

IBPS Question Bank

Chapter 1 — Quantitative Aptitude / Numerical Ability

1323 questions | 63 subtopics

Easy / Moderate / Difficult | with worked solutions

How this was produced, and how far it has been checked. These questions were machine-generated against the IBPS syllabus breakdown. Every question was then re-solved by a second, independent pass that did not see the proposed answer, and anything it flagged was re-worked by a third pass. In this chapter 63 of 63 subtopics (100%) completed that check; any marked [unchecked] below did not, and should be treated as a draft.

Across the whole bank the checker flagged **285 of 3,948 questions (7.2%)**, and 149 subtopics were revised as a result. The largest categories were near-duplicate questions within a subtopic (34%) and a faulty explanation attached to an otherwise correct answer (22%); genuinely wrong answer keys were 9%. The counts in each subtopic heading show what was flagged there *before* repair.

This is a strong check, not a proof. Both passes are the same kind of system and can share a blind spot, so a surviving error is likelier in the places machines agree wrongly — fine detail in Computer Knowledge, and judgement calls in English usage. Re-solve any answer you dispute rather than trusting the key, and please report anything that still looks wrong.

Section 1.1

1.1.1 Classification of numbers; place value

[checked, 2 flagged]

1. In the number 5,84,769, what is the place value of the digit 8? [Easy]

- (A) 8
- (B) 8,000
- (C) 80,000
- (D) 8,00,000
- (E) None of these

2. What is the difference between the place value and the face value of the digit 7 in the number 3,17,542? [Easy]

- (A) 6,993
- (B) 693
- (C) 7,000
- (D) 6,930
- (E) None of these

3. Which one of the following numbers is a composite number? [Easy]

- (A) 31
- (B) 37
- (C) 41
- (D) 51
- (E) 61

4. Which one of the following is NOT a rational number? [Easy]

- (A) $\sqrt{49}$
- (B) $\frac{22}{7}$
- (C) $\sqrt{30}$
- (D) 0.75
- (E) -8

5. What is the sum of the place values of all the digits 3 in the number 5,33,308? [Easy]

- (A) 33,300 (D) 33,003
(B) 33,000 (E) None of these
(C) 30,300

6. How many prime numbers lie between 1 and 30? [Easy]

- (A) 9 (D) 12
(B) 10 (E) None of these
(C) 11

7. In the decimal number 63.472, the place value of the digit 7 is: [Easy]

- (A) $\frac{7}{10}$ (C) $\frac{7}{1000}$
(B) $\frac{7}{100}$ (D) 7
(E) None of these

8. In the number 8,47,563, if the digit 4 is replaced by 9 and every other digit is left unchanged, by how much does the number increase? [Moderate]

- (A) 5,000 (D) 5,00,000
(B) 50,000 (E) None of these
(C) 45,000

9. What is the sum of the place value and the face value of the digit 6 in the number 3,86,024? [Moderate]

- (A) 6,006 (D) 6,000
(B) 6,060 (E) None of these
(C) 6,600

10. What is the difference between the place values of the two 7s in the number 6,72,738? [Moderate]

- (A) 69,300 (D) 6,930
(B) 69,930 (E) None of these
(C) 70,700

11. The sum of the two digits of a two-digit number is 11. If the number exceeds the number formed by reversing its digits by 27, then the original number is: [Moderate]

- (A) 74 (D) 65
(B) 47 (E) None of these
(C) 83

12. How many of the following numbers are prime? 91, 97, 111, 113, 119, 127 [Moderate]

- (A) 2 (D) 5
(B) 3 (E) None of these
(C) 4

13. A bank clerk had to credit Rs. 3,45,600 to a customer's account, but while entering the amount he typed the digit in the thousands place as 9 instead of 5, all other digits being entered correctly. By how much was the account over-credited? [Moderate]

- (A) Rs. 4,000
(B) Rs. 400
(C) Rs. 40,000
- (D) Rs. 4,400
(E) None of these

14. Which one of the following expressions represents a rational number?

[Moderate]

- (A) $\sqrt{2} + \sqrt{8}$
(B) $(3 + \sqrt{5})(3 - \sqrt{5})$
(C) $\frac{\pi}{2}$
- (D) $\sqrt{7} \times \sqrt{5}$
(E) None of these

15. Let X be the difference between the place value and the face value of 6 in 6,54,321, and let Y be the difference between the place value and the face value of 4 in 3,45,678. What is the value of $X - Y$?

[Difficult]

- (A) 5,59,998
(B) 5,60,004
(C) 5,39,994
- (D) 5,59,988
(E) None of these

16. In a three-digit number, the digit in the hundreds place is twice the digit in the units place, and the digit in the tens place is 3 more than the units digit. If the number is exactly divisible by 4, then the number is:

[Difficult]

- (A) 241
(B) 452
(C) 663
- (D) 874
(E) None of these

17. If p and $p + 2$ are both prime numbers greater than 3, then $p + 1$ is always divisible by:

[Difficult]

- (A) 6
(B) 4
(C) 12
- (D) 10
(E) None of these

18. What is the sum of all the prime numbers lying between 40 and 70?

[Difficult]

- (A) 371
(B) 361
(C) 373
- (D) 351
(E) None of these

19. In a five-digit number, when the digit in the thousands place and the digit in the tens place are interchanged (all other digits remaining unchanged), the number increases by 2,970. What is the difference between those two digits?

[Difficult]

- (A) 2
(B) 3
(C) 4
- (D) 5
(E) None of these

20. Consider the following statements: (i) Every integer is a rational number. (ii) Every rational number is an integer. (iii) 0 is neither prime nor composite. (iv) The square root of every natural number is irrational. Which of the statements are TRUE?

[Difficult]

- (A) (i) and (ii) only
- (B) (i) and (iii) only
- (C) (ii) and (iv) only
- (D) (i), (iii) and (iv) only
- (E) None of these

21. A six-digit number is formed by writing a three-digit number twice in succession, for example 256256 or 478478. Every such six-digit number is necessarily divisible by: [Difficult]

- (A) 7 but not by 11
- (B) 11 but not by 13
- (C) 1001
- (D) 101
- (E) None of these

1.1.2 Divisibility rules; factors and multiples

[checked]

22. Which one of the following numbers is exactly divisible by 11? [Easy]

- (A) 45871
- (B) 61809
- (C) 73952
- (D) 58147
- (E) None of these

23. A cashier records a day's total collection as Rs. 34,258. What is the least amount, in rupees, that must be added to this figure so that the resulting number is exactly divisible by 9? [Easy]

- (A) 2
- (B) 4
- (C) 5
- (D) 7
- (E) None of these

24. The LCM of two numbers is 120 and their HCF is 10. If one of the numbers is 40, the other number is: [Easy]

- (A) 20
- (B) 30
- (C) 60
- (D) 80
- (E) None of these

25. How many factors does the number 180 have (including 1 and 180 itself)? [Easy]

- (A) 12
- (B) 16
- (C) 18
- (D) 20
- (E) None of these

26. Which one of the following numbers is exactly divisible by 6? [Easy]

- (A) 23412
- (B) 51236
- (C) 74318
- (D) 41102
- (E) None of these

27. Find the least number which is exactly divisible by 12, 16, 18 and 24. [Easy]

- (A) 72
- (B) 96
- (C) 144
- (D) 288
- (E) None of these

28. How many numbers lying between 100 and 400 are exactly divisible by 13? [Easy]

- (A) 21 (D) 24
(B) 22 (E) None of these
(C) 23

29. A four-digit account code is written as $7x3y$, where x and y are digits. If the code is exactly divisible by 45, what is the value of $x + y$? [Moderate]

- (A) 5 (D) 11
(B) 6 (E) None of these
(C) 8

30. Find the least number which, when divided by 5, 6, 7 and 8, leaves a remainder of 3 in each case, but when divided by 9 leaves no remainder. [Moderate]

- (A) 1043 (D) 2523
(B) 1683 (E) None of these
(C) 1883

31. A bank branch has three separate cash bundles worth Rs. 1,08,000, Rs. 1,44,000 and Rs. 1,80,000. The cashier wants to repack the entire cash into packets, every packet holding the same amount and that amount being as large as possible, without mixing money across bundles. How many packets will be formed in all? [Moderate]

- (A) 9 (D) 18
(B) 12 (E) None of these
(C) 15

32. How many factors of 1080 are perfect squares? [Moderate]

- (A) 3 (D) 8
(B) 4 (E) None of these
(C) 6

33. What is the greatest number which divides 43, 91 and 183 leaving the same remainder in each case? [Moderate]

- (A) 4 (D) 13
(B) 7 (E) None of these
(C) 9

34. What is the highest power of 3 that exactly divides $30!$ (that is, the product $1 \times 2 \times 3 \times \cdots \times 30$)? [Moderate]

- (A) 12 (D) 15
(B) 13 (E) None of these
(C) 14

35. Token numbers 1 to 200 are issued at a bank counter on a particular day. How many of these tokens bear a number divisible by 4 or by 6 (or by both)? [Moderate]

- (A) 61 (D) 83
(B) 67 (E) None of these
(C) 71

36. Find the smallest four-digit number which, when divided by 8, 12 and 18, leaves a remainder of 5 in each case. [Difficult]

- (A) 1005 (D) 1157
(B) 1013 (E) None of these
(C) 1085

37. What is the sum of all the factors of 1800 (including 1 and 1800)? [Difficult]

- (A) 5382 (D) 6825
(B) 6045 (E) None of these
(C) 6210

38. Find the largest number which divides 1657 and 2037 leaving remainders 6 and 5 respectively. [Difficult]

- (A) 117 (D) 133
(B) 123 (E) None of these
(C) 127

39. How many three-digit numbers are divisible by 7 but NOT divisible by 3? [Difficult]

- (A) 43 (D) 128
(B) 81 (E) None of these
(C) 85

40. The product of two two-digit numbers is 2028 and their HCF is 13. What is the sum of the two numbers? [Difficult]

- (A) 78 (D) 104
(B) 85 (E) None of these
(C) 91

41. If $N = 2^4 \times 3^3 \times 5^2$, how many factors of N are divisible by 12 but not divisible by 36? [Difficult]

- (A) 6 (D) 27
(B) 9 (E) None of these
(C) 18

42. What is the sum of all two-digit numbers that are divisible by 3 but not by 5? [Difficult]

- (A) 1215 (D) 1710
(B) 1350 (E) None of these
(C) 1665

1.1.3 HCF and LCM, including of fractions and decimals

[checked, 2 flagged]

43. A stationery vendor supplying a bank branch has 36 pens and 84 pencils. He wants to make identical bundles using all the items, with the largest possible number of items of each type common to every bundle. The highest common factor of 36 and 84 is: [Easy]

- (A) 6
- (B) 12
- (C) 18
- (D) 24
- (E) None of these

44. Three cash counters at a bank are audited every 12, 15 and 20 days respectively. The least common multiple of 12, 15 and 20 is: [Easy]

- (A) 60
- (B) 120
- (C) 180
- (D) 240
- (E) 300

45. The HCF of the fractions $\frac{2}{3}$, $\frac{8}{9}$ and $\frac{16}{81}$ is: [Easy]

- (A) $\frac{2}{81}$
- (B) $\frac{2}{3}$
- (C) $\frac{16}{3}$
- (D) $\frac{8}{81}$
- (E) None of these

46. The LCM of the fractions $\frac{3}{4}$, $\frac{6}{7}$ and $\frac{9}{8}$ is: [Easy]

- (A) 18
- (B) $\frac{9}{2}$
- (C) $\frac{3}{56}$
- (D) 54
- (E) None of these

47. The product of two numbers is 2028 and their HCF is 13. What is their LCM? [Easy]

- (A) 146
- (B) 152
- (C) 166
- (D) 178
- (E) None of these

48. The HCF of 0.63, 1.05 and 2.1 is: [Easy]

- (A) 0.03
- (B) 0.07
- (C) 0.21
- (D) 0.63
- (E) None of these

49. Sunita wants to buy sweets for a branch function so that the packets can be distributed equally among 8, 12 or 18 staff members with nothing left over. The least number of sweets she must buy is: [Easy]

- (A) 36
- (B) 48
- (C) 72
- (D) 144
- (E) None of these

50. The HCF of two numbers is 16 and their LCM is 240. How many unordered pairs of such numbers are possible? [Moderate]

- (A) 1
- (B) 2
- (C) 3
- (D) 4
- (E) None of these

51. What is the greatest number that divides 43, 91 and 183 leaving the same remainder in each case? [Moderate]

- (A) 4
- (B) 7
- (C) 9
- (D) 13
- (E) None of these

52. Three alarm bells in a bank's security system ring at intervals of 9, 12 and 15 minutes respectively. If they all ring together at 8:00 a.m., at what time will they next ring together? [Moderate]

- (A) 10:00 a.m.
- (B) 10:30 a.m.
- (C) 11:00 a.m.
- (D) 11:30 a.m.
- (E) None of these

53. Two numbers are in the ratio 3 : 4 and their HCF is 4. What is their LCM? [Moderate]

- (A) 12
- (B) 16
- (C) 48
- (D) 96
- (E) None of these

54. Find the greatest number which divides 2011 and 2623 leaving remainders 9 and 5 respectively. [Moderate]

- (A) 11
- (B) 77
- (C) 154
- (D) 308
- (E) None of these

55. The HCF and LCM of two numbers are 12 and 336 respectively. If one of the numbers is 84, the other number is: [Moderate]

- (A) 36
- (B) 48
- (C) 60
- (D) 72
- (E) None of these

56. A tailor has three pieces of cloth of lengths $\frac{7}{2}$ m, $\frac{5}{4}$ m and $\frac{4}{5}$ m. He wants the longest measuring rod that can measure each of the three pieces an exact whole number of times. The length of that rod is: [Moderate]

- (A) $\frac{1}{20}$ m
- (B) $\frac{1}{10}$ m
- (C) $\frac{1}{5}$ m
- (D) $\frac{7}{20}$ m
- (E) None of these

57. Find the least number which, when divided by 5, 6, 7 and 8, leaves a remainder of 3 in each case, but when divided by 9 leaves no remainder. [Difficult]

- (A) 1677 (D) 3363
(B) 1683 (E) None of these
(C) 2523

58. The LCM of two numbers is 495 and their HCF is 5. If the sum of the two numbers is 100, what is their difference? [Difficult]

- (A) 10 (D) 90
(B) 46 (E) None of these
(C) 70

59. Find the smallest number greater than 1000 which, when divided by 6, 7 and 8, leaves remainders 5, 6 and 7 respectively. [Difficult]

- (A) 1001 (D) 1343
(B) 1007 (E) None of these
(C) 1175

60. The HCF of two fractions is $\frac{1}{12}$ and their LCM is $\frac{35}{2}$. If one of the fractions is $\frac{5}{6}$, the other fraction is: [Difficult]

- (A) $\frac{7}{4}$ (C) $\frac{4}{7}$
(B) $\frac{7}{2}$ (D) $\frac{35}{12}$
(E) None of these

61. The sum of the HCF and the LCM of two numbers is 680, and the LCM is 84 times the HCF. If one of the numbers is 56, the other number is: [Difficult]

- (A) 84 (D) 120
(B) 96 (E) None of these
(C) 108

62. Find the least number which, when divided by 20, 25, 35 and 40, leaves remainders 14, 19, 29 and 34 respectively. [Difficult]

- (A) 1394 (D) 2794
(B) 1400 (E) None of these
(C) 1406

63. Let H be the HCF and L be the LCM of the decimals 0.6, 9.6 and 0.36. What is the value of $\frac{L}{H}$? [Difficult]

- (A) 24 (D) 2400
(B) 240 (E) None of these
(C) 288

1.1.4 Fractions, decimals, and their comparison

[checked, 1 flagged]

64. Which of the following fractions has the greatest value?

[Easy]

- (A) $\frac{3}{5}$ (D) $\frac{7}{12}$
(B) $\frac{2}{3}$ (E) $\frac{11}{20}$
(C) $\frac{5}{8}$

65. The decimal 0.375, when written as a fraction in its lowest terms, equals:

[Easy]

- (A) $\frac{5}{16}$ (C) $\frac{3}{8}$
(B) $\frac{2}{5}$ (D) $\frac{7}{20}$
(E) None of these

66. What is the value of $2.5 + 0.75 - 1.125$?

[Easy]

- (A) 2.25 (D) 2.125
(B) 1.875 (E) None of these
(C) 2.375

67. Rahul's monthly salary is Rs. 32,000. He pays $\frac{2}{5}$ of his salary as house rent. How much rent does he pay in a month?

[Easy]

- (A) Rs. 12,400 (D) Rs. 14,000
(B) Rs. 12,800 (E) None of these
(C) Rs. 13,200

68. Which of the following decimals is the smallest?

[Easy]

- (A) 0.7 (D) 0.707
(B) 0.077 (E) 0.0707
(C) 0.07

69. The fraction $\frac{7}{8}$ expressed as a decimal is:

[Easy]

- (A) 0.785 (D) 0.75
(B) 0.875 (E) None of these
(C) 0.878

70. The recurring decimal $0.\overline{6}$ is equal to which of the following fractions?

[Easy]

- (A) $\frac{3}{5}$ (C) $\frac{2}{3}$
(B) $\frac{6}{10}$ (D) $\frac{6}{11}$
(E) None of these

71. By how much does the greater of the two fractions $\frac{13}{17}$ and $\frac{15}{19}$ exceed the smaller one? [Moderate]
- (A) $\frac{2}{323}$ (C) $\frac{8}{319}$
 (B) $\frac{8}{323}$ (D) $\frac{6}{323}$
 (E) None of these
72. Find the value of $\frac{1}{1 \times 2} + \frac{1}{2 \times 3} + \frac{1}{3 \times 4} + \frac{1}{4 \times 5}$. [Moderate]
- (A) $\frac{3}{4}$ (C) $\frac{7}{10}$
 (B) $\frac{5}{6}$ (D) $\frac{4}{5}$
 (E) None of these
73. When a certain number is multiplied by 0.05, the result is 45 more than the result obtained on multiplying the same number by 0.02. The number is: [Moderate]
- (A) 900 (D) 1800
 (B) 1200 (E) None of these
 (C) 1500
74. Simplify: $\frac{0.35 \times 0.35 - 0.15 \times 0.15}{0.35 + 0.15}$ [Moderate]
- (A) 0.5 (D) 0.35
 (B) 0.05 (E) None of these
 (C) 0.2
75. Which of the following is the second largest value in the set $\left\{0.85, \frac{7}{9}, \frac{5}{6}, 0.8, \frac{13}{16}\right\}$? [Moderate]
- (A) 0.85 (C) $\frac{5}{6}$
 (B) $\frac{13}{16}$ (D) 0.8
 (E) $\frac{7}{9}$
76. Express the recurring decimal $2.\overline{36}$ as a fraction in its simplest form. [Moderate]
- (A) $\frac{13}{6}$ (C) $\frac{236}{99}$
 (B) $\frac{24}{11}$ (D) $\frac{26}{11}$
 (E) None of these
77. Meena spends $\frac{1}{3}$ of her monthly income on house rent and $\frac{2}{5}$ of the remaining amount on food. If she is still left with Rs. 7,200, what is her monthly income? [Moderate]
- (A) Rs. 15,000 (D) Rs. 18,000
 (B) Rs. 16,200 (E) None of these
 (C) Rs. 21,600

78. Which one of the following fractions is the largest?

[Difficult]

- (A) $\frac{17}{23}$ (D) $\frac{31}{41}$
(B) $\frac{25}{34}$ (E) $\frac{22}{29}$
(C) $\frac{39}{52}$

79. What is the value of $\frac{1}{2 + \frac{1}{3 + \frac{1}{4}}}$?

[Difficult]

- (A) $\frac{13}{30}$ (C) $\frac{4}{13}$
(B) $\frac{30}{13}$ (D) $\frac{17}{30}$
(E) None of these

80. The value of $0.\overline{6} + 0.\overline{7} + 0.\overline{8}$ is:

[Difficult]

- (A) 2.1 (D) $1.\overline{3}$
(B) $2.\overline{1}$ (E) None of these
(C) $2.\overline{3}$

81. Find the value of $(0.75)^3 + (0.25)^3 + 3 \times 0.75 \times 0.25$.

[Difficult]

- (A) 0.5 (D) 1
(B) 0.75 (E) None of these
(C) 1.5

82. The denominator of a fraction is 2 less than three times its numerator. If both the numerator and the denominator are increased by 2, the fraction becomes $\frac{1}{2}$. What is the sum of the numerator and the denominator of the original fraction?

[Difficult]

- (A) 12 (D) 7
(B) 14 (E) None of these
(C) 16

83. If $\frac{a}{b} = \frac{3}{5}$, then the value of $\frac{3a + 2b}{5a - 2b}$ is:

[Difficult]

- (A) $\frac{5}{19}$ (C) 4
(B) $\frac{19}{25}$ (D) $\frac{19}{5}$
(E) None of these

84. Simplify: $\frac{0.0203 \times 2.92}{0.0073 \times 14.5 \times 0.7}$

[Difficult]

- (A) 8 (D) 0.8
(B) 0.08 (E) None of these
(C) 1.25

1.1.5 Surds and indices; laws of exponents**[checked]**

85. Simplify: $\frac{\sqrt{144} \times \sqrt{81}}{\sqrt{36}}$ [Easy]

- | | |
|--------|-------------------|
| (A) 12 | (D) 24 |
| (B) 16 | (E) None of these |
| (C) 18 | |

86. The value of $\frac{2^5 \times 2^3}{2^6}$ is: [Easy]

- | | |
|-------|--------|
| (A) 2 | (D) 16 |
| (B) 4 | (E) 32 |
| (C) 8 | |

87. Find the value of $(81)^{3/4}$. [Easy]

- | | |
|--------|-------------------|
| (A) 9 | (D) 81 |
| (B) 18 | (E) None of these |
| (C) 27 | |

88. A cashier at a bank branch notes that the number of currency bundles in a vault satisfies $5^x = 625$. The value of x is: [Easy]

- | | |
|-------|-------|
| (A) 2 | (D) 5 |
| (B) 3 | (E) 6 |
| (C) 4 | |

89. The value of $\sqrt{0.0064}$ is: [Easy]

- | | |
|-----------|-------------------|
| (A) 0.008 | (D) 8 |
| (B) 0.08 | (E) None of these |
| (C) 0.8 | |

90. Simplify: $(7^0 + 4^{-1}) \times 8$ [Easy]

- | | |
|--------|-------------------|
| (A) 8 | (D) 12 |
| (B) 9 | (E) None of these |
| (C) 10 | |

91. On rationalising the denominator, $\frac{1}{\sqrt{5}-2}$ equals: [Easy]

- | | |
|--------------------|------------------------------|
| (A) $\sqrt{5} - 2$ | (D) $\frac{\sqrt{5} + 2}{9}$ |
| (B) $\sqrt{5} + 2$ | (E) None of these |
| (C) $2 - \sqrt{5}$ | |

92. If $2^{x+3} = 8^{x-1}$, then the value of x is: [Moderate]

- (A) 2 (D) 5
 (B) 3 (E) 6
 (C) 4

93. Simplify: $\frac{\sqrt{50} + \sqrt{18}}{\sqrt{8}}$ [Moderate]

- (A) 2 (D) 5
 (B) 3 (E) None of these
 (C) 4

94. If $\sqrt{2} = 1.414$, then the value of $\frac{1}{3 + 2\sqrt{2}}$ is approximately: [Moderate]

- (A) 0.172 (D) 0.343
 (B) 0.586 (E) None of these
 (C) 5.828

95. Which of the following is the greatest? [Moderate]

- (A) $\sqrt[3]{4}$ (D) $\sqrt[4]{8}$
 (B) $\sqrt{3}$ (E) None of these
 (C) $\sqrt[6]{20}$

96. If $x = \frac{1}{2 - \sqrt{3}}$, then the value of $x^2 - 4x + 1$ is: [Moderate]

- (A) 0 (D) -1
 (B) 1 (E) None of these
 (C) 2

97. The value of $\left(\frac{9}{16}\right)^{-3/2}$ is: [Moderate]

- (A) $\frac{27}{64}$ (C) $\frac{4}{3}$
 (B) $\frac{64}{27}$ (D) $\frac{3}{4}$
 (E) None of these

98. The total deposit of a rural branch headed by Mr. Rakesh Nair is Rs. $[(64)^{5/6} \times (32)^{2/5}]$ lakh. The deposit, in lakh rupees, is: [Moderate]

- (A) 96 (D) 144
 (B) 112 (E) None of these
 (C) 128

99. If $x = 3 + 2\sqrt{2}$, then the value of $\sqrt{x} - \frac{1}{\sqrt{x}}$ is: [Difficult]

- (A) 1 (D) $\sqrt{2}$
 (B) 2 (E) None of these
 (C) $2\sqrt{2}$

100. If $2^a = 3^b = 6^{-c}$, where a , b and c are non-zero, then $\frac{1}{a} + \frac{1}{b} + \frac{1}{c}$ equals: [Difficult]

- (A) 0 (D) 2
(B) 1 (E) None of these
(C) -1

101. If $x^y = y^x$ and $y = 2x$, where x and y are positive numbers with $x \neq 1$, then the value of x is: [Difficult]

- (A) 1 (D) 4
(B) 2 (E) None of these
(C) 3

102. The value of $\frac{1}{1+\sqrt{2}} + \frac{1}{\sqrt{2}+\sqrt{3}} + \frac{1}{\sqrt{3}+\sqrt{4}} + \cdots + \frac{1}{\sqrt{80}+\sqrt{81}}$ is: [Difficult]

- (A) 7 (D) 10
(B) 8 (E) None of these
(C) 9

103. If $\sqrt{x} + \frac{1}{\sqrt{x}} = \sqrt{6}$, then the value of $x^2 + \frac{1}{x^2}$ is: [Difficult]

- (A) 12 (D) 18
(B) 14 (E) None of these
(C) 16

104. Under a long-term deposit scheme of a co-operative bank, a sum of Rs. P grows to Rs. $P \times 2^{t/5}$ in t years. Smt. Kavita Deshmukh deposited Rs. 25,000 and received Rs. 2,00,000 on maturity. The tenure of her deposit was: [Difficult]

- (A) 10 years (D) 20 years
(B) 12 years (E) None of these
(C) 15 years

105. For a positive number $a \neq 1$, the value of $\left(\frac{a^m}{a^n}\right)^{m+n} \times \left(\frac{a^n}{a^p}\right)^{n+p} \times \left(\frac{a^p}{a^m}\right)^{p+m}$ is: [Difficult]

- (A) 0 (D) a^{m+n+p}
(B) 1 (E) None of these
(C) a

1.1.6 Squares, cubes, square roots, cube roots [checked, 1 flagged]

106. What is the value of $\sqrt{5184}$? [Easy]

- (A) 68 (D) 76
(B) 72 (E) None of these
(C) 74

107. Find the value of $\sqrt[3]{6859}$. [Easy]

- (A) 17
(B) 19
(C) 21
- (D) 23
(E) None of these

108. What is the value of $\sqrt{1764} + \sqrt{2025}$?

[Easy]

- (A) 85
(B) 89
(C) 91
- (D) 93
(E) None of these

109. A square plot of land bought by a bank for a new branch has an area of 3136 square metres. What is the perimeter of the plot?

[Easy]

- (A) 196 m
(B) 212 m
(C) 240 m
- (D) 224 m
(E) None of these

110. What is the smallest number by which 1080 must be multiplied so that the product becomes a perfect cube?

[Easy]

- (A) 2
(B) 3
(C) 5
- (D) 25
(E) None of these

111. Find the value of $\sqrt[3]{0.000216}$.

[Easy]

- (A) 0.6
(B) 0.06
(C) 0.006
- (D) 0.0006
(E) None of these

112. Which of the following numbers is a perfect square?

[Easy]

- (A) 2028
(B) 2058
(C) 2116
- (D) 2180
(E) None of these

113. What is the value of $\sqrt{0.0169} \times \sqrt{6.25}$?

[Moderate]

- (A) 0.325
(B) 3.25
(C) 0.0325
- (D) 32.5
(E) None of these

114. What is the least number that must be subtracted from 7500 so that the remainder is a perfect square?

[Moderate]

- (A) 104
(B) 96
(C) 69
- (D) 111
(E) None of these

115. Three numbers are in the ratio 1 : 2 : 3 and the sum of their cubes is 4500. What is the largest of the three numbers? [Moderate]

- (A) 5
- (B) 10
- (C) 15
- (D) 20
- (E) None of these

116. What is the value of $\sqrt[3]{9261} + \sqrt{2916} - \sqrt[3]{4096}$? [Moderate]

- (A) 55
- (B) 57
- (C) 61
- (D) 59
- (E) None of these

117. What is the least number that must be added to 4931 to make the sum a perfect cube? [Moderate]

- (A) 901
- (B) 883
- (C) 919
- (D) 795
- (E) None of these

118. What is the value of $\frac{\sqrt{3136}}{\sqrt{196}} + \sqrt[3]{\frac{2744}{343}}$? [Moderate]

- (A) 4
- (B) 5
- (C) 6
- (D) 8
- (E) None of these

119. A sum of Rs. 15,876 collected as a welfare fund is distributed among the members of a bank staff association in such a way that each member receives as many rupees as there are members in the association. How many members are there? [Moderate]

- (A) 126
- (B) 116
- (C) 124
- (D) 136
- (E) None of these

120. If $x = \sqrt{5} + \sqrt{3}$ and $y = \sqrt{5} - \sqrt{3}$, then what is the value of $x^2 + y^2$? [Difficult]

- (A) 10
- (B) 16
- (C) $2\sqrt{15}$
- (D) 8
- (E) None of these

121. Which is the smallest four-digit number that is both a perfect square and a perfect cube? [Difficult]

- (A) 1024
- (B) 1728
- (C) 4096
- (D) 5832
- (E) None of these

122. If $\sqrt{1 + \frac{x}{144}} = \frac{13}{12}$, then what is the value of x ? [Difficult]

- (A) 25 (D) 12
(B) 1 (E) None of these
(C) 5

123. What is the difference between the greatest four-digit perfect square and the least four-digit perfect cube? [Difficult]

- (A) 8801 (D) 8901
(B) 8081 (E) None of these
(C) 7801

124. What is the least perfect square that is exactly divisible by each of 8, 12, 15 and 20? [Difficult]

- (A) 900 (D) 4900
(B) 3600 (E) None of these
(C) 1600

125. A cubical water tank installed at a bank's regional office has a volume of 13824 cubic centimetres in its scale model. The entire outer surface of this model is to be painted at Rs. 15 per square centimetre. What is the total cost of painting? [Difficult]

- (A) Rs. 48,960 (D) Rs. 57,600
(B) Rs. 51,840 (E) None of these
(C) Rs. 54,720

126. The sum of the squares of two positive numbers is 185 and their product is 52. What is the difference between the two numbers? [Difficult]

- (A) 7 (D) 11
(B) 8 (E) None of these
(C) 9

1.1.7 Remainder theorem; unit digit and last-two-digit problems [checked]

127. A branch manager, Mr. Ramesh Iyer, asks his trainee to state the unit digit of 7^{35} . What is the correct unit digit? [Easy]

- (A) 1 (D) 9
(B) 3 (E) None of these
(C) 7

128. A cashier records a day's total collection as Rs. 4,57,893. If this amount is divided by 9, what remainder is left? [Easy]

- (A) 0 (D) 6
(B) 1 (E) None of these
(C) 3

129. What is the unit digit of the product $2^{34} \times 3^{17}$? [Easy]

- (A) 2 (D) 8
(B) 4 (E) None of these
(C) 6

130. Find the remainder when 6^{50} is divided by 5. [Easy]

- (A) 0 (D) 4
(B) 1 (E) None of these
(C) 2

131. What is the unit digit of $(37)^{12} + (43)^{15}$? [Easy]

- (A) 4 (D) 0
(B) 6 (E) None of these
(C) 8

132. A number of currency bundles, when divided into groups of 15, leaves 7 bundles over. If the same number of bundles is divided into groups of 5, how many bundles are left over? [Easy]

- (A) 1 (D) 0
(B) 3 (E) None of these
(C) 4

133. What are the last two digits of $(76)^{25}$? [Easy]

- (A) 16 (D) 76
(B) 36 (E) None of these
(C) 56

134. Find the remainder when 2^{51} is divided by 7. [Moderate]

- (A) 1 (D) 6
(B) 2 (E) None of these
(C) 4

135. What is the unit digit of $7^{95} - 3^{58}$? [Moderate]

- (A) 0 (D) 6
(B) 2 (E) None of these
(C) 4

136. A number, when divided by 361, leaves a remainder of 47. What remainder will the same number leave when divided by 19? [Moderate]

- (A) 5 (D) 13
(B) 9 (E) None of these
(C) 11

137. Find the remainder when $1! + 2! + 3! + \cdots + 100!$ is divided by 8. [Moderate]

- (A) 0
(B) 1
(C) 5
- (D) 7
(E) None of these

138. What are the last two digits of 7^{54} ?

[Moderate]

- (A) 07
(B) 29
(C) 43
- (D) 49
(E) None of these

139. Find the remainder when $53^{53} - 33^{33}$ is divided by 10.

[Moderate]

- (A) 0
(B) 2
(C) 6
- (D) 8
(E) None of these

140. Mrs. Anita Deshmukh counts the passbooks in her drawer. When she stacks them in piles of 7, exactly 3 are left over; when she stacks them in piles of 9, exactly 4 are left over. What is the least possible number of passbooks?

[Moderate]

- (A) 22
(B) 31
(C) 49
- (D) 58
(E) None of these

141. Find the remainder when $32^{32^{32}}$ is divided by 7.

[Difficult]

- (A) 1
(B) 2
(C) 4
- (D) 6
(E) None of these

142. What are the last two digits of $(2017)^{2019}$?

[Difficult]

- (A) 13
(B) 33
(C) 53
- (D) 73
(E) None of these

143. Find the remainder when $1^2 + 2^2 + 3^2 + \cdots + 100^2$ is divided by 7.

[Difficult]

- (A) 2
(B) 3
(C) 5
- (D) 6
(E) None of these

144. What is the unit digit of $1^1 + 2^2 + 3^3 + 4^4 + 5^5 + 6^6 + 7^7 + 8^8 + 9^9$?

[Difficult]

- (A) 3
(B) 5
(C) 7
- (D) 9
(E) None of these

145. Find the remainder when $(444)^{444} + (333)^{333}$ is divided by 5.

[Difficult]

- (A) 0
(B) 1
(C) 2
- (D) 3
(E) None of these

146. Find the remainder when 7^{103} is divided by 25.

[Difficult]

- (A) 7
(B) 11
(C) 18
- (D) 23
(E) None of these

147. What are the last two digits of 8^{25} ?

[Difficult]

- (A) 08
(B) 18
(C) 48
- (D) 68
(E) None of these

Section 1.2

1.2.1 BODMAS and order of operations

[checked, 3 flagged]

148. What value should come in place of the question mark? $48 \div 6 + 3 \times 5 - 7 = ?$

[Easy]

- (A) 12
(B) 14
(C) 15
- (D) 16
(E) None of these

149. Simplify: $15 + 5 \times (12 - 8) \div 2 = ?$

[Easy]

- (A) 25
(B) 27
(C) 30
- (D) 32
(E) None of these

150. Find the value of $36 \div [4 + (7 - 5) \times 2]$.

[Easy]

- (A) 3.5
(B) 4
(C) 4.5
- (D) 5
(E) None of these

151. What is the value of $\sqrt{169} + 12^2 \div 6$?

[Easy]

- (A) 35
(B) 36
(C) 38
- (D) 40
(E) None of these

152. What value should come in place of the question mark? $25\% \text{ of } 480 + 15\% \text{ of } 200 = ?$

[Easy]

- (A) 145
(B) 150
(C) 155
- (D) 160
(E) None of these

- 153.** Simplify: $7 \times 8 - 36 \div 9 + 5 = ?$ [Easy]
- (A) 53 (D) 59
(B) 55 (E) None of these
(C) 57
- 154.** Kavita is asked to evaluate $(18 + 12) \div 6 \times 4 - 5$. What answer should she get? [Easy]
- (A) 10 (D) 25
(B) 15 (E) None of these
(C) 20
- 155.** What value comes in place of the question mark? $\frac{5}{8}$ of 720 + $\frac{3}{7}$ of 490 - 15% of 400 = ? [Moderate]
- (A) 560 (D) 620
(B) 580 (E) None of these
(C) 600
- 156.** Simplify: $[(36 \div 4) \times 5 - (48 \div 6) \times 3] \div 7 = ?$ [Moderate]
- (A) 3 (D) 6
(B) 4 (E) None of these
(C) 5
- 157.** A branch manager records the figure $12 \times 15 - 144 \div 12 + 8^2 \div 4$. What is its value? [Moderate]
- (A) 178 (D) 192
(B) 184 (E) None of these
(C) 188
- 158.** Find the value of $\left\{ [(25 - 9) \div 4] + 6 \times 3 \right\} \times 2$. [Moderate]
- (A) 38 (D) 44
(B) 40 (E) None of these
(C) 42
- 159.** What value should replace the question mark? $\sqrt{576} \div 4 + \sqrt[3]{729} \times 2 - 5 = ?$ [Moderate]
- (A) 17 (D) 23
(B) 19 (E) None of these
(C) 21
- 160.** Simplify: $\frac{0.6 \times 0.6 + 0.4 \times 0.4}{(0.6 + 0.4)^2}$ [Moderate]
- (A) 0.48 (D) 0.60
(B) 0.50 (E) None of these
(C) 0.55
- 161.** If $18 \times ? - 240 \div 8 = 150$, then the value in place of the question mark is [Moderate]

- (A) 10 (D) 18
 (B) 12 (E) None of these
 (C) 15

162. What value should come in place of the question mark? $\left[\frac{3}{5} \text{ of } 1250 - \frac{7}{9} \text{ of } 810\right] \div [15\% \text{ of } 120 - 6] = ?$ [Difficult]

- (A) 8 (D) 15
 (B) 10 (E) None of these
 (C) 12

163. Find the value of $(0.8)^3 + (0.2)^3 + 3 \times 0.8 \times 0.2$. [Difficult]

- (A) 0.5 (D) 1.2
 (B) 0.8 (E) None of these
 (C) 1

164. Simplify: $\left[\frac{5}{6} + \frac{2}{3} \times \frac{9}{4}\right] \div \left[\frac{7}{4} - \frac{5}{8} \div \frac{5}{2}\right] - \frac{1}{3}$ [Difficult]

- (A) $\frac{8}{9}$ (C) $\frac{4}{3}$
 (B) $\frac{11}{9}$ (D) $\frac{14}{9}$
 (E) None of these

165. What is the value of $\sqrt{(84 \div 4 + 15) \times 4 + 12^2 \div 24}$? [Difficult]

- (A) 15 (D) 18
 (B) 16 (E) None of these
 (C) 17

166. Three-fourths of two-fifths of a certain sum invested by Mr. Iyer is Rs. 45 more than one-sixth of three-fifths of the same sum. What is the sum (in Rs.)? [Difficult]

- (A) 200 (D) 240
 (B) 210 (E) None of these
 (C) 225

167. Simplify: $(45\% \text{ of } 1200) \div (30\% \text{ of } 40) + 20\% \text{ of } 150 = ?$ [Difficult]

- (A) 70 (D) 80
 (B) 72 (E) None of these
 (C) 78

168. Find the value of $\frac{(3.5)^2 - (1.5)^2}{3.5 - 1.5} \times \frac{(2.4)^2 + 2 \times 2.4 \times 0.6 + (0.6)^2}{3}$ [Difficult]

- (A) 15 (D) 22.5
 (B) 18 (E) None of these
 (C) 20

1.2.2 Simplification of complex expressions

[checked]

169. What value should come in place of the question mark? $48 \div 6 + 12 \times 3 - 15 = ?$ [Easy]

- (A) 26 (D) 33
 (B) 29 (E) None of these
 (C) 31

170. Find the value of $\frac{3}{5}$ of $450 + \frac{2}{7}$ of 259. [Easy]

- (A) 334 (D) 364
 (B) 344 (E) None of these
 (C) 354

171. What is the value of $\sqrt{1024} + \sqrt{729} - \sqrt{441}$? [Easy]

- (A) 36 (D) 42
 (B) 38 (E) None of these
 (C) 40

172. What value should replace the question mark? $(18)^2 - (13)^2 + 45 = ?$ [Easy]

- (A) 185 (D) 200
 (B) 190 (E) None of these
 (C) 195

173. Find the value of 37.5% of 800 + 12.5% of 640. [Easy]

- (A) 360 (D) 390
 (B) 370 (E) None of these
 (C) 375

174. If $\frac{x}{4} + \frac{x}{6} = 25$, then the value of x is: [Easy]

- (A) 60 (D) 75
 (B) 66 (E) None of these
 (C) 72

175. What value should come in place of the question mark? $\frac{144 \times 16}{48} - 25 = ?$ [Easy]

- (A) 15 (D) 23
 (B) 18 (E) None of these
 (C) 20

176. What value should come in place of the question mark? $\left(\frac{3}{4} \text{ of } 1200\right) \div 15 + 42\% \text{ of } 350 = ?$

[Moderate]

- (A) 207 (D) 222
 (B) 212 (E) None of these
 (C) 217

177. What value should come in place of the question mark? $\sqrt{?} + 15 = \frac{2}{5} \times 700 - 195$ [Moderate]

- (A) 4225 (D) 4900
 (B) 4489 (E) None of these
 (C) 4624

178. Find the value of $\frac{2}{3}$ of $\frac{5}{8}$ of $\frac{4}{7}$ of 4410. [Moderate]

- (A) 950 (D) 1050
 (B) 1000 (E) None of these
 (C) 1025

179. Mr. Rajesh Sharma, a bank officer, earns a monthly salary of Rs. 48,000. He spends 35% of it on household expenses and $\frac{1}{6}$ of the remaining amount on transport. The rest he deposits in his savings account. How much does he deposit each month? [Moderate]

- (A) Rs. 24,800 (D) Rs. 27,200
 (B) Rs. 25,600 (E) None of these
 (C) Rs. 26,000

180. What value should come in place of the question mark? $(24)^2 \div 16 + (13)^2 - \sqrt{2025} = ?$ [Moderate]

- (A) 150 (D) 170
 (B) 155 (E) None of these
 (C) 165

181. Simplify: $\frac{(0.8)^3 + (0.2)^3}{(0.8)^2 - 0.8 \times 0.2 + (0.2)^2}$ [Moderate]

- (A) 0.6 (D) 1.2
 (B) 0.8 (E) None of these
 (C) 1

182. What is the value of $12\frac{1}{2} + 8\frac{3}{4} - \left(6\frac{5}{8} \times 2\right)$? [Moderate]

- (A) 6.5 (D) 10.25
 (B) 8 (E) None of these
 (C) 9.5

183. What value should come in place of the question mark? $\frac{(18)^2 + \sqrt{1296}}{\sqrt{225} \times 2} + 37.5\% \text{ of } 96 = ?$ [Difficult]

- (A) 44 (D) 56
 (B) 48 (E) None of these
 (C) 52

184. Simplify: $\frac{(4.5)^2 - (2.5)^2}{(4.5)^3 + (2.5)^3} \times [(4.5)^2 - 4.5 \times 2.5 + (2.5)^2]$ [Difficult]
- (A) 2 (D) 3.5
 (B) 2.5 (E) None of these
 (C) 3

185. The Verma family's total monthly expenditure is Rs. 63,000. They spend $\frac{2}{9}$ of it on rent, 25% of the remainder on food, and $\frac{3}{7}$ of whatever is then left on their children's education. The balance goes on miscellaneous items. How much is spent on miscellaneous items? [Difficult]

- (A) Rs. 18,900 (D) Rs. 22,750
 (B) Rs. 20,250 (E) None of these
 (C) Rs. 21,000

186. Simplify: $\left(\frac{7}{9} \div \frac{14}{27}\right) \times \left(\frac{5}{8} + \frac{3}{4}\right) \div \frac{11}{16}$ [Difficult]
- (A) $1\frac{1}{2}$ (C) $2\frac{1}{2}$
 (B) 2 (D) 3
 (E) None of these

187. What value should come in place of the question mark? $(?)^2 + (23)^2 = (35)^2 - (12)^2 + 24$ [Difficult]
- (A) 24 (D) 32
 (B) 26 (E) None of these
 (C) 28

188. Simplify: $\frac{3.6 \times 0.48 \times 2.50}{0.12 \times 0.09 \times 0.5}$ [Difficult]
- (A) 600 (D) 900
 (B) 720 (E) None of these
 (C) 800

189. Find the value of $\frac{1}{2} + \frac{1}{6} + \frac{1}{12} + \frac{1}{20} + \frac{1}{30} + \frac{1}{42}$. [Difficult]
- (A) $\frac{5}{7}$ (C) $\frac{7}{8}$
 (B) $\frac{6}{7}$ (D) $\frac{11}{12}$
 (E) None of these

1.2.3 Approximation and rounding techniques [checked, 1 flagged]

190. What approximate value should come in place of the question mark (?) in the following?
 $\sqrt{624.98} \times 15.02 = ?$ [Easy]

- (A) 360 (D) 400
 (B) 375 (E) 420
 (C) 390

191. What approximate value should come in place of the question mark (?) in the following?

$$19.97\% \text{ of } 4501 = ?$$

[Easy]

- | | |
|---------|---------|
| (A) 750 | (D) 900 |
| (B) 800 | (E) 950 |
| (C) 850 | |

192. What approximate value should come in place of the question mark (?) in the following?

$$(23.98)^2 - (15.99)^2 = ?$$

[Easy]

- | | |
|---------|---------|
| (A) 320 | (D) 380 |
| (B) 340 | (E) 400 |
| (C) 360 | |

193. What approximate value should come in place of the question mark (?) in the following?

$$1249.87 \div 24.98 = ?$$

[Easy]

- | | |
|--------|--------|
| (A) 30 | (D) 45 |
| (B) 35 | (E) 50 |
| (C) 40 | |

194. Suresh purchases 19.87 kg of basmati rice for his shop at a rate of Rs. 47.95 per kg. Approximately how much does he pay in all?

[Easy]

- | | |
|-------------|--------------|
| (A) Rs. 780 | (D) Rs. 960 |
| (B) Rs. 840 | (E) Rs. 1020 |
| (C) Rs. 900 | |

195. What approximate value should come in place of the question mark (?) in the following?

$$\sqrt[3]{4095.99} + \sqrt{1024.02} = ?$$

[Easy]

- | | |
|--------|--------|
| (A) 40 | (D) 46 |
| (B) 42 | (E) 48 |
| (C) 44 | |

196. A bank branch reports its half-yearly deposit mobilisation as Rs. 2,34,567. Rounded off to the nearest thousand rupees, this figure becomes:

[Easy]

- | | |
|------------------|-------------------|
| (A) Rs. 2,34,000 | (D) Rs. 2,35,600 |
| (B) Rs. 2,34,500 | (E) None of these |
| (C) Rs. 2,35,000 | |

197. What approximate value should come in place of the question mark (?) in the following?

$$\frac{4999.99}{24.99} + \frac{3600.11}{5.98} = ?$$

[Moderate]

- | | |
|---------|----------|
| (A) 800 | (D) 950 |
| (B) 850 | (E) 1000 |
| (C) 900 | |

198. What approximate value should come in place of the question mark (?) in the following?

$$(15.02)^2 \times \sqrt{195.99} \div 3.99 = ?$$

[Moderate]

- (A) 690 (D) 840
 (B) 740 (E) 890
 (C) 790

199. During a financial year a bank branch disbursed loans worth Rs. 24,98,760, of which 14.98% later turned into non-performing assets. Approximately what amount turned into non-performing assets?

[Moderate]

- (A) Rs. 2,75,000 (D) Rs. 3,50,000
 (B) Rs. 3,00,000 (E) Rs. 3,75,000
 (C) Rs. 3,25,000

200. What approximate value should come in place of the question mark (?) in the following?

$$\frac{3}{7} \text{ of } 1399.94 + \frac{5}{9} \text{ of } 899.87 = ?$$

[Moderate]

- (A) 1000 (D) 1300
 (B) 1100 (E) 1400
 (C) 1200

201. The price of a commodity is Rs. 1250. It is first increased by 19.98% and the increased price is then reduced by 10.01%. Approximately what is the final price?

[Moderate]

- (A) Rs. 1300 (D) Rs. 1375
 (B) Rs. 1325 (E) Rs. 1400
 (C) Rs. 1350

202. What approximate value should come in place of the question mark (?) in the following?

$$\sqrt{1295.99} \times \sqrt{255.98} \div \sqrt{80.98} = ?$$

[Moderate]

- (A) 64 (D) 76
 (B) 68 (E) 80
 (C) 72

203. Five branches of a bank collected deposits of Rs. 12,49,870, Rs. 8,00,120, Rs. 15,49,890, Rs. 9,99,970 and Rs. 13,99,850 in a month. Approximately what is the average deposit per branch?

[Moderate]

- (A) Rs. 10,00,000 (D) Rs. 13,00,000
 (B) Rs. 11,00,000 (E) None of these
 (C) Rs. 12,00,000

204. What approximate value should come in place of the question mark (?) in the following?

$$(7.98)^3 + (4.02)^3 - (5.99)^3 = ?$$

[Difficult]

- (A) 360 (D) 420
 (B) 380 (E) 440
 (C) 400

205. What approximate value should come in place of the question mark (?) in the following?

$$\sqrt[3]{5831.98} \times \sqrt{440.99} \div (2.99)^2 = ?$$

[Difficult]

- (A) 36 (D) 42
 (B) 38 (E) 44
 (C) 40

206. Mr. Iyer deposits Rs. 15,998 in a scheme paying 10.02% per annum compounded annually. Approximately what amount will he receive at the end of 2 years? [Difficult]

- (A) Rs. 18,700 (D) Rs. 20,160
 (B) Rs. 19,360 (E) None of these
 (C) Rs. 19,840

207. Rajesh earns a monthly salary of Rs. 39,998. He spends 24.98% of it on house rent, then 20.01% of the remaining amount on food, and then $\frac{1}{8}$ of what is still left on transport. Approximately how much is he left with at the end of the month? [Difficult]

- (A) Rs. 19,000 (D) Rs. 22,000
 (B) Rs. 20,000 (E) Rs. 23,000
 (C) Rs. 21,000

208. What approximate value should come in place of the question mark (?) in the following?

$$\left(\frac{4}{5} \text{ of } 2499.87\right) \div \left(\frac{3}{8} \text{ of } 639.94\right) \times 5.98 = ? \quad [\text{Difficult}]$$

- (A) 35 (D) 50
 (B) 40 (E) 55
 (C) 45

209. What approximate value should come in place of the question mark (?) in the following?

$$34.98\% \text{ of } 799.87 + 44.97\% \text{ of } 1199.94 - 24.99\% \text{ of } 399.98 = ? \quad [\text{Difficult}]$$

- (A) 660 (D) 750
 (B) 690 (E) 780
 (C) 720

210. What approximate value should come in place of the question mark (?) in the following?

$$\frac{12.02 \times 14.98 \times 8.03}{5.99 \times 3.01} = ? \quad [\text{Difficult}]$$

- (A) 60 (D) 75
 (B) 65 (E) None of these
 (C) 70

1.2.4 Speed-calculation methods: tables, squares, fraction-percentage equivalents [checked, 2 flagged]

211. Anjali's monthly salary is Rs. 48,000. She deposits 12.5% of it in a recurring deposit with her bank every month. How much does she deposit each month? [Easy]

- (A) Rs. 5,000 (D) Rs. 7,200
 (B) Rs. 6,000 (E) Rs. 8,000
 (C) Rs. 6,400

212. Using the short method for squaring a number ending in 5, find the value of 45^2 . [Easy]

- (A) 2025 (D) 2225
- (B) 2045 (E) 2125
- (C) 1845

213. A bank cashier receives 14 sealed bundles of currency notes, each bundle containing 17 notes. What is the total number of notes received? [Easy]

- (A) 228 (D) 244
- (B) 234 (E) 252
- (C) 238

214. What is 62.5% of Rs. 3,200? [Easy]

- (A) Rs. 1,600 (D) Rs. 2,000
- (B) Rs. 1,800 (E) None of these
- (C) Rs. 1,920

215. A shopkeeper allows a discount of $16\frac{2}{3}\%$ on a refrigerator marked at Rs. 5,400. What is the discount amount? [Easy]

- (A) Rs. 720 (D) Rs. 864
- (B) Rs. 750 (E) Rs. 900
- (C) Rs. 810

216. Find the value of 108^2 using the base method. [Easy]

- (A) 10,864 (D) 11,764
- (B) 11,608 (E) 11,864
- (C) 11,664

217. Which one of the following fractions is exactly equal to 37.5%? [Easy]

- (A) $\frac{2}{5}$ (D) $\frac{3}{8}$
- (B) $\frac{5}{16}$ (E) $\frac{3}{7}$
- (C) $\frac{1}{3}$

218. A square conference hall in a bank's regional office has each side measuring 96 metres. What is its area, in square metres? [Moderate]

- (A) 9,116 (D) 9,164
- (B) 9,216 (E) 9,616
- (C) 9,316

219. In a month Ramesh spends $33\frac{1}{3}\%$ of his Rs. 4,200 travel budget on fuel and 12.5% of his Rs. 3,200 grocery budget on dairy items. What is the total of these two expenses? [Moderate]

- (A) Rs. 1,700
 (B) Rs. 1,750
 (C) Rs. 1,800
- (D) Rs. 1,850
 (E) None of these

220. Find the value of $87^2 - 13^2$.

[Moderate]

- (A) 7,400
 (B) 7,300
 (C) 7,040
- (D) 7,440
 (E) 6,400

221. A stationery supplier delivers 384 identical packets to a bank branch, each costing Rs. 125. What is the total bill?

[Moderate]

- (A) Rs. 46,000
 (B) Rs. 47,500
 (C) Rs. 48,500
- (D) Rs. 49,200
 (E) None of these

222. A bank branch sanctioned 6,400 loan applications in a year, of which 18.75% were education loans. How many education loans were sanctioned?

[Moderate]

- (A) 1,050
 (B) 1,120
 (C) 1,150
- (D) 1,200
 (E) 1,280

223. By what percent is $\frac{5}{8}$ greater than $\frac{1}{2}$?

[Moderate]

- (A) 12.5%
 (B) 20%
 (C) 25%
- (D) 30%
 (E) $33\frac{1}{3}\%$

224. The difference between the squares of two consecutive natural numbers is 141. What is the larger of the two numbers?

[Moderate]

- (A) 70
 (B) 71
 (C) 72
- (D) 73
 (E) 74

225. A retiring employee receives a lump sum of Rs. 76,800. He puts 37.5% of it into a pension fund, and then invests $16\frac{2}{3}\%$ of whatever remains in mutual funds. How much money is he left with after both investments?

[Difficult]

- (A) Rs. 38,400
 (B) Rs. 40,000
 (C) Rs. 41,600
- (D) Rs. 42,000
 (E) Rs. 44,800

226. Find the value of $\frac{113 \times 113 + 87 \times 87 + 2 \times 113 \times 87}{40}$.

[Difficult]

- (A) 1,000 (D) 1,200
 (B) 800 (E) 1,600
 (C) 900

227. The price of a washing machine, originally Rs. 7,200, was first increased by 12.5% and later reduced by $11\frac{1}{9}\%$ of the increased price. What is the final price? [Difficult]

- (A) Rs. 6,912 (D) Rs. 7,344
 (B) Rs. 7,200 (E) None of these
 (C) Rs. 7,290

228. Find the value of $\frac{(76)^2 - (24)^2}{52} + \frac{(63)^2 - (37)^2}{26}$. [Difficult]

- (A) 150 (D) 225
 (B) 175 (E) 250
 (C) 200

229. If $8\frac{1}{3}\%$ of a certain number is equal to 6.25% of Rs. 2,400, what is that number? [Difficult]

- (A) 1,500 (D) 1,800
 (B) 1,600 (E) 2,000
 (C) 1,750

230. A square plot of land has an area of 7,396 square metres. What is the cost of fencing it once along its boundary at Rs. 250 per metre? [Difficult]

- (A) Rs. 86,000 (D) Rs. 91,000
 (B) Rs. 84,000 (E) None of these
 (C) Rs. 88,000

231. A bank branch has 12,800 registered customers. Of these, 43.75% use net banking. Of the customers who do not use net banking, $33\frac{1}{3}\%$ use only the mobile app. How many customers use neither net banking nor the mobile app? [Difficult]

- (A) 4,200 (D) 5,200
 (B) 4,500 (E) 5,600
 (C) 4,800

Section 1.3

1.3.1 Percentage fundamentals; conversion to and from fractions [checked, 3 flagged]

232. Out of the 20 counters in a branch of Bharat Bank, 7 are reserved for senior citizens. What percentage of the counters is reserved for senior citizens? [Easy]

- (A) 30% (D) 37.5%
 (B) 32.5% (E) None of these
 (C) 35%

233. What is 45% of 640?

[Easy]

- (A) 268
- (B) 288
- (C) 298
- (D) 308
- (E) None of these

234. 37.5%, when expressed as a fraction in its lowest terms, is equal to:

[Easy]

- (A) $\frac{2}{5}$
- (B) $\frac{3}{5}$
- (C) $\frac{5}{8}$
- (D) $\frac{3}{8}$
- (E) None of these

235. If 25% of a certain number is 90, then the number is:

[Easy]

- (A) 320
- (B) 340
- (C) 350
- (D) 380
- (E) None of these

236. 45 is what percent of 250?

[Easy]

- (A) 15%
- (B) 16%
- (C) 17.5%
- (D) 18%
- (E) None of these

237. The fraction $\frac{3}{16}$ expressed as a percentage is:

[Easy]

- (A) 18.75%
- (B) 16.75%
- (C) 18.25%
- (D) 19.25%
- (E) None of these

238. $16\frac{2}{3}\%$, when expressed as a fraction in its lowest terms, is equal to:

[Easy]

- (A) $\frac{1}{5}$
- (B) $\frac{1}{6}$
- (C) $\frac{2}{15}$
- (D) $\frac{3}{20}$
- (E) None of these

239. A branch manager sanctions a loan portfolio of Rs. 2,500. Of this, 30% is lent to traders, and 40% of the traders' share is lent to a single firm, Kapoor & Sons. How much is lent to Kapoor & Sons?

[Moderate]

- (A) Rs. 250
- (B) Rs. 280
- (C) Rs. 320
- (D) Rs. 300
- (E) None of these

240. In an office of a public sector bank, $\frac{5}{8}$ of the employees are men and the rest are women. If there are 96 women in the office, how many men work there?

[Moderate]

- (A) 144
(B) 160
(C) 168
- (D) 176
(E) None of these

241. By what percent is $\frac{5}{6}$ greater than $\frac{3}{4}$? [Moderate]

- (A) $8\frac{1}{3}\%$
(B) 10%
(C) 12.5%
- (D) $11\frac{1}{9}\%$
(E) None of these

242. In a recruitment test, Deepak scored 35% of the maximum marks and fell short of the pass mark by 35 marks. If 210 marks are required to pass, what are the maximum marks of the test? [Moderate]

- (A) 500
(B) 480
(C) 450
- (D) 520
(E) None of these

243. If 15% of A is equal to 20% of B, then A : B is: [Moderate]

- (A) 3 : 4
(B) 5 : 3
(C) 4 : 3
- (D) 5 : 4
(E) None of these

244. What is the sum of $33\frac{1}{3}\%$ of 720 and 12.5% of 1,024? [Moderate]

- (A) 348
(B) 368
(C) 358
- (D) 378
(E) None of these

245. In a written examination of total 400 marks, Anil scored 240 marks and Priya scored 30% more marks than Anil. Priya's score, expressed as a percentage of the total marks, is: [Moderate]

- (A) 80%
(B) 78%
(C) 75%
- (D) 72%
(E) None of these

246. If 40% of a is equal to $\frac{2}{3}$ of b , and b is $\frac{3}{5}$ of c , then a is what percent of c ? [Difficult]

- (A) 80%
(B) 90%
(C) 100%
- (D) 120%
(E) None of these

247. In a school, 60% of the students are girls. If 40% of the boys and 25% of the girls have opted for the music class, what percent of the total students have NOT opted for the music class? [Difficult]

- (A) 71%
(B) 69%
(C) 65%
- (D) 62%
(E) None of these

248. The numerator of a fraction is increased by 20% and its denominator is decreased by 25%. The resulting fraction is $\frac{16}{15}$. What was the original fraction? [Difficult]

- (A) $\frac{3}{4}$ (C) $\frac{2}{3}$
(B) $\frac{4}{5}$ (D) $\frac{5}{6}$
(E) None of these

249. A bonus of Rs. 14,000 is divided among three employees Amit, Bhavna and Chetan in such a way that Amit gets 25% more than Bhavna, and Bhavna gets 20% less than Chetan. What is Chetan's share? [Difficult]

- (A) Rs. 4,000 (D) Rs. 6,000
(B) Rs. 4,500 (E) None of these
(C) Rs. 5,500

250. Two numbers are respectively 25% and 40% less than a third number. The first number is what percent of the second? [Difficult]

- (A) 130% (D) 115%
(B) 125% (E) None of these
(C) 120%

251. Mahesh spends 62.5% of his monthly income and saves the rest. In the next year his income rises by 20% while his expenditure rises by 15%. The percentage increase in his monthly savings is: [Difficult]

- (A) $26\frac{2}{3}\%$ (D) $28\frac{1}{3}\%$
(B) 30% (E) None of these
(C) 31.25%

252. In an election contested by two candidates, 7,500 votes were polled in all, of which 20% were declared invalid. The winning candidate secured 55% of the valid votes. How many valid votes did the losing candidate get? [Difficult]

- (A) 2,500 (D) 3,000
(B) 2,700 (E) None of these
(C) 2,900

1.3.2 Percentage increase and decrease; successive change [checked, 1 flagged]

253. The monthly salary of Ramesh, a clerk in a public sector bank, is Rs. 24,000. After his annual appraisal his salary is increased by 15%. What is his new monthly salary? [Easy]

- (A) Rs. 26,400 (D) Rs. 27,000
(B) Rs. 27,600 (E) None of these
(C) Rs. 28,200

254. In a clearance sale the price of a table fan was reduced from Rs. 850 to Rs. 731. What is the percentage decrease in the price? [Easy]

- (A) 12% (D) 15%
(B) 13% (E) None of these
(C) 14%

255. A retail store marks a mixer grinder at Rs. 2,500 and offers two successive discounts of 20% and 10% on it. What amount does a customer finally pay? [Easy]

- (A) Rs. 1,750 (D) Rs. 1,900
(B) Rs. 1,800 (E) None of these
(C) Rs. 1,850

256. The daily output of a small manufacturing unit is first increased by 25% and the increased output is then decreased by 25%. The net change in the output is: [Easy]

- (A) No change (D) A decrease of 5%
(B) A decrease of 6.25% (E) None of these
(C) An increase of 6.25%

257. The present population of a village is 40,000 and it increases at the rate of 10% per annum. What will the population be after 2 years? [Easy]

- (A) 44,000 (D) 48,400
(B) 48,000 (E) None of these
(C) 49,200

258. Each side of a square plot of land is increased by 20%. By what percent does the area of the plot increase? [Easy]

- (A) 20% (D) 46%
(B) 40% (E) None of these
(C) 44%

259. A shopkeeper reduces the price of a jacket by 20%. By what percent must the reduced price now be increased so that the price returns to its original value? [Easy]

- (A) 20% (D) 30%
(B) 22.5% (E) None of these
(C) 25%

260. The monthly salary of Sunita was first increased by 20% and the increased salary was later decreased by 20%. Her present salary is Rs. 28,800. What was her salary before these two changes? [Moderate]

- (A) Rs. 28,800 (D) Rs. 31,200
(B) Rs. 29,400 (E) None of these
(C) Rs. 30,000

261. The price of rice increases by 25%. To economise, the Verma family reduces its monthly consumption of rice by 10%. What is the percentage change in the family's monthly expenditure on rice? [Moderate]

- (A) An increase of 10% (D) A decrease of 12.5%
(B) An increase of 15% (E) None of these
(C) An increase of 13.5%

262. The monthly income of Arun is 25% more than that of Bharat, and the monthly income of Bharat is 20% more than that of Chetan. Arun's income is what percent more than Chetan's income?

[Moderate]

- (A) 45% (D) 47.5%
(B) 50% (E) None of these
(C) 55%

263. A machine bought by a factory depreciates at 10% per annum on its value at the beginning of each year. Its value at the end of 3 years is Rs. 43,740. What was its purchase price? [Moderate]

- (A) Rs. 55,000 (D) Rs. 60,000
(B) Rs. 58,000 (E) None of these
(C) Rs. 62,500

264. The number of savings accounts at a bank branch rose by the same percentage in each of two consecutive years, and the total rise over the two years together was 21%. What was the annual percentage rise? [Moderate]

- (A) 10% (D) 12%
(B) 10.5% (E) None of these
(C) 11%

265. After a recruitment drive the staff strength of a bank increased by 15% and became 1,725. During the next year 8% of the staff left the bank. How many employees does the bank have now? [Moderate]

- (A) 1,560 (D) 1,595
(B) 1,587 (E) None of these
(C) 1,610

266. Ramesh's monthly income is Rs. 40,000, of which he spends 75%. Next year his income increases by 25% while his monthly expenditure increases by 20%. By what percent do his monthly savings increase? [Moderate]

- (A) 30% (D) 45%
(B) 35% (E) None of these
(C) 40%

267. A wholesaler allows three successive discounts of 20%, 15% and 10% on the list price of an air conditioner. The single discount equivalent to these three successive discounts is: [Difficult]

- (A) 38.8% (D) 36.2%
(B) 40.5% (E) None of these
(C) 45%

268. When the price of sugar falls by 12.5%, a household finds that it can buy 4 kg more sugar for Rs. 224 than it could before. What was the original price of sugar per kg? [Difficult]

- (A) Rs. 7 (D) Rs. 10
 (B) Rs. 8 (E) None of these
 (C) Rs. 9

269. The length of a rectangular plot is increased by 25%. By what percent should its breadth be decreased so that the area of the plot increases by only 5%? [Difficult]

- (A) 15% (D) 20%
 (B) 16% (E) None of these
 (C) 18%

270. The deposits of a bank branch rose by 20% during 2023, fell by 10% during 2024 and rose by 25% during 2025. If the deposits at the end of 2025 were Rs. 28 lakh more than at the beginning of 2023, what were the deposits at the beginning of 2023? [Difficult]

- (A) Rs. 75 lakh (D) Rs. 84 lakh
 (B) Rs. 78 lakh (E) None of these
 (C) Rs. 80 lakh

271. The population of a town is 25,000, consisting of males and females. In one year the number of males increases by 8% and the number of females increases by 12%, so that the total population becomes 27,600. How many males were there in the town originally? [Difficult]

- (A) 10,000 (D) 11,500
 (B) 12,000 (E) None of these
 (C) 15,000

272. The market value of a share rose by 20% in the first week and then fell by 25% in the second week. In the third week it rose by $x\%$, after which the share stood exactly at its value at the start of the first week. The value of x is: [Difficult]

- (A) 5% (D) 12.5%
 (B) 10% (E) None of these
 (C) $11\frac{1}{9}\%$

273. Rohit's salary is 20% less than Sanjay's salary. In the next revision Sanjay's salary is increased by 10% and Rohit's salary is increased by 25%. After the revision, Rohit's salary is less than Sanjay's salary by: [Difficult]

- (A) $9\frac{1}{11}\%$ (D) $11\frac{1}{9}\%$
 (B) 10% (E) None of these
 (C) $8\frac{1}{3}\%$

1.3.3 Net change and equivalent-discount formulae

[checked, 2 flagged]

274. The monthly salary of Ramesh was first increased by 20% and, after a revision of the pay policy, the increased salary was reduced by 20%. What is the net change in his salary? [Easy]

- (A) 4% increase (D) 2% decrease
 (B) 4% decrease (E) 8% decrease
 (C) No change

275. A garment showroom in Nagpur offers two successive discounts of 25% and 20% on every winter jacket. The single discount equivalent to these two successive discounts is: [Easy]

- (A) 42% (D) 38%
 (B) 45% (E) None of these
 (C) 40%

276. The price of rice has gone up by 25%. By what percent must a household reduce its consumption of rice so that the monthly expenditure on rice remains unchanged? [Easy]

- (A) 20% (D) 30%
 (B) 25% (E) None of these
 (C) $16\frac{2}{3}\%$

277. The side of a square plot of land in Pune is increased by 10%. The percentage increase in the area of the plot is: [Easy]

- (A) 20% (D) 21%
 (B) 22% (E) None of these
 (C) 25%

278. A dealer allows three successive discounts of 10%, 10% and 10% on the list price of a ceiling fan. The single discount equivalent to this scheme is: [Easy]

- (A) 30% (D) 24.3%
 (B) 28% (E) None of these
 (C) 27.1%

279. The marked price of a wall clock is Rs. 4,800. A shopkeeper allows two successive discounts of 20% and 10%. What amount does a customer actually pay? [Easy]

- (A) Rs. 3,456 (D) Rs. 3,500
 (B) Rs. 3,360 (E) None of these
 (C) Rs. 3,400

280. The book value of a machine in a factory falls by 10% in the first year and then rises by 20% in the second year. The net change in the book value over the two years is: [Easy]

- (A) 10% increase (D) 8% increase
 (B) 2% increase (E) None of these
 (C) 8% decrease

281. A wholesaler of stationery offers three successive discounts of 20%, 15% and 10% to retailers. The single discount equivalent to this offer is: [Moderate]

- (A) 45% (D) 40%
(B) 38.8% (E) None of these
(C) 38.2%

282. A trader marks his goods 40% above the cost price and then allows a discount of 25% on the marked price. If he earns a profit of Rs. 120 on one article, what is the cost price of that article?

[Moderate]

- (A) Rs. 2,000 (D) Rs. 2,880
(B) Rs. 2,200 (E) None of these
(C) Rs. 2,400

283. A television set is marked at Rs. 8,000. Store P offers successive discounts of 25% and 5%, while Store Q offers a flat discount of 30% on the same marked price. How much less does a customer pay at the cheaper store?

[Moderate]

- (A) Rs. 50 (D) Rs. 100
(B) Rs. 150 (E) None of these
(C) Rs. 200

284. The monthly income of Sunita was increased by 20% when she was promoted, but a later restructuring cut the revised income by 25%. If her present monthly income is Rs. 43,200, what was her income before the promotion?

[Moderate]

- (A) Rs. 45,000 (D) Rs. 54,000
(B) Rs. 48,000 (E) None of these
(C) Rs. 50,000

285. The length of a rectangular advertisement hoarding is increased by 20% while its breadth is decreased by 10%. What is the percentage change in the area of the hoarding?

[Moderate]

- (A) 10% increase (D) 6% decrease
(B) 12% increase (E) None of these
(C) 9% increase

286. When the price of sugar fell by 20%, Mrs. Iyer found that she could buy 5 kg more sugar for Rs. 400 than before. What is the reduced price of sugar per kg?

[Moderate]

- (A) Rs. 16 (D) Rs. 15
(B) Rs. 20 (E) None of these
(C) Rs. 18

287. A crockery outlet runs a 'buy 4 get 1 free' scheme on identical mugs and, in addition, allows a discount of 15% on the amount payable. The single discount equivalent to this entire scheme is:

[Moderate]

- (A) 35% (D) 34%
(B) 32% (E) None of these
(C) 30%

288. A dealer marks an air cooler 60% above its cost price and then allows two successive discounts of 20% and 10% to a customer. If he still makes a profit of Rs. 912 on the sale, what is the marked price of the air cooler? [Difficult]

- (A) Rs. 9,000
- (B) Rs. 9,600
- (C) Rs. 8,000
- (D) Rs. 10,000
- (E) None of these

289. Three successive discounts of 10%, 20% and $x\%$ on the marked price of a laptop are together equivalent to a single discount of 42.4%. The value of x is: [Difficult]

- (A) 15
- (B) 18
- (C) 20
- (D) 22
- (E) None of these

290. The population of a town increased by 10% in the first year, decreased by 20% in the second year and increased by 25% in the third year. If the population at the end of the third year is 66,000, what was the population at the beginning of the first year? [Difficult]

- (A) 60,000
- (B) 62,500
- (C) 58,000
- (D) 64,000
- (E) None of these

291. As part of a cost-cutting exercise, the salary of an employee was first reduced by 20% and the reduced salary was again reduced by 25%. By what percent must the final salary now be increased so that the employee gets back his original salary? [Difficult]

- (A) 45%
- (B) 50%
- (C) 60%
- (D) $66\frac{2}{3}\%$
- (E) None of these

292. A retailer sells an article at a discount of 20% on the marked price and still gains 20%. If instead he had allowed a discount of 30% on the same marked price, his profit percent would have been: [Difficult]

- (A) 10%
- (B) 5%
- (C) 7.5%
- (D) 4%
- (E) None of these

293. Two equal successive discounts allowed on the marked price of a refrigerator are together equivalent to a single discount of 36%. If the dealer instead allows three successive discounts at that same rate, the equivalent single discount would be: [Difficult]

- (A) 48.8%
- (B) 51.2%
- (C) 54%
- (D) 60%
- (E) None of these

294. The monthly expenditure of Mr. Deshmukh is 75% of his monthly income and the rest is saved. In the next financial year his income increases by 20% and his expenditure increases by 15%. What is the percentage increase in his monthly savings? [Difficult]

- (A) 30% (D) 40%
 (B) 32% (E) None of these
 (C) 35%

1.3.4 Applications: population growth, depreciation, exam marks

[checked]

295. The population of Rampur village is 25,000 at present and it grows at the rate of 4% per annum. What will be the population of the village after 2 years? [Easy]

- (A) 26,000 (D) 27,400
 (B) 27,000 (E) 28,080
 (C) 27,040

296. Sunita Enterprises purchased a photocopier for Rs. 80,000. Its value depreciates by 10% every year on the reducing balance. What is its value at the end of 2 years? [Easy]

- (A) Rs. 64,000 (D) Rs. 66,000
 (B) Rs. 64,800 (E) Rs. 72,000
 (C) Rs. 65,000

297. In a certain examination the maximum marks are 650 and a candidate must obtain 40% of the maximum marks to pass. Ramesh secured 234 marks. By how many marks did he fail? [Easy]

- (A) 16 (D) 34
 (B) 24 (E) 46
 (C) 26

298. Due to migration to nearby cities, the population of a small town fell by 20% in one year and became 9600. What was the population of the town before the fall? [Easy]

- (A) 11,520 (D) 12,500
 (B) 12,000 (E) None of these
 (C) 12,200

299. A car bought by Mr. Iyer for Rs. 6,50,000 was valued at Rs. 5,20,000 exactly one year later. What is the annual rate of depreciation? [Easy]

- (A) 15% (D) 22%
 (B) 18% (E) 25%
 (C) 20%

300. In a recruitment test taken by 1200 candidates, 65% of the candidates cleared the test. How many candidates did not clear it? [Easy]

- (A) 350 (D) 460
 (B) 400 (E) 780
 (C) 420

301. The population of a colony was 50,000. It increased by 10% during the first year and then decreased by 10% during the second year. What was the population at the end of the second year? [Easy]

- (A) 49,000 (D) 50,500
(B) 49,500 (E) 55,000
(C) 50,000

302. The population of a town increased by 10% during the first year and by 20% during the next year. If the present population is 66,000, what was the population two years ago? [Moderate]

- (A) 45,000 (D) 52,000
(B) 48,000 (E) 55,000
(C) 50,000

303. A printing machine costing Rs. 1,50,000 depreciates at 20% per annum on the reducing balance. At the end of how many complete years will its value first fall below Rs. 80,000? [Moderate]

- (A) 2 years (D) 5 years
(B) 3 years (E) 6 years
(C) 4 years

304. A student must obtain 40% of the total marks to pass an examination. He obtained 178 marks and failed by 22 marks. What are the maximum marks of the examination? [Moderate]

- (A) 400 (D) 550
(B) 450 (E) 600
(C) 500

305. In an examination, Anil obtained 25% of the maximum marks and failed by 30 marks, while Bhavna obtained 45% of the maximum marks and secured 30 marks more than the pass marks. What are the maximum marks? [Moderate]

- (A) 250 (D) 320
(B) 280 (E) None of these
(C) 300

306. The population of a village is 15,000, consisting of men and women only. In one year the number of men increased by 8% and the number of women increased by 5%, so that the total population became 15,990. How many men were there in the village originally? [Moderate]

- (A) 6000 (D) 8000
(B) 7000 (E) 9000
(C) 7500

307. A machine bought for Rs. 2,00,000 depreciated by 15% in the first year and by a further 10% of its then value in the second year. The total depreciation over the two years, expressed as a percentage of the original cost, is [Moderate]

- (A) 20% (D) 27.5%
(B) 22.5% (E) None of these
(C) 25%

308. In a competitive test Deepak scored 60% in Quantitative Aptitude (maximum 150 marks), 55% in English (maximum 100 marks) and 70% in General Awareness (maximum 50 marks). What is his overall percentage in the test? [Moderate]

- (A) 58% (D) 61.67%
 (B) 59% (E) 62.5%
 (C) 60%

309. The population of a city rose by 10% in the first year, fell by 10% in the second year and rose again by 20% in the third year. If the population at the end of the third year was 1,18,800, what was the population at the beginning of the first year? [Difficult]

- (A) 95,000 (D) 1,10,000
 (B) 1,00,000 (E) 1,20,000
 (C) 1,05,000

310. A firm bought a generator for Rs. 3,12,500. Its book value depreciates at 20% per annum on the reducing balance. At the end of the third year the firm sold the generator for Rs. 1,80,000. What was the firm's gain over the book value on the date of sale? [Difficult]

- (A) Rs. 12,500 (D) Rs. 25,600
 (B) Rs. 16,000 (E) Rs. 32,000
 (C) Rs. 20,000

311. In an examination taken by 1000 candidates, 52% failed in English and 42% failed in Mathematics, while 17% failed in both the subjects. How many candidates passed in both the subjects? [Difficult]

- (A) 130 (D) 270
 (B) 170 (E) 330
 (C) 230

312. In an examination a candidate scoring 25% of the maximum marks fails by 45 marks. The marks needed for a first class are 60 more than the pass marks, and a candidate scoring 55% of the maximum marks gets 15 marks more than the first-class requirement. What are the maximum marks? [Difficult]

- (A) 350 (D) 500
 (B) 400 (E) None of these
 (C) 450

313. The value of a machine depreciates at a constant rate per annum on the reducing balance. Its value at the end of 2 years is Rs. 1,45,800 and at the end of 4 years is Rs. 1,18,098. What was the original cost of the machine? [Difficult]

- (A) Rs. 1,62,000 (D) Rs. 1,85,000
 (B) Rs. 1,75,000 (E) Rs. 2,00,000
 (C) Rs. 1,80,000

314. The population of town A is 20% more than that of town B . During a year the population of A increases by 10% and that of B increases by 25%, after which the population of B becomes 25,000. The new population of A is what percent more than the new population of B ? [Difficult]

- (A) 4.5% (D) 8%
 (B) 5.6% (E) None of these
 (C) 6.4%

315. A test consists of 200 questions, each carrying 1 mark, with $\frac{1}{4}$ mark deducted for every wrong answer. Kavita attempted 80% of the questions and 70% of her attempted questions were correct. What percentage of the maximum marks did she finally score? [Difficult]

- (A) 44% (D) 60%
 (B) 50% (E) 70%
 (C) 56%

Section 1.4

1.4.1 Ratio, compound and inverse ratio

[checked, 1 flagged]

316. Two numbers are in the ratio 5 : 7 and their sum is 720. What is the larger of the two numbers? [Easy]

- (A) 300 (D) 360
 (B) 420 (E) None of these
 (C) 480

317. What is the compound ratio of 3 : 4, 5 : 7 and 8 : 9? [Easy]

- (A) 5 : 14 (D) 10 : 21
 (B) 15 : 28 (E) None of these
 (C) 20 : 63

318. The monthly salaries of Amit and Bhavna are in the ratio 4 : 5. If Amit's monthly salary is Rs. 24,000, what is Bhavna's monthly salary? [Easy]

- (A) Rs. 28,000 (D) Rs. 27,000
 (B) Rs. 32,000 (E) None of these
 (C) Rs. 30,000

319. A festival bonus of Rs. 11,700 is divided among Deepak, Farhan and Geeta in the ratio 2 : 3 : 4. What is Geeta's share? [Easy]

- (A) Rs. 2,600 (D) Rs. 6,300
 (B) Rs. 3,900 (E) None of these
 (C) Rs. 4,800

320. What is the duplicate ratio of 9 : 11? [Easy]

- (A) 81 : 121 (D) 121 : 81
 (B) 18 : 22 (E) None of these
 (C) 27 : 33

321. If $A : B = 2 : 3$ and $B : C = 4 : 5$, then $A : C$ is equal to: [Easy]

- (A) 2 : 5
(B) 3 : 10
(C) 8 : 15
- (D) 5 : 8
(E) None of these

322. What is the inverse ratio of the compound ratio of 2 : 3 and 5 : 8?

[Easy]

- (A) 5 : 12
(B) 3 : 2
(C) 12 : 5
- (D) 8 : 5
(E) None of these

323. Two numbers are in the ratio 3 : 5. If 6 is added to each of them, the ratio becomes 2 : 3. What is the smaller number?

[Moderate]

- (A) 15
(B) 18
(C) 21
- (D) 24
(E) None of these

324. An incentive of Rs. 24,500 is shared among Arjun, Bhaskar and Chitra. Arjun's share to Bhaskar's share is 3 : 4, and Bhaskar's share to Chitra's share is 6 : 7. Find Chitra's share.

[Moderate]

- (A) Rs. 8,400
(B) Rs. 6,300
(C) Rs. 10,500
- (D) Rs. 9,800
(E) None of these

325. The monthly incomes of Naveen and Pooja are in the ratio 5 : 4 and their monthly expenditures are in the ratio 3 : 2. If each of them saves Rs. 9,000 per month, what is Naveen's monthly income?

[Moderate]

- (A) Rs. 22,500
(B) Rs. 18,000
(C) Rs. 20,000
- (D) Rs. 25,000
(E) None of these

326. A vessel contains 21 litres of a mixture of milk and water in the ratio 5 : 2. How many litres of water must be added so that milk and water are in the ratio 1 : 1?

[Moderate]

- (A) 6 litres
(B) 7.5 litres
(C) 9 litres
- (D) 10.5 litres
(E) None of these

327. The present ages of Rakesh and Sunita are in the ratio 5 : 7. Six years from now, the ratio of their ages will be 3 : 4. What is Sunita's present age?

[Moderate]

- (A) 30 years
(B) 35 years
(C) 36 years
- (D) 48 years
(E) None of these

328. A bank's cash box contains coins of denominations Rs. 1, Rs. 2 and Rs. 5, and the numbers of these coins are in the ratio 3 : 5 : 7. If the total value of the coins is Rs. 2,400, how many Rs. 2 coins are there?

[Moderate]

- (A) 150 (D) 250
 (B) 300 (E) None of these
 (C) 350

329. The compound ratio of $3 : 4$, $x : 5$ and $10 : 9$ is $2 : 3$. What is the value of x ? [Moderate]

- (A) 3 (D) 6
 (B) 4 (E) None of these
 (C) 5

330. A sum of money is divided among Anand, Bharti and Chandan in such a way that Anand's share is half of what Bharti and Chandan together receive, while Bharti's share is two-thirds of what Anand and Chandan together receive. If Anand receives Rs. 4,000, how much does Chandan receive? [Difficult]

- (A) Rs. 2,800 (D) Rs. 4,800
 (B) Rs. 3,000 (E) None of these
 (C) Rs. 3,200

331. Vessel A contains milk and water in the ratio $5 : 3$, and vessel B contains milk and water in the ratio $7 : 5$. Mixtures are drawn from A and B in the ratio $3 : 2$ by volume and poured into a third vessel. What is the ratio of milk to water in the resulting mixture? [Difficult]

- (A) $47 : 73$ (D) $35 : 24$
 (B) $73 : 47$ (E) None of these
 (C) $61 : 59$

332. If $x : y = 4 : 3$, what is the value of $(3x^2 + 2y^2) : (3x^2 - 2y^2)$? [Difficult]

- (A) $11 : 5$ (D) $9 : 4$
 (B) $5 : 11$ (E) None of these
 (C) $13 : 7$

333. An amount of Rs. 15,500 is divided among Kiran, Latha and Mohan in the inverse ratio of $2 : 3 : 5$. What is Mohan's share? [Difficult]

- (A) Rs. 7,500 (D) Rs. 3,000
 (B) Rs. 5,000 (E) None of these
 (C) Rs. 3,100

334. Three numbers are in the ratio $3 : 4 : 5$ and the sum of their squares is 1250. What is the sum of the three numbers? [Difficult]

- (A) 50 (D) 75
 (B) 60 (E) None of these
 (C) 45

335. The salaries of Ravi, Meena and Suresh are in the ratio $2 : 3 : 5$. If Ravi's salary is increased by 15%, Meena's by 10% and Suresh's by 20%, what will be the new ratio of their salaries? [Difficult]

- (A) 23 : 33 : 50
 (B) 46 : 33 : 60
 (C) 23 : 33 : 60
 (D) 20 : 30 : 50
 (E) None of these

336. A vessel contains 60 litres of a mixture of milk and water in the ratio 7 : 3. If 15 litres of the mixture is drawn off and replaced by an equal quantity of pure water, what is the new ratio of milk to water? [Difficult]

- (A) 21 : 19
 (B) 19 : 21
 (C) 7 : 5
 (D) 49 : 51
 (E) None of these

1.4.2 Proportion; direct and inverse variation

[checked, 1 flagged]

337. The cost of stationery purchased by a bank branch varies directly as the number of items bought. If 12 gel pens cost Rs. 180, what will 18 such pens cost? [Easy]

- (A) Rs. 240
 (B) Rs. 250
 (C) Rs. 270
 (D) Rs. 300
 (E) None of these

338. A contractor observes that 15 workers can complete the plastering of a building in 24 days. Working at the same rate, in how many days will 18 workers complete the same job? [Easy]

- (A) 18 days
 (B) 20 days
 (C) 21 days
 (D) 22.5 days
 (E) None of these

339. Find the fourth proportional to 8, 12 and 20. [Easy]

- (A) 13.5
 (B) 24
 (C) 28
 (D) 30
 (E) None of these

340. What is the mean proportional between 9 and 49? [Easy]

- (A) 21
 (B) 24
 (C) 29
 (D) 58
 (E) None of these

341. A quantity x varies inversely as a quantity y . When $y = 8$, the value of x is 15. What is the value of x when $y = 12$? [Easy]

- (A) 8
 (B) 10
 (C) 18
 (D) 22.5
 (E) None of these

342. A car covers 240 km using 16 litres of petrol. Assuming the distance covered varies directly as the petrol consumed, how many litres will be needed for a journey of 375 km? [Easy]

- (A) 20 litres
(B) 22 litres
(C) 25 litres
- (D) 28 litres
(E) None of these

343. Find the third proportional to 6 and 12.

[Easy]

- (A) 18
(B) 24
(C) 36
- (D) 48
(E) None of these

344. The value of a diamond varies directly as the square of its weight. A diamond worth Rs. 72,000 accidentally breaks into two pieces whose weights are in the ratio 1 : 2. What is the loss in value caused by the breakage?

[Moderate]

- (A) Rs. 24,000
(B) Rs. 32,000
(C) Rs. 40,000
- (D) Rs. 48,000
(E) None of these

345. In a data-entry centre, 12 operators working 8 hours a day finish a project in 15 days. How many days will 18 operators working 10 hours a day take to finish the same project, if all operators work at the same rate?

[Moderate]

- (A) 8 days
(B) 9 days
(C) 10 days
- (D) 12 days
(E) None of these

346. A quantity y is partly directly proportional to x and partly inversely proportional to x . When $x = 1$, $y = 7$; and when $x = 2$, $y = 8$. What is the value of y when $x = 4$?

[Moderate]

- (A) 11
(B) 12
(C) 13
- (D) 15
(E) None of these

347. Six identical pipes together fill an overhead tank in 1 hour 20 minutes, the filling time varying inversely as the number of pipes in use. If two of the pipes are shut for repairs, how much extra time will the tank now take to fill?

[Moderate]

- (A) 20 minutes
(B) 30 minutes
(C) 35 minutes
- (D) 40 minutes
(E) None of these

348. Three numbers are in continued proportion. The middle number is 12 and the sum of the two extreme numbers is 40. What is the smallest of the three numbers?

[Moderate]

- (A) 3
(B) 4
(C) 6
- (D) 8
(E) None of these

349. A profit of Rs. 6,300 is distributed among three partners Ramesh, Sunita and Vikram in the proportion $\frac{1}{3} : \frac{1}{4} : \frac{1}{6}$ respectively. What is the smallest of the three shares?

[Moderate]

- (A) Rs. 1,400
(B) Rs. 1,800
(C) Rs. 2,100
- (D) Rs. 2,800
(E) None of these

350. A contractor engages 40 labourers to complete a road-repair job in 30 days. After 12 days of work, 8 labourers leave the site. Working at the same rate, in how many more days will the remaining labourers finish the job? [Moderate]

- (A) 18 days
(B) 22.5 days
(C) 24 days
- (D) 25 days
(E) None of these

351. A printing press charges a fixed set-up fee plus a variable amount that varies jointly as the number of copies printed and the number of pages in each copy. Printing 500 copies of an 80-page booklet costs Rs. 46,000, while printing 300 copies of a 60-page booklet costs Rs. 24,000. What will it cost to print 750 copies of a 96-page booklet? [Difficult]

- (A) Rs. 72,000
(B) Rs. 74,000
(C) Rs. 78,000
- (D) Rs. 82,000
(E) None of these

352. The value of a gemstone varies directly as the cube of its weight. A stone weighing 10 grams and worth Rs. 2,00,000 is dropped and breaks into three pieces whose weights are in the ratio 2 : 3 : 5. What is the loss in value? [Difficult]

- (A) Rs. 1,44,000
(B) Rs. 1,52,000
(C) Rs. 1,60,000
- (D) Rs. 1,72,000
(E) None of these

353. A quantity x varies directly as the square of y and inversely as the square root of z . When $y = 4$ and $z = 9$, the value of x is 16. What is the value of x when $y = 6$ and $z = 4$? [Difficult]

- (A) 36
(B) 48
(C) 54
- (D) 60
(E) None of these

354. In a bank branch the number of clerks and the number of officers were in the proportion 5 : 2. After a recruitment drive in which 12 more clerks and 3 more officers joined, the proportion became 8 : 3. How many officers were there in the branch before the recruitment drive? [Difficult]

- (A) 18
(B) 20
(C) 22
- (D) 24
(E) None of these

355. In a factory, 10 machines working 8 hours a day produce 4,000 units in 6 days. The management installs 15 machines of a newer model, each 25% more efficient than the old ones, and runs them 10 hours a day. In how many days will these machines produce 12,500 units? [Difficult]

- (A) 8 days (D) 12 days
 (B) 9 days (E) None of these
 (C) 10 days

356. Four quantities a, b, c, d are in continued proportion. If $a = 3$ and $d = 81$, what is the value of $b + c$? [Difficult]

- (A) 18 (D) 36
 (B) 27 (E) None of these
 (C) 30

357. An annual incentive is divided among three field officers in inverse proportion to the number of days each of them remained absent, namely 12, 15 and 20 days. If the difference between the largest and the smallest share is Rs. 8,000, what is the total incentive amount? [Difficult]

- (A) Rs. 36,000 (D) Rs. 54,000
 (B) Rs. 42,000 (E) None of these
 (C) Rs. 48,000

1.4.3 Partnership, simple and compound

[checked]

358. Ramesh and Suresh started a stationery shop by investing Rs. 12,000 and Rs. 18,000 respectively for the same period. At the end of the year they earned a profit of Rs. 15,000. What is Suresh's share of the profit? [Easy]

- (A) Rs. 6,000 (D) Rs. 10,000
 (B) Rs. 7,500 (E) None of these
 (C) Rs. 9,000

359. Anil, Bhaskar and Chetan invested Rs. 5,000, Rs. 6,000 and Rs. 9,000 respectively in a courier agency for one full year. If the annual profit was Rs. 12,000, how much did the partner with the smallest investment receive? [Easy]

- (A) Rs. 2,400 (D) Rs. 5,400
 (B) Rs. 3,000 (E) None of these
 (C) Rs. 3,600

360. Deepak invested Rs. 8,000 in a business for 6 months while Gopal invested Rs. 4,000 for 12 months. If the total profit earned was Rs. 9,000, what is Gopal's share? [Easy]

- (A) Rs. 3,000 (D) Rs. 4,500
 (B) Rs. 6,000 (E) None of these
 (C) Rs. 5,400

361. Kiran put Rs. 25,000 into a garment business and remained in it for the whole year of 12 months. Manoj put in Rs. 30,000 but stayed for only 8 months. If the yearly profit was Rs. 27,000, what was Kiran's share? [Easy]

- (A) Rs. 12,000
(B) Rs. 15,000
(C) Rs. 13,500
- (D) Rs. 16,200
(E) None of these

362. Three partners of a hardware firm invested amounts in the ratio 3 : 5 : 7 for equal periods. If the partner with the smallest investment received Rs. 4,500 as his share of the profit, what was the total profit of the firm? [Easy]

- (A) Rs. 18,000
(B) Rs. 21,000
(C) Rs. 25,500
- (D) Rs. 22,500
(E) None of these

363. Sameer and Vijay jointly opened a mobile accessories outlet with capitals of Rs. 40,000 and Rs. 50,000 for the same duration. The profit at the end of the year was Rs. 18,000. By how much does Vijay's share exceed Sameer's share? [Easy]

- (A) Rs. 1,000
(B) Rs. 2,000
(C) Rs. 2,500
- (D) Rs. 4,000
(E) None of these

364. Xavier, Yusuf and Zakir each invested Rs. 30,000 in a catering venture, but Xavier stayed for 4 months, Yusuf for 6 months and Zakir for 8 months. If the venture earned Rs. 10,800, what is Zakir's share? [Easy]

- (A) Rs. 2,400
(B) Rs. 3,600
(C) Rs. 5,400
- (D) Rs. 4,800
(E) None of these

365. Arun started a business with Rs. 12,000. After 6 months he withdrew Rs. 4,000 from his capital. Bimal invested Rs. 9,000 and kept it in the business for the entire year. If the annual profit was Rs. 19,000, what is Arun's share? [Moderate]

- (A) Rs. 9,000
(B) Rs. 9,500
(C) Rs. 10,000
- (D) Rs. 11,000
(E) None of these

366. Rahul started a distribution agency with Rs. 30,000. Four months later Nikhil joined him with Rs. 45,000, and two months after Nikhil joined, Sanjay came in with Rs. 60,000. At the end of the year the agency earned Rs. 81,000. What is Sanjay's share? [Moderate]

- (A) Rs. 20,250
(B) Rs. 24,000
(C) Rs. 36,000
- (D) Rs. 27,000
(E) None of these

367. The capitals invested by Farhan and Gita in a printing press are in the ratio 5 : 9, while the periods for which they invested are in the ratio 3 : 2. If the total profit is Rs. 33,000, by how much do their profit shares differ? [Moderate]

- (A) Rs. 2,500
(B) Rs. 3,000
(C) Rs. 4,500
- (D) Rs. 6,000
(E) None of these

368. Ajay and Bharat invested Rs. 24,000 and Rs. 36,000 respectively in a trading firm for one year. Ajay, being the working partner, is paid 15% of the profit as salary and the remaining profit is divided in the ratio of their capitals. If the total profit for the year is Rs. 20,000, how much does Ajay receive in all? [Moderate]

- (A) Rs. 8,000
(B) Rs. 10,200
(C) Rs. 9,800
- (D) Rs. 11,200
(E) None of these

369. Harish invested Rs. 15,000 and Irfan invested a certain sum in a partnership, both for the same period. At the end of the year the firm made a total profit of Rs. 19,500, of which Harish received Rs. 7,500. How much did Irfan invest? [Moderate]

- (A) Rs. 20,000
(B) Rs. 22,500
(C) Rs. 27,000
- (D) Rs. 24,000
(E) None of these

370. Pooja began a business with Rs. 20,000 and after 3 months she brought in an additional Rs. 10,000. Ravi joined at the very start with Rs. 30,000 but withdrew Rs. 10,000 at the end of 6 months. If the profit at the end of the year is Rs. 42,000, what is Pooja's share? [Moderate]

- (A) Rs. 20,000
(B) Rs. 21,000
(C) Rs. 22,000
- (D) Rs. 23,100
(E) None of these

371. In a partnership firm, Lalit invested Rs. 40,000 for 12 months, Mohan invested Rs. 50,000 for 9 months and Nadeem invested Rs. 60,000 for 6 months. If Mohan's share of the annual profit is Rs. 15,000, what is the total profit of the firm? [Moderate]

- (A) Rs. 40,000
(B) Rs. 42,000
(C) Rs. 45,000
- (D) Rs. 43,000
(E) None of these

372. Prakash started a business with Rs. 25,000 and Quresh joined him on the same day with Rs. 35,000. At the end of 4 months Prakash added Rs. 15,000 more, and at the end of 6 months Quresh withdrew Rs. 10,000. At the end of the year Prakash's share exceeded Quresh's share by Rs. 4,000. What was the total annual profit? [Difficult]

- (A) Rs. 48,000
(B) Rs. 52,000
(C) Rs. 54,000
- (D) Rs. 56,000
(E) None of these

373. Nitin and Priya started a firm with capitals of Rs. 45,000 and Rs. 30,000 respectively for one year. Priya manages the firm and is entitled to 20% of the total profit for her services; the balance is divided in the ratio of their capitals. If Priya received Rs. 1,600 more than Nitin, what was the total profit? [Difficult]

- (A) Rs. 32,000 (D) Rs. 50,000
 (B) Rs. 36,000 (E) None of these
 (C) Rs. 40,000

374. Anil started a business with Rs. 20,000 and continued for the whole year. Sunil joined him later in the year with Rs. 30,000. At the end of the year the profit was divided between Anil and Sunil in the ratio 4 : 3. After how many months from the start of the business did Sunil join? [Difficult]

- (A) After 4 months (D) After 6 months
 (B) After 5 months (E) None of these
 (C) After 7 months

375. Kavita began a business with Rs. 36,000. At the end of 4 months she withdrew a part of her capital. Manish joined at the start with Rs. 30,000 and kept it unchanged for the whole year. At the end of the year the profit was shared equally between the two. How much did Kavita withdraw? [Difficult]

- (A) Rs. 6,000 (D) Rs. 12,000
 (B) Rs. 8,000 (E) None of these
 (C) Rs. 9,000

376. Arjun started a wholesale business with Rs. 45,000. Three months later Bhavna joined him with Rs. 60,000. At the end of 9 months from the start, Arjun withdrew Rs. 15,000 while Bhavna added Rs. 20,000 to her capital. If the total profit for the year was Rs. 73,000, what is Arjun's share? [Difficult]

- (A) Rs. 30,000 (D) Rs. 33,000
 (B) Rs. 36,500 (E) None of these
 (C) Rs. 40,000

377. Rohit and Seema entered into a partnership with capitals in the ratio 7 : 5. After 6 months Rohit withdrew $\frac{1}{7}$ of his capital while Seema added $\frac{1}{5}$ of her capital. At the end of the year the total profit was Rs. 1,20,000. What is Seema's share? [Difficult]

- (A) Rs. 50,000 (D) Rs. 65,000
 (B) Rs. 55,000 (E) None of these
 (C) Rs. 60,000

378. Manoj, Naveen and Om invested Rs. 30,000, Rs. 40,000 and Rs. 50,000 respectively in a firm for one year. Manoj, as the working partner, receives 10% of the total profit as commission, and the remaining profit is divided in the ratio of their capitals. If Naveen's share is Rs. 12,000, what is the total profit of the firm? [Difficult]

- (A) Rs. 36,000 (D) Rs. 48,000
 (B) Rs. 42,000 (E) None of these
 (C) Rs. 45,000

1.4.4 Average, basic, weighted, of series

[checked, 1 flagged]

379. What is the average of the first five multiples of 7?

[Easy]

- (A) 17 (D) 24
(B) 19 (E) None of these
(C) 21

380. The average monthly salary of 6 clerks in a bank branch is Rs. 18,500. What is the total monthly salary paid to these 6 clerks? [Easy]

- (A) Rs. 1,11,000 (D) Rs. 1,16,000
(B) Rs. 1,05,000 (E) None of these
(C) Rs. 1,08,000

381. The average of five numbers is 27. Four of the numbers are 20, 25, 30 and 35. What is the fifth number? [Easy]

- (A) 20 (D) 25
(B) 22 (E) 30
(C) 28

382. The average of six numbers is 24. If every one of the six numbers is multiplied by 3, what will be the average of the new set of numbers? [Easy]

- (A) 24 (D) 81
(B) 27 (E) None of these
(C) 48

383. In five one-day matches a batsman scored 45, 52, 38, 61 and 44 runs. What is his average score per match? [Easy]

- (A) 48 (D) 49
(B) 46 (E) 50
(C) 47

384. The average of 20 numbers is zero. At most how many of these numbers can be greater than zero? [Easy]

- (A) 0 (D) 19
(B) 1 (E) 20
(C) 10

385. The average weight of 5 parcels at a courier counter is 12 kg. If one parcel weighing 8 kg is taken away, what is the average weight of the remaining 4 parcels? [Easy]

- (A) 11 kg (D) 14 kg
(B) 13 kg (E) None of these
(C) 12.5 kg

386. The average age of 30 students of a class is 14 years. When the age of the class teacher is included, the average increases by 1 year. What is the age of the class teacher? [Moderate]

- (A) 41 years (D) 47 years
(B) 43 years (E) None of these
(C) 45 years

387. The average of 40 numbers was worked out as 36. Later it was found that one number, 76, had been wrongly read as 36. What is the correct average? [Moderate]

- (A) 36.5 (D) 38
(B) 37 (E) None of these
(C) 37.5

388. In a bank branch, 12 clerks earn an average salary of Rs. 22,000 per month and 8 officers earn an average salary of Rs. 35,000 per month. What is the average monthly salary of all 20 employees? [Moderate]

- (A) Rs. 27,200 (D) Rs. 27,500
(B) Rs. 26,800 (E) None of these
(C) Rs. 28,500

389. The average of 11 results is 50. If the average of the first six results is 49 and that of the last six results is 52, what is the sixth result? [Moderate]

- (A) 52 (D) 58
(B) 54 (E) None of these
(C) 56

390. A bank auditor travels from Chennai to a rural branch 120 km away at a speed of 40 km/h and returns along the same route at 60 km/h. What is his average speed for the whole journey? [Moderate]

- (A) 50 km/h (D) 52 km/h
(B) 48 km/h (E) None of these
(C) 45 km/h

391. A family's average monthly expenditure was Rs. 2,600 for the first three months of a year, Rs. 2,900 for the next four months and Rs. 3,200 for the last five months. During the same year the family saved Rs. 4,200. What was the average monthly income of the family? [Moderate]

- (A) Rs. 3,200 (D) Rs. 3,300
(B) Rs. 3,250 (E) None of these
(C) Rs. 3,350

392. What is the average of all the even numbers lying between 11 and 51? [Moderate]

- (A) 30 (D) 31
(B) 32 (E) None of these
(C) 33

393. The average age of the 8 members of a bank's loan committee is 40 years. Two members aged 35 years and 45 years leave the committee and are replaced by two new members, after which the average age of the committee becomes 42 years. What is the sum of the ages of the two new members? [Difficult]

- (A) 86 years
(B) 90 years
(C) 96 years
- (D) 100 years
(E) None of these

394. In a batch of 60 trainees at a bank academy the average score in an aptitude test is 62 marks. The average score of the boys is 66 marks and that of the girls is 56 marks. How many boys are there in the batch? [Difficult]

- (A) 30
(B) 32
(C) 34
- (D) 36
(E) None of these

395. The average of five consecutive odd numbers is 61. What is the value obtained when the second largest of these numbers is subtracted from twice the smallest number? [Difficult]

- (A) 51
(B) 48
(C) 54
- (D) 45
(E) None of these

396. The average of six numbers is 3.95. The average of two of them is 3.4 and the average of two others is 3.85. What is the average of the remaining two numbers? [Difficult]

- (A) 4.5
(B) 4.6
(C) 4.7
- (D) 4.8
(E) None of these

397. A batsman has an average of 36 runs after 16 innings. How many runs must he score in his 17th innings so that his average rises to 39 runs? [Difficult]

- (A) 78
(B) 82
(C) 85
- (D) 90
(E) 87

398. The average of 11 consecutive natural numbers is 32. If the next four consecutive natural numbers after the largest of them are also included in the set, what is the average of all 15 numbers? [Difficult]

- (A) 33
(B) 34
(C) 34.5
- (D) 35
(E) None of these

399. A shopkeeper sold 40 units of item P at an average price of Rs. 250 per unit and 60 units of item Q at an average price of Rs. 180 per unit. He also sold x units of item R at an average price of Rs. 300 per unit. If the average selling price of all the units sold was Rs. 220, what is the value of x ? [Difficult]

- (A) 10
(B) 12
(C) 18
- (D) 15
(E) None of these

1.4.5 Problems on ages

[checked, 2 flagged]

400. The sum of the present ages of Mahesh and his son is 56 years. Four years from now, Mahesh will be three times as old as his son will be then. What is the present age of the son? [Easy]

- (A) 10 years (D) 16 years
(B) 12 years (E) None of these
(C) 14 years

401. The ratio of the present ages of Sunita and her mother is 3 : 8. If Sunita is 15 years old at present, what will be her mother's age after 6 years? [Easy]

- (A) 46 years (D) 48 years
(B) 45 years (E) None of these
(C) 44 years

402. The average age of the 5 members of a family is 28 years. If the youngest member of the family is 8 years old, what is the average age of the remaining 4 members? [Easy]

- (A) 31 years (D) 35 years
(B) 32 years (E) None of these
(C) 33 years

403. Ravi is 8 years older than his brother Sohan. Ten years ago, Ravi was twice as old as Sohan was at that time. What is Ravi's present age? [Easy]

- (A) 22 years (D) 26 years
(B) 24 years (E) None of these
(C) 25 years

404. The present age of Mr. Iyer is four times the present age of his son. After 16 years, his age will be twice the age of his son. What is the present age of the son? [Easy]

- (A) 6 years (D) 14 years
(B) 10 years (E) None of these
(C) 12 years

405. The present ages of Anita and Bhavna are in the ratio 5 : 7. Six years from now, the ratio of their ages will be 3 : 4. What is the sum of their present ages? [Easy]

- (A) 66 years (D) 76 years
(B) 70 years (E) None of these
(C) 72 years

406. The average age of 30 students of a class is 14 years. When the age of the class teacher is included, the average age of the whole group increases by 1 year. What is the age of the class teacher? [Easy]

- (A) 42 years (D) 45 years
(B) 43 years (E) None of these
(C) 44 years

407. The present ages of Anil and Bimal are in the ratio 7 : 5. Ten years from now, the ratio of their ages will be 9 : 7. What is Bimal's present age? [Moderate]

- (A) 20 years
(B) 30 years
(C) 35 years
- (D) 25 years
(E) None of these

408. Three years ago, the average age of a husband, his wife and their child was 27 years. Five years ago, the average age of the wife and the child was 20 years. What is the present age of the husband?
[Moderate]

- (A) 45 years
(B) 40 years
(C) 38 years
- (D) 42 years
(E) None of these

409. Ten years ago, the age of a father was three times the age of his son. Ten years from now, the father's age will be twice the age of his son. What is the ratio of their present ages?
[Moderate]

- (A) 7 : 3
(B) 5 : 2
(C) 9 : 4
- (D) 13 : 4
(E) None of these

410. Arun is two years older than Balu, and Balu is twice as old as Chetan. If the total of the ages of Arun, Balu and Chetan is 27 years, how old is Balu?
[Moderate]

- (A) 8 years
(B) 9 years
(C) 10 years
- (D) 12 years
(E) None of these

411. Sunil got married 8 years ago. His present age is $\frac{6}{5}$ times his age at the time of his marriage. His son's present age is $\frac{1}{12}$ of Sunil's present age. What is the present age of his son?
[Moderate]

- (A) 3 years
(B) 4 years
(C) 5 years
- (D) 6 years
(E) None of these

412. The present age of a father is 3 years more than three times the present age of his son. Three years from now, the father's age will be 10 years more than twice the age of his son at that time. What is the father's present age?
[Moderate]

- (A) 30 years
(B) 33 years
(C) 34 years
- (D) 36 years
(E) None of these

413. Three years ago, the age of Rekha's mother was four times Rekha's age at that time. Rekha's father is 5 years older than her mother. If the sum of the present ages of Rekha, her mother and her father is 104 years, what is Rekha's present age?
[Moderate]

- (A) 11 years
(B) 12 years
(C) 13 years
- (D) 14 years
(E) None of these

414. The present ages of Deepak, Esha and Farhan are in the ratio 4 : 7 : 9. Eight years ago, the sum of their ages was 56 years. What is Farhan's present age? [Difficult]

- (A) 36 years
- (B) 30 years
- (C) 32 years
- (D) 40 years
- (E) None of these

415. The present average age of a family of 4 members is 28 years. At the time of the birth of the youngest member of this family, the average age of the family was 24 years. What is the present age of the youngest member? [Difficult]

- (A) 8 years
- (B) 9 years
- (C) 12 years
- (D) 10 years
- (E) None of these

416. The difference between the present ages of Rohan and his father is 30 years. Five years ago, the product of their ages was 400. What is Rohan's present age? [Difficult]

- (A) 12 years
- (B) 15 years
- (C) 18 years
- (D) 20 years
- (E) None of these

417. Sanjay is as much younger than Vikas as he is older than Mohan. The sum of the ages of Vikas and Mohan is 74 years. If Vikas is 8 years older than Sanjay, what is Mohan's present age? [Difficult]

- (A) 27 years
- (B) 28 years
- (C) 31 years
- (D) 33 years
- (E) None of these

418. The ages of two persons differ by 16 years. Six years ago, the elder one was three times as old as the younger one. What will be the ratio of their ages 10 years from now? [Difficult]

- (A) 2 : 3
- (B) 3 : 5
- (C) 4 : 7
- (D) 5 : 8
- (E) None of these

419. The present age of a father is four times the present age of his son. Five years ago, the father's age was seven times the son's age at that time. After how many years from now will the father's age be exactly twice the age of his son? [Difficult]

- (A) 15 years
- (B) 18 years
- (C) 20 years
- (D) 25 years
- (E) None of these

420. The average age of the 8 officers posted at a bank branch is 35 years. Two officers aged 45 years and 51 years are transferred out and two new officers join in their place, after which the average age of the 8 officers of the branch becomes 34 years. What is the average age of the two newly joined officers? [Difficult]

- (A) 42 years
(B) 43 years
(C) 46 years
- (D) 44 years
(E) None of these

Section 1.5

1.5.1 Profit, loss, and profit percentage

[checked, 1 flagged]

421. Ramesh purchased a washing machine for Rs. 4,500 and sold it to a neighbour for Rs. 5,220. What is his profit per cent? [Easy]

- (A) 12%
(B) 14%
(C) 16%
- (D) 18%
(E) None of these

422. A stationery dealer bought a printer for Rs. 1,250 and had to sell it at a loss of 12%. At what price did he sell the printer? [Easy]

- (A) Rs. 1,050
(B) Rs. 1,100
(C) Rs. 1,125
- (D) Rs. 1,150
(E) Rs. 1,175

423. Sunita sold a gold-plated bangle for Rs. 6,900, thereby earning a profit of 15%. What was the cost price of the bangle? [Easy]

- (A) Rs. 5,750
(B) Rs. 5,865
(C) Rs. 6,000
- (D) Rs. 6,150
(E) Rs. 6,250

424. On selling a second-hand scooter, Mahesh earned a profit of Rs. 960, which was exactly 20% of the price he had paid for it. At what price did he sell the scooter? [Easy]

- (A) Rs. 4,800
(B) Rs. 5,520
(C) Rs. 5,760
- (D) Rs. 5,800
(E) Rs. 6,000

425. A furniture shop sold a study table for Rs. 2,240 and in the process incurred a loss of 20%. What was the amount of loss in rupees? [Easy]

- (A) Rs. 448
(B) Rs. 480
(C) Rs. 520
- (D) Rs. 560
(E) Rs. 600

426. The cost price of 10 identical notebooks is equal to the selling price of 8 such notebooks. What is the profit per cent earned by the seller? [Easy]

- (A) 20%
(B) 22.5%
(C) 25%
- (D) 28%
(E) None of these

427. A wholesaler bought 40 kg of basmati rice at Rs. 25 per kg and sold the entire quantity at Rs. 30 per kg. What is his profit per cent on the whole transaction? [Easy]

- (A) 15% (C) 18%
 (B) $16\frac{2}{3}\%$ (D) 20%
 (E) 25%

428. A dealer sold two air-conditioners for Rs. 9,600 each. On the first he gained 20% and on the second he lost 20%. What is his overall profit or loss per cent on the two transactions taken together?

[Moderate]

- (A) No profit, no loss (D) Loss of 2%
 (B) Loss of 4% (E) Loss of 5%
 (C) Profit of 4%

429. A garment retailer marks the price of a jacket 40% above its cost price and then allows a festive discount of 15% on the marked price. What is his profit per cent on the jacket?

[Moderate]

- (A) 19% (D) 23%
 (B) 21% (E) None of these
 (C) 25%

430. A grocer sells pulses at his cost price, but while weighing he uses a weight of 800 g in place of the standard 1 kg weight. What is his actual profit per cent?

[Moderate]

- (A) 20% (C) 25%
 (B) $22\frac{1}{2}\%$ (D) 28%
 (E) 30%

431. By selling a microwave oven for Rs. 7,200, a shopkeeper earns a profit of 20%. At what price should he sell the same oven so as to earn a profit of 30%?

[Moderate]

- (A) Rs. 7,560 (D) Rs. 7,920
 (B) Rs. 7,680 (E) Rs. 8,100
 (C) Rs. 7,800

432. Kavita sold a laptop at a loss of 10%. Had she sold it for Rs. 1,800 more, she would have made a profit of 20%. What was the cost price of the laptop?

[Moderate]

- (A) Rs. 5,400 (D) Rs. 7,200
 (B) Rs. 6,000 (E) Rs. 9,000
 (C) Rs. 6,400

433. Arjun sells a bicycle to Bhaskar at a profit of 25%. Bhaskar in turn sells the same bicycle to Chandan at a profit of 20%. If Chandan pays Rs. 9,000 for the bicycle, what did Arjun originally pay for it?

[Moderate]

- (A) Rs. 5,400 (D) Rs. 6,250
 (B) Rs. 5,760 (E) Rs. 6,750
 (C) Rs. 6,000

434. A trader mixes 25 kg of tea costing Rs. 32 per kg with 15 kg of a superior variety costing Rs. 40 per kg, and sells the entire mixture at Rs. 42 per kg. What is his profit per cent?

[Moderate]

- (A) 15% (D) 22%
 (B) 18% (E) 24%
 (C) 20%

435. A showroom marks the price of a refrigerator 60% above its cost price and then offers two successive discounts of 10% and 12.5% on the marked price. What is the resulting profit per cent?

[Difficult]

- (A) 22.5% (D) 28.5%
 (B) 24% (E) None of these
 (C) 26%

436. A dishonest grocer marks his goods 20% above cost price, allows a discount of 10% on the marked price, and additionally delivers only 900 g when a customer pays for 1 kg. What is his net profit per cent?

[Difficult]

- (A) 8% (D) 20%
 (B) 12% (E) 25%
 (C) 18%

437. A dealer sold a treadmill at a profit of 20%. Had he bought it for 20% less and sold it for Rs. 1,500 less than he actually did, he would still have made a profit of 25%. What was his actual cost price?

[Difficult]

- (A) Rs. 6,000 (D) Rs. 7,500
 (B) Rs. 6,750 (E) Rs. 8,000
 (C) Rs. 7,200

438. The profit earned by selling an article for Rs. 1,754 is exactly equal in rupees to the loss incurred by selling the same article for Rs. 1,486. At what price should the article be sold in order to earn a profit of 25%?

[Difficult]

- (A) Rs. 1,980 (D) Rs. 2,105
 (B) Rs. 2,025 (E) None of these
 (C) Rs. 2,050

439. A retailer buys 80 shirts for a total of Rs. 24,000. He sells 30 of them at a profit of 25% and another 20 at a loss of 10%. At what profit per cent must he sell the remaining shirts so that his overall profit on the entire lot is 20%?

[Difficult]

- (A) 30% (D) 36%
 (B) 32% (E) 40%
 (C) 35%

440. A shopkeeper allows a discount of 20% on the marked price of an item and still gains 12%. If his cost price now rises by 25% while the marked price and the rate of discount remain unchanged, what will be the result of a sale?

[Difficult]

- (A) Profit of 10.4% (D) Profit of 12.5%
 (B) Loss of 10.4% (E) Neither profit nor loss
 (C) Loss of 13%

441. A fruit vendor buys apples at 6 for Rs. 50 and an equal number of apples at 4 for Rs. 50. He mixes the two lots together and sells the whole stock at 5 for Rs. 55. What is his profit per cent?
 [Difficult]

- (A) 4% (D) 8%
 (B) 5.6% (E) 10%
 (C) 6.4%

1.5.2 Discount, marked price, successive discounts

[checked]

442. The marked price of an electric kettle in a Pune showroom is Rs. 2,400. The shopkeeper allows a discount of 15% on the marked price. What is the selling price of the kettle?
 [Easy]

- (A) Rs. 2,020 (D) Rs. 2,160
 (B) Rs. 2,040 (E) None of these
 (C) Rs. 2,060

443. After allowing a discount of 20% on the marked price, Ramesh sells a wall clock for Rs. 1,224. What is the marked price of the clock?
 [Easy]

- (A) Rs. 1,428 (D) Rs. 1,560
 (B) Rs. 1,470 (E) Rs. 1,600
 (C) Rs. 1,530

444. A garment showroom advertises two successive discounts of 20% and 10% on all winter wear. The single discount equivalent to these two successive discounts is
 [Easy]

- (A) 26% (D) 32%
 (B) 28% (E) None of these
 (C) 30%

445. A dining table is marked at Rs. 1,500 in a furniture store and is finally sold for Rs. 1,275. What is the rate of discount allowed by the store?
 [Easy]

- (A) 12% (D) 16%
 (B) 13.5% (E) 18%
 (C) 15%

446. A bank employee buys a printer whose marked price is Rs. 2,500. The dealer allows a discount of 16%. How much does the employee actually pay?
 [Easy]

- (A) Rs. 2,050 (D) Rs. 2,150
 (B) Rs. 2,075 (E) None of these
 (C) Rs. 2,125

447. A shopkeeper in Nagpur buys a mixer-grinder for Rs. 600 and marks it at Rs. 800. He then allows a discount of 10% on the marked price. What is his profit percent?
 [Easy]

- (A) 10% (D) 20%
(B) 12.5% (E) 25%
(C) 15%

448. A saree marked at Rs. 1,800 is sold after two successive discounts of 10% and 5%. What amount does the customer pay? [Easy]

- (A) Rs. 1,530 (D) Rs. 1,545
(B) Rs. 1,539 (E) Rs. 1,550
(C) Rs. 1,540

449. A trader marks his goods 40% above the cost price and then allows a discount of 25% on the marked price. What is his profit or loss percent? [Moderate]

- (A) Loss of 5% (D) Profit of 7.5%
(B) Profit of 5% (E) Profit of 15%
(C) Profit of 6%

450. An article marked at Rs. 2,500 is sold for Rs. 1,700 after two successive discounts, the first of which is 20%. What is the rate of the second discount? [Moderate]

- (A) 12% (D) 16%
(B) 12.5% (E) 20%
(C) 15%

451. A washing machine is marked at Rs. 8,000. Store A offers a flat discount of 30%, while Store B offers two successive discounts of 20% and 15% on the same marked price. What is the difference between the two final prices? [Moderate]

- (A) Rs. 120 (D) Rs. 180
(B) Rs. 140 (E) Nil, both are the same
(C) Rs. 160

452. A dealer buys a cycle for Rs. 1,200. He wishes to allow a discount of 20% on the marked price and still make a profit of 20%. At what price should he mark the cycle? [Moderate]

- (A) Rs. 1,700 (D) Rs. 1,850
(B) Rs. 1,750 (E) Rs. 1,920
(C) Rs. 1,800

453. A shopkeeper marks his goods 25% above the cost price. After allowing a certain discount on the marked price he still earns a profit of 10%. What is the rate of discount? [Moderate]

- (A) 10% (D) 12.5%
(B) 11% (E) 15%
(C) 12%

454. A retailer allows a discount of 15% on the marked price of a refrigerator and an additional 5% on the reduced price for immediate cash payment. A customer paying cash pays Rs. 3,876. What is the marked price of the refrigerator? [Moderate]

- (A) Rs. 4,600 (D) Rs. 4,850
 (B) Rs. 4,750 (E) Rs. 5,000
 (C) Rs. 4,800

455. Rekha buys a handbag marked at Rs. 2,400 at a discount of 25% and a pair of shoes marked at Rs. 1,600 at a discount of 15%. Taking the two purchases together, the overall rate of discount she receives on the total marked price is [Moderate]

- (A) 19% (D) 22%
 (B) 20% (E) None of these
 (C) 21%

456. A wholesaler marks his stock 60% above the cost price and then allows two successive discounts of 20% and $12\frac{1}{2}\%$ to a retailer. What is the wholesaler's profit percent? [Difficult]

- (A) 10% (D) 12.5%
 (B) 11.2% (E) 14%
 (C) 12%

457. A grocer marks his goods 25% above the cost price and allows a discount of 10% on the marked price. However, while selling he uses a weight of 900 g in place of 1 kg. What is his actual profit percent? [Difficult]

- (A) 20% (D) 26.5%
 (B) 22.5% (E) 27.5%
 (C) 25%

458. During a clearance sale a store announces three successive discounts of 10%, 20% and 25% on the marked price. The single discount equivalent to this offer is [Difficult]

- (A) 44% (D) 47.5%
 (B) 45% (E) 55%
 (C) 46%

459. A laptop bag is marked at Rs. 12,000. Scheme A offers three successive discounts of 20%, 10% and 5%. Scheme B offers a flat discount of 30% together with an extra cash rebate of Rs. 100 on the discounted price. Which scheme is cheaper for the customer and by how much? [Difficult]

- (A) Scheme A, by Rs. 92 (D) Scheme B, by Rs. 108
 (B) Scheme B, by Rs. 92 (E) Both cost the same
 (C) Scheme A, by Rs. 108

460. A dealer allows a discount of 20% on the marked price of an article and still gains 25%. If, in a festive offer, he allows a discount of 30% on the same marked price, then he will [Difficult]

- (A) gain $6\frac{1}{4}\%$ (D) gain 10%
 (B) gain 8% (E) lose $6\frac{1}{4}\%$
 (C) gain $9\frac{3}{8}\%$

461. A stationery wholesaler allows a discount of 20% on the marked price and, in addition, gives 3 articles free with every 12 articles purchased. What is the effective single rate of discount enjoyed by the buyer? [Difficult]

- (A) 32% (D) 36%
 (B) 34% (E) 40%
 (C) 35%

462. An article marked at Rs. 5,000 is sold after two successive discounts of 20% and 10%, yielding the trader a profit of 20%. At what price should the same article be marked so that, after allowing the same two successive discounts, the trader earns a profit of 35%? [Difficult]

- (A) Rs. 5,400 (D) Rs. 5,625
 (B) Rs. 5,500 (E) Rs. 5,750
 (C) Rs. 5,600

1.5.3 Dishonest dealings and false weights

[checked, 3 flagged]

463. Mahesh, a grocer in Nagpur, sells wheat at his cost price but uses a weight of 900 g in place of a 1 kg weight. What is his gain percent? [Easy]

- (A) 10% (D) $9\frac{1}{11}\%$
 (B) $11\frac{1}{9}\%$ (E) None of these
 (C) $12\frac{1}{2}\%$

464. Deepa buys 5 kg of flour from a grocer in Kanpur whose “1 kg” weight is actually only 940 g. How many grams of flour less than the correct quantity does she receive? [Easy]

- (A) 240 g (D) 320 g
 (B) 280 g (E) 360 g
 (C) 300 g

465. Suresh sells sugar at cost price but his balance shows 1 kg when only 960 g of sugar is placed on it. His gain percent is: [Easy]

- (A) 4% (D) $3\frac{1}{3}\%$
 (B) $4\frac{1}{6}\%$ (E) None of these
 (C) 5%

466. Anil buys pulses from a wholesaler using a faulty balance: he pays for 1 kg but actually takes away 1100 g each time. He then sells the pulses to customers at his cost price using correct weights. His profit percent is: [Easy]

- (A) $9\frac{1}{11}\%$ (C) $11\frac{1}{9}\%$
 (B) 10% (D) 12%
 (E) 11%

467. A trader sells his articles at cost price but cheats using a false weight, gaining 20% in the process. What weight does he actually use in place of 1 kg? [Easy]

- (A) 800 g (D) 850 g
 (B) 820 g (E) 880 g
 (C) $833\frac{1}{3}$ g

468. A shopkeeper sells rice at the correct market rate of Rs. 60 per kg but uses a weight of 750 g for 1 kg. If Kavita pays him Rs. 600, what is her loss percent on the money she has spent? [Easy]

- (A) 20% (D) $33\frac{1}{3}\%$
 (B) 25% (E) None of these
 (C) 30%

469. A dishonest milk dealer sells ghee at cost price but his weighing machine registers 1 kg for only 875 g. His gain percent is: [Easy]

- (A) $12\frac{1}{2}\%$ (D) 15%
 (B) 13% (E) $16\frac{2}{3}\%$
 (C) $14\frac{2}{7}\%$

470. Rajesh sells cashews at 12% above his cost price and, in addition, uses a weight of 900 g for 1 kg. What is his overall profit percent? [Moderate]

- (A) $22\frac{2}{9}\%$ (C) $25\frac{1}{3}\%$
 (B) $24\frac{4}{9}\%$ (D) 26%
 (E) None of these

471. A shopkeeper announces that he is selling his stock at a loss of 10%, but he uses a weight of 800 g for every 1 kg. His actual result is: [Moderate]

- (A) Loss of 10% (D) Profit of 15%
 (B) Profit of 10% (E) Profit of 12%
 (C) Profit of $12\frac{1}{2}\%$

472. A dealer buys goods at the market rate of Rs. 100 per kg and advertises a discount of 10% on this rate to his customers, but he uses a weight of 800 g for every 1 kg. What is a customer's loss percent on the money he spends? [Moderate]

- (A) 10% (C) $12\frac{1}{2}\%$
 (B) $11\frac{1}{9}\%$ (D) 20%
 (E) None of these

473. Vikram marks his goods 20% above cost price, allows his customers a discount of 10% on the marked price, and also uses a weight of 900 g for 1 kg. His net profit percent is: [Moderate]

- (A) 8% (D) $22\frac{2}{9}\%$
 (B) 18% (E) 30%
 (C) 20%

474. A grain merchant cheats at both ends: while buying he takes 1100 g for the price of 1 kg, and while selling he gives only 900 g for 1 kg. If he sells at his cost price, his overall gain percent is:[Moderate]

- (A) 20% (D) $24\frac{4}{9}\%$
 (B) 21% (E) None of these
 (C) $22\frac{2}{9}\%$

475. Ramesh buys 100 kg of rice at Rs. 40 per kg using an accurate balance. He sells the entire stock at Rs. 44 per kg but uses a weight of 800 g for every 1 kg. What is his total profit? [Moderate]

- (A) Rs. 400 (D) Rs. 1,500
 (B) Rs. 1,100 (E) Rs. 1,750
 (C) Rs. 1,375

476. A shopkeeper sells his articles at 5% above cost price and simultaneously uses a false weight in place of 1 kg. If his overall gain is 40%, the false weight used is: [Moderate]

- (A) 700 g (D) 760 g
 (B) 720 g (E) 780 g
 (C) 750 g

477. A dishonest trader cheats his supplier by taking 1080 g for the price of 1 kg. He then marks his goods 20% above the rate he pays the supplier, offers a discount of 10% to customers, and delivers only 900 g for every 1 kg sold. His overall profit percent is: [Difficult]

- (A) 25% (D) 32%
 (B) 28% (E) None of these
 (C) 30%

478. A spice merchant mixes 20% (by weight) of a costless powder into his turmeric, sells the mixture at the cost price of pure turmeric, and additionally uses a weight of 900 g for 1 kg. His profit percent is: [Difficult]

- (A) 30% (D) $38\frac{8}{9}\%$
 (B) $33\frac{1}{3}\%$ (E) 50%
 (C) 36%

479. A dealer marks his goods 40% above cost price and uses a weight of 875 g for 1 kg. He wishes his overall profit to be exactly 40%. What rate of discount should he allow on the marked price? [Difficult]

- (A) 10% (C) $14\frac{2}{7}\%$
 (B) $12\frac{1}{2}\%$ (D) 15%
 (E) 20%

480. Two traders in the same market deal in identical goods. Trader A sells at his cost price but uses a weight of 900 g for 1 kg, while Trader B uses perfectly accurate weights and sells at 12% above cost. Whose profit percent is higher, and by how much? [Difficult]

- (A) A, by $\frac{8}{9}$ percentage point

- (B) B, by $\frac{8}{9}$ percentage point
- (C) A, by 1 percentage point
- (D) B, by $1\frac{1}{9}$ percentage points
- (E) Both earn the same profit percent

481. A shopkeeper cheats to the extent of 20% while buying (he receives 20% more than he pays for) and by $x\%$ while selling (he delivers $x\%$ less than the stated weight). He sells at his cost price and his overall profit works out to 100%. The value of x is: [Difficult]

- (A) 25
- (B) 30
- (C) $33\frac{1}{3}$
- (D) 40
- (E) 50

482. A rice dealer pays for 200 kg of rice at Rs. 35 per kg, but his faulty purchase balance lets him carry away 250 kg. He then sells the whole lot at Rs. 42 per kg using a weight of 800 g for 1 kg. His total profit is: [Difficult]

- (A) Rs. 3,500
- (B) Rs. 4,375
- (C) Rs. 5,250
- (D) Rs. 6,125
- (E) None of these

483. A shopkeeper uses a weight of 900 g for 1 kg and sells his goods at a discount of 10% on the marked price, yet his profit is only 10%. By what percent is the marked price above the cost price? [Difficult]

- (A) 10%
- (B) $11\frac{1}{9}\%$
- (C) 20%
- (D) 21%
- (E) $22\frac{2}{9}\%$

1.5.4 Simple interest

[checked]

484. Meena deposits Rs. 12,500 in a recurring-free savings scheme that pays simple interest at 8% per annum. What interest will she earn in 3 years? [Easy]

- (A) Rs. 2,500
- (B) Rs. 3,000
- (C) Rs. 3,200
- (D) Rs. 2,800
- (E) None of these

485. A sum of Rs. 18,000 lent at 6% per annum simple interest yields an interest of Rs. 4,320. For how many years was the sum lent? [Easy]

- (A) 3 years
- (B) $3\frac{1}{2}$ years
- (C) 4 years
- (D) $4\frac{1}{2}$ years
- (E) 5 years

486. Rakesh lent Rs. 9,600 to a friend for 5 years and received Rs. 3,360 as simple interest. What was the annual rate of interest? [Easy]

- (A) 6% (D) 7.5%
(B) 6.5% (E) 8%
(C) 7%

487. What amount will Rs. 7,200 become in $2\frac{1}{2}$ years at 9% per annum simple interest? [Easy]

- (A) Rs. 8,460 (D) Rs. 9,000
(B) Rs. 8,640 (E) Rs. 8,280
(C) Rs. 8,820

488. A certain sum earns Rs. 2,100 as simple interest in 4 years at 7% per annum. What is the sum? [Easy]

- (A) Rs. 6,000 (D) Rs. 9,000
(B) Rs. 7,500 (E) None of these
(C) Rs. 8,400

489. A short-term loan of Rs. 15,000 taken at 12% per annum simple interest attracted an interest of Rs. 900. For how many months was the loan taken? [Easy]

- (A) 4 months (D) 8 months
(B) 5 months (E) 9 months
(C) 6 months

490. A bank charges simple interest at 5% per annum, counting a year as 365 days. What interest is payable on Rs. 10,000 borrowed for 146 days? [Easy]

- (A) Rs. 150 (D) Rs. 250
(B) Rs. 180 (E) Rs. 365
(C) Rs. 200

491. A sum of money placed at simple interest doubles itself in 12 years. In how many years will the same sum become four times itself at the same rate? [Moderate]

- (A) 24 years (D) 40 years
(B) 30 years (E) 48 years
(C) 36 years

492. A sum invested at simple interest amounts to Rs. 14,880 in 3 years and to Rs. 17,760 in 6 years. What is the sum invested? [Moderate]

- (A) Rs. 11,520 (D) Rs. 13,200
(B) Rs. 12,000 (E) Rs. 14,400
(C) Rs. 12,480

493. Sunita divides Rs. 25,000 into two parts, investing one part at 7% per annum and the other at 10% per annum simple interest. If her total interest for one year is Rs. 2,050, what is the part invested at 10%? [Moderate]

- (A) Rs. 8,000 (D) Rs. 12,500
 (B) Rs. 9,500 (E) Rs. 15,000
 (C) Rs. 10,000

494. Had the rate of simple interest been 2% higher, a certain sum would have fetched Rs. 1,800 more interest over 5 years. What is the sum? [Moderate]

- (A) Rs. 15,000 (D) Rs. 22,500
 (B) Rs. 16,000 (E) None of these
 (C) Rs. 20,000

495. Anand lends Rs. 20,000 to Bhaskar at 8% per annum and Rs. 15,000 to Chitra at 10% per annum, both on simple interest and for the same period. If he receives Rs. 9,300 as total interest, for how long was the money lent? [Moderate]

- (A) 2 years (D) $3\frac{1}{2}$ years
 (B) $2\frac{1}{2}$ years (E) 4 years
 (C) 3 years

496. Ravi borrows Rs. 30,000 under a scheme charging simple interest at 6% per annum for the first 2 years, 8% per annum for the next 3 years and 10% per annum for the period beyond that. If he finally pays Rs. 13,800 as interest, for how long did he keep the money? [Moderate]

- (A) 5 years (D) $6\frac{1}{2}$ years
 (B) $5\frac{1}{2}$ years (E) 7 years
 (C) 6 years

497. The simple interest on a certain sum for 4 years at 8% per annum exceeds the simple interest on the same sum for 3 years at 6% per annum by Rs. 1,400. What is the sum? [Moderate]

- (A) Rs. 8,000 (D) Rs. 12,000
 (B) Rs. 9,000 (E) Rs. 14,000
 (C) Rs. 10,000

498. A sum is lent on simple interest at 6% per annum for the first 3 years, 8% per annum for the next 4 years and 10% per annum thereafter. If the total interest at the end of 10 years is Rs. 12,000, what is the sum? [Difficult]

- (A) Rs. 12,500 (D) Rs. 18,000
 (B) Rs. 15,000 (E) Rs. 20,000
 (C) Rs. 16,000

499. Bharat borrows Rs. 25,000 at 8% per annum simple interest for 5 years. He immediately lends one part of it at 10% and the rest at 12% per annum simple interest for the same 5 years, and gains Rs. 4,000 over the whole period. What sum did he lend at 12%? [Difficult]

- (A) Rs. 7,500 (D) Rs. 15,000
(B) Rs. 10,000 (E) Rs. 17,500
(C) Rs. 12,500

500. What equal annual instalment will discharge a debt of Rs. 1,092 due in 3 years, money being reckoned at 12% per annum simple interest? (Each instalment is paid at the end of a year.) [Difficult]

- (A) Rs. 300 (D) Rs. 336
(B) Rs. 312 (E) Rs. 364
(C) Rs. 325

501. A sum of money lent at simple interest amounts to Rs. 24,000 in 4 years. Had the rate been 3% higher, it would have amounted to Rs. 26,400 in the same time. What is the original rate of interest? [Difficult]

- (A) 4% (D) 6.25%
(B) 5% (E) 7.5%
(C) 6%

502. The simple interest earned on a certain sum in 8 years is $\frac{2}{5}$ of the sum. At the same rate, in how many years will the sum double itself? [Difficult]

- (A) 16 years (D) 24 years
(B) 18 years (E) 25 years
(C) 20 years

503. A deposit of Rs. 4,000 grows to Rs. 5,000 under simple interest, the number of years for which it was kept being numerically equal to the rate percent per annum. What is the rate of interest? [Difficult]

- (A) 4% (D) 5.5%
(B) 4.5% (E) 6%
(C) 5%

504. Rahul invests a sum at 10% per annum simple interest for 3 years. At the end of that period he withdraws only the interest earned and re-invests the original principal at 12% per annum simple interest for 2 more years. If the interest collected over the entire 5 years is Rs. 8,100, what was the sum invested? [Difficult]

- (A) Rs. 12,000 (D) Rs. 16,200
(B) Rs. 13,500 (E) None of these
(C) Rs. 15,000

1.5.5 Compound interest: annual, half-yearly, quarterly

[checked, 1 flagged]

505. Ramesh deposits Rs. 5,000 in a bank that pays 10% per annum compound interest, compounded annually. What amount will he receive at the end of 2 years? [Easy]

- (A) Rs. 5,500 (D) Rs. 6,100
(B) Rs. 6,000 (E) Rs. 6,500
(C) Rs. 6,050

506. Sunita invests Rs. 8,000 in a fixed deposit at 10% per annum, compounded half-yearly. What compound interest does she earn in 1 year? [Easy]

- (A) Rs. 800
- (B) Rs. 810
- (C) Rs. 820
- (D) Rs. 840
- (E) Rs. 880

507. The difference between the compound interest and the simple interest on a sum of Rs. 12,000 for 2 years at 10% per annum, compounded annually, is [Easy]

- (A) Rs. 120
- (B) Rs. 144
- (C) Rs. 240
- (D) Rs. 264
- (E) Rs. 1,200

508. Mahesh borrows Rs. 10,000 from a financier at 20% per annum, compounded quarterly. How much interest must he pay if he clears the loan after exactly 6 months? [Easy]

- (A) Rs. 1,000
- (B) Rs. 1,025
- (C) Rs. 1,050
- (D) Rs. 1,100
- (E) Rs. 2,050

509. What sum of money will amount to Rs. 9,261 in 3 years at 5% per annum, compounded annually? [Easy]

- (A) Rs. 7,000
- (B) Rs. 7,350
- (C) Rs. 7,500
- (D) Rs. 7,800
- (E) Rs. 8,000

510. A cooperative society invests Rs. 15,000 at 10% per annum compound interest for 3 years. The compound interest earned is [Easy]

- (A) Rs. 4,500
- (B) Rs. 4,650
- (C) Rs. 4,950
- (D) Rs. 4,965
- (E) Rs. 19,965

511. A sum of Rs. 4,000 becomes Rs. 4,410 in 2 years when interest is compounded annually. The rate of interest per annum is [Easy]

- (A) 4%
- (B) 5%
- (C) 6%
- (D) 8%
- (E) 10%

512. The difference between the compound interest (compounded annually) and the simple interest on a certain sum for 3 years at 10% per annum is Rs. 620. What is the sum? [Moderate]

- (A) Rs. 15,000
- (B) Rs. 16,000
- (C) Rs. 18,000
- (D) Rs. 20,000
- (E) None of these

513. Anil invests Rs. 20,000 for 1 year at 20% per annum. How much more interest does he earn if the interest is compounded half-yearly instead of annually? [Moderate]

- (A) Rs. 100 (D) Rs. 420
 (B) Rs. 200 (E) Rs. 800
 (C) Rs. 400

514. The compound interest on a certain sum for 2 years, compounded annually, is Rs. 1,050 while the simple interest on the same sum for the same period at the same rate is Rs. 1,000. The sum is [Moderate]

- (A) Rs. 4,000 (D) Rs. 5,500
 (B) Rs. 4,500 (E) Rs. 6,000
 (C) Rs. 5,000

515. A sum of money invested at compound interest, compounded annually, amounts to Rs. 7,260 at the end of 2 years and to Rs. 7,986 at the end of 3 years. The sum invested is [Moderate]

- (A) Rs. 5,500 (D) Rs. 6,800
 (B) Rs. 6,250 (E) None of these
 (C) Rs. 6,600

516. Kavita borrows a sum at 20% per annum compound interest, compounded annually, and repays it in two equal annual instalments of Rs. 3,600 each, the first at the end of one year. The sum she borrowed is [Moderate]

- (A) Rs. 5,500 (D) Rs. 6,480
 (B) Rs. 5,760 (E) Rs. 7,200
 (C) Rs. 6,000

517. A finance company credits interest at 10% for the first year and 12% for the second year on a deposit of Rs. 25,000, the interest being compounded annually. The total interest credited over the two years is [Moderate]

- (A) Rs. 5,000 (D) Rs. 5,750
 (B) Rs. 5,500 (E) Rs. 5,800
 (C) Rs. 5,600

518. A certain sum invested at compound interest becomes 8 times itself in 9 years. In how many years will the same sum become 4 times itself at the same rate? [Moderate]

- (A) 3 years (D) 6 years
 (B) 4 years (E) 12 years
 (C) $4\frac{1}{2}$ years

519. Neha deposits Rs. 2,000 at the beginning of each of three consecutive years in a scheme paying 10% per annum compounded annually. What is the total value of her deposits at the end of the third year? [Difficult]

- (A) Rs. 6,000 (D) Rs. 7,700
 (B) Rs. 6,620 (E) Rs. 7,986
 (C) Rs. 7,282

520. Deepak invests a total of Rs. 16,000 for one year, putting one part in a scheme paying 10% per annum compounded annually and the remaining part in a scheme paying 20% per annum compounded half-yearly. If his total interest for the year is Rs. 2,700, how much did he put in the first scheme?
[Difficult]

- | | |
|---------------|----------------|
| (A) Rs. 5,000 | (D) Rs. 7,500 |
| (B) Rs. 6,000 | (E) Rs. 10,000 |
| (C) Rs. 6,400 | |

521. Priya deposits Rs. 12,000 in a scheme paying 10% per annum compounded annually. At the end of the first year she withdraws Rs. 4,000 and lets the balance stay for two more years in the same scheme. What is the total amount she has received from the scheme by the end of the third year?
[Difficult]

- | | |
|----------------|-------------------|
| (A) Rs. 15,132 | (D) Rs. 17,132 |
| (B) Rs. 15,972 | (E) None of these |
| (C) Rs. 16,132 | |

522. What is the difference between the compound interest on Rs. 10,000 for $1\frac{1}{2}$ years at 20% per annum when the interest is compounded half-yearly and when it is compounded annually?
[Difficult]

- | | |
|-------------|-------------|
| (A) Rs. 55 | (D) Rs. 200 |
| (B) Rs. 100 | (E) Rs. 220 |
| (C) Rs. 110 | |

523. A sum of money placed at compound interest amounts to Rs. 6,690 after 3 years and to Rs. 10,035 after 6 years. What is the sum?
[Difficult]

- | | |
|---------------|---------------|
| (A) Rs. 4,000 | (D) Rs. 5,020 |
| (B) Rs. 4,460 | (E) Rs. 5,350 |
| (C) Rs. 4,800 | |

524. The simple interest on a certain sum for 2 years at 10% per annum is Rs. 3,200. If the same sum is invested for 9 months at 20% per annum compounded quarterly, the compound interest earned will be
[Difficult]

- | | |
|---------------|---------------|
| (A) Rs. 2,200 | (D) Rs. 2,450 |
| (B) Rs. 2,400 | (E) Rs. 2,522 |
| (C) Rs. 2,440 | |

525. Vikram borrows Rs. 5,000 at 10% per annum compound interest, compounded annually. He repays Rs. 2,000 at the end of the first year and Rs. 3,000 at the end of the second year. How much must he pay at the end of the third year to clear the entire loan?
[Difficult]

- | | |
|-------------|---------------|
| (A) Rs. 825 | (D) Rs. 935 |
| (B) Rs. 850 | (E) Rs. 1,050 |
| (C) Rs. 880 | |

1.5.6 Difference between SI and CI; instalments

[checked, 3 flagged]

526. Ramesh deposits Rs. 8,000 in a bank for 2 years at 10% per annum. What is the difference between the compound interest (compounded annually) and the simple interest he earns?
[Easy]

- (A) Rs. 40
(B) Rs. 60
(C) Rs. 100
- (D) Rs. 120
(E) None of these

527. The difference between the compound interest and the simple interest on a certain sum for 2 years at 8% per annum is Rs. 128. What is the sum? [Easy]

- (A) Rs. 16,000
(B) Rs. 18,000
(C) Rs. 20,000
- (D) Rs. 22,000
(E) None of these

528. Find the difference between the compound interest (compounded annually) and the simple interest on Rs. 10,000 for 3 years at 10% per annum. [Easy]

- (A) Rs. 300
(B) Rs. 310
(C) Rs. 320
- (D) Rs. 331
(E) None of these

529. The difference between the compound interest and the simple interest on Rs. 6,250 for 2 years is Rs. 10. What is the rate of interest per annum? [Easy]

- (A) 3%
(B) 4%
(C) 5%
- (D) 6%
(E) None of these

530. Anita borrows a sum from a co-operative bank at 10% per annum compound interest and clears it by paying two equal annual instalments of Rs. 1,210 each, the first at the end of one year. How much did she borrow? [Easy]

- (A) Rs. 2,000
(B) Rs. 2,100
(C) Rs. 2,200
- (D) Rs. 2,420
(E) None of these

531. A loan of Rs. 1,100 taken at 20% per annum compound interest is to be repaid in two equal annual instalments. What is the value of each instalment? [Easy]

- (A) Rs. 660
(B) Rs. 700
(C) Rs. 720
- (D) Rs. 750
(E) None of these

532. The simple interest on a certain sum for 2 years at 6% per annum is Rs. 600. What will be the compound interest on the same sum for the same period at the same rate, interest compounded annually? [Easy]

- (A) Rs. 612
(B) Rs. 615
(C) Rs. 618
- (D) Rs. 620
(E) None of these

533. The difference between the compound interest (compounded annually) and the simple interest on a sum for 3 years at 5% per annum is Rs. 122. What is the sum? [Moderate]

- (A) Rs. 14,000
(B) Rs. 15,000
(C) Rs. 16,000
- (D) Rs. 18,000
(E) None of these

534. Mohan invests Rs. 20,000 for one year at 10% per annum, interest being compounded half-yearly. By how much does the interest he receives exceed the simple interest on the same sum for the same period at the same rate? [Moderate]

- (A) Rs. 25
(B) Rs. 50
(C) Rs. 75
- (D) Rs. 100
(E) None of these

535. Rahul buys a scooter by paying Rs. 8,000 at the time of purchase and the balance in two equal annual instalments of Rs. 4,840 each, interest being charged at 10% per annum compounded annually. What is the cash price of the scooter? [Moderate]

- (A) Rs. 16,000
(B) Rs. 16,400
(C) Rs. 16,800
- (D) Rs. 17,680
(E) None of these

536. What equal annual instalment will discharge a debt of Rs. 1,092 due in 3 years, the rate of interest being 12% per annum simple interest? (Each instalment earns simple interest from the date of payment up to the end of the third year.) [Moderate]

- (A) Rs. 300
(B) Rs. 315
(C) Rs. 325
- (D) Rs. 350
(E) None of these

537. The difference between the compound interest (compounded annually) and the simple interest on a certain sum at 15% per annum for 2 years is Rs. 45. What is the compound interest on that sum for those 2 years? [Moderate]

- (A) Rs. 600
(B) Rs. 630
(C) Rs. 645
- (D) Rs. 690
(E) None of these

538. A sum of Rs. 8,000 amounts to Rs. 9,261 in 3 years under annual compounding. What is the difference between this compound interest and the simple interest on the same sum for the same period at the same rate? [Moderate]

- (A) Rs. 51
(B) Rs. 55
(C) Rs. 61
- (D) Rs. 71
(E) None of these

539. Kavita takes a loan of Rs. 3,600 at 25% per annum compound interest and repays it in two equal annual instalments. What is the total interest she pays over the two years? [Moderate]

- (A) Rs. 1,200
(B) Rs. 1,400
(C) Rs. 1,500
- (D) Rs. 1,600
(E) None of these

540. For a certain sum lent at compound interest, the difference between the compound interest and the simple interest is Rs. 200 for 2 years and Rs. 620 for 3 years, the rate being the same throughout. What is the sum? [Difficult]

- (A) Rs. 16,000
- (B) Rs. 18,000
- (C) Rs. 20,000
- (D) Rs. 25,000
- (E) None of these

541. The difference between the compound interest (compounded annually) and the simple interest on a certain sum for 3 years at 10% per annum is Rs. 1,240. What would be the simple interest on the same sum for 5 years at 8% per annum? [Difficult]

- (A) Rs. 14,000
- (B) Rs. 15,000
- (C) Rs. 16,000
- (D) Rs. 18,000
- (E) None of these

542. The difference between the compound interest (compounded annually) and the simple interest on Rs. 10,000 at 20% per annum is Rs. 1,280. For how long was the sum lent? [Difficult]

- (A) 2 years
- (B) 3 years
- (C) 4 years
- (D) 5 years
- (E) None of these

543. A businessman borrows Rs. 36,400 at 20% per annum compound interest and agrees to repay it in three equal annual instalments, the first falling due one year after the loan. What is the value of each instalment? [Difficult]

- (A) Rs. 15,000
- (B) Rs. 16,200
- (C) Rs. 17,280
- (D) Rs. 18,200
- (E) None of these

544. The compound interest, compounded annually, on a certain sum for 2 years at 12% per annum is Rs. 3,180. What would be the simple interest on the same sum for 4 years at 9% per annum? [Difficult]

- (A) Rs. 4,000
- (B) Rs. 4,250
- (C) Rs. 4,500
- (D) Rs. 5,000
- (E) None of these

545. Suresh borrows Rs. 12,000 from a bank at 10% per annum compound interest. He repays Rs. 4,000 at the end of the first year and Rs. 5,000 at the end of the second year. What amount does he owe at the end of the third year? [Difficult]

- (A) Rs. 5,120
- (B) Rs. 5,500
- (C) Rs. 5,632
- (D) Rs. 5,750
- (E) None of these

546. A certain sum invested at compound interest, compounded annually, amounts to Rs. 7,350 in 2 years and to Rs. 8,575 in 3 years. What is the difference between the compound interest and the simple interest on this sum for 2 years at the same rate? [Difficult]

- (A) Rs. 125 (D) Rs. 200
 (B) Rs. 150 (E) None of these
 (C) Rs. 175

1.5.7 Mixture and alligation

[checked, 1 flagged]

547. A vessel contains 40 litres of a mixture of milk and water in which milk and water are in the ratio 3 : 1. What is the quantity of water in the vessel? [Easy]

- (A) 6 litres (D) 12 litres
 (B) 8 litres (E) None of these
 (C) 10 litres

548. In what ratio must tea costing Rs. 180 per kg be mixed with tea costing Rs. 280 per kg so that the mixture is worth Rs. 220 per kg? [Easy]

- (A) 2 : 3 (D) 5 : 3
 (B) 3 : 2 (E) None of these
 (C) 3 : 5

549. A can of 60 litres contains milk and water in the ratio 2 : 1. If 15 litres of water is added to it, what is the new ratio of milk to water? [Easy]

- (A) 8 : 7 (D) 7 : 8
 (B) 2 : 1 (E) None of these
 (C) 4 : 3

550. A grocer mixes 8 kg of pulses costing Rs. 45 per kg with 12 kg of pulses costing Rs. 65 per kg. What is the cost price of the mixture per kg? [Easy]

- (A) Rs. 55 (D) Rs. 58
 (B) Rs. 56 (E) None of these
 (C) Rs. 57

551. A milkman buys 45 litres of pure milk at Rs. 50 per litre and adds 5 litres of water (available free of cost) to it. What is his cost price per litre of the resulting mixture? [Easy]

- (A) Rs. 40 (D) Rs. 48
 (B) Rs. 42 (E) None of these
 (C) Rs. 44

552. A shopkeeper mixes 8 kg of rice costing Rs. 40 per kg with 12 kg of a second variety of rice. The resulting mixture is worth Rs. 46 per kg. What is the cost price per kg of the second variety? [Easy]

- (A) Rs. 48 (D) Rs. 54
 (B) Rs. 50 (E) None of these
 (C) Rs. 52

553. Sunita invests a part of her savings in a scheme yielding 6% per annum and the rest in a scheme yielding 10% per annum. If the overall yield on her total investment is 7.5% per annum, in what ratio has she split her savings between the two schemes? [Easy]

- (A) 3 : 5
(B) 5 : 3
(C) 2 : 3
- (D) 3 : 2
(E) None of these

554. A container has 40 litres of a mixture of milk and water in the ratio 7 : 3. How much water must be added so that the ratio of milk to water becomes 7 : 5? [Moderate]

- (A) 5 litres
(B) 6 litres
(C) 10 litres
- (D) 12 litres
(E) None of these

555. A drum contains 50 litres of pure milk. 5 litres is drawn out and replaced by water; from the resulting mixture 5 litres is again drawn out and replaced by water. How much pure milk is now left in the drum? [Moderate]

- (A) 40 litres
(B) 40.5 litres
(C) 41 litres
- (D) 45 litres
(E) None of these

556. Vessel A contains milk and water in the ratio 4 : 1 and vessel B contains milk and water in the ratio 2 : 3. If the contents of A and B are mixed in the ratio 2 : 3, what is the ratio of milk to water in the final mixture? [Moderate]

- (A) 11 : 14
(B) 7 : 5
(C) 14 : 11
- (D) 3 : 2
(E) None of these

557. A trader mixes 26 kg of rice costing Rs. 20 per kg with 30 kg of rice costing Rs. 36 per kg and sells the whole mixture at Rs. 30 per kg. What is his profit percent? [Moderate]

- (A) 4%
(B) 5%
(C) 6%
- (D) 8%
(E) None of these

558. In what ratio must water be mixed with milk costing Rs. 48 per litre so that the resulting mixture is worth Rs. 40 per litre? [Moderate]

- (A) 1 : 4
(B) 1 : 5
(C) 5 : 1
- (D) 2 : 5
(E) None of these

559. A milk vendor sells his milk at cost price but mixes water with it, thereby gaining 25%. What is the ratio of water to milk in the mixture he sells? [Moderate]

- (A) 1 : 3
(B) 1 : 5
(C) 1 : 4
- (D) 4 : 1
(E) None of these

560. A vessel contains 60 litres of a mixture of spirit and water in the ratio 7 : 5. How much of this mixture must be drawn off and replaced with water so that the ratio of spirit to water becomes 7 : 9? [Moderate]

- (A) 15 litres (D) 20 litres
 (B) 12 litres (E) None of these
 (C) 18 litres

561. A container is filled with a mixture of milk and water in the ratio 5 : 1. When 20 litres of water is poured in, the ratio of milk to water becomes 5 : 3. What was the original quantity of the mixture in the container? [Difficult]

- (A) 48 litres (D) 72 litres
 (B) 54 litres (E) None of these
 (C) 60 litres

562. A tank holds 80 litres of pure milk. Some quantity is drawn out and replaced with water; the same quantity of the new mixture is then drawn out and again replaced with water. If 45 litres of pure milk now remains, what quantity was drawn out each time? [Difficult]

- (A) 16 litres (D) 20 litres
 (B) 18 litres (E) None of these
 (C) 24 litres

563. Vessel P contains milk and water in the ratio 5 : 3 and vessel Q contains milk and water in the ratio 3 : 5. In what ratio must the contents of P and Q be mixed so that the resulting mixture has milk and water in the ratio 9 : 7? [Difficult]

- (A) 3 : 1 (D) 3 : 2
 (B) 1 : 3 (E) None of these
 (C) 2 : 1

564. A wholesaler buys 40 kg of wheat at Rs. 32 per kg and 60 kg of wheat at Rs. 27 per kg, mixes the two lots thoroughly and wants an overall profit of 20% on the whole lot. At what price per kg must he sell the mixture? [Difficult]

- (A) Rs. 33.60 (D) Rs. 36.00
 (B) Rs. 34.80 (E) None of these
 (C) Rs. 35.40

565. Rajesh divides Rs. 12,000 into two parts, lending one part at 8% per annum simple interest and the other at 12% per annum simple interest. If the total interest received after 2 years is Rs. 2,240, what is the part lent at 12% per annum? [Difficult]

- (A) Rs. 6,000 (D) Rs. 8,000
 (B) Rs. 5,000 (E) None of these
 (C) Rs. 4,000

566. Vessel X holds 20 litres of a milk and water mixture in the ratio 3 : 2, and vessel Y holds 30 litres of a milk and water mixture in the ratio 7 : 3. Both are emptied into a large empty drum and a further 10 litres of water is poured in. What is the ratio of milk to water in the drum? [Difficult]

- (A) 3 : 2
(B) 11 : 9
(C) 13 : 9
- (D) 33 : 17
(E) None of these

567. A grocer wishes to mix three varieties of pulses costing Rs. 60, Rs. 75 and Rs. 100 per kg so that the mixture costs Rs. 80 per kg. If the second and third varieties are taken in equal quantities, in what ratio must the three varieties be mixed? [Difficult]

- (A) 2 : 3 : 3
(B) 4 : 3 : 3
(C) 3 : 5 : 5
- (D) 3 : 4 : 4
(E) None of these

Section 1.6

1.6.1 Time and work; efficiency method

[checked]

568. Ramesh alone can audit a branch ledger in 12 days, while Sunita alone can audit the same ledger in 18 days. If both work together, in how many days will the audit be completed? [Easy]

- (A) $7\frac{1}{5}$ days
(B) $7\frac{1}{2}$ days
- (C) 8 days
(D) $6\frac{3}{5}$ days
(E) None of these

569. Anil is twice as efficient as Bhaskar. Working together they can complete a data-entry assignment in 12 days. In how many days can Bhaskar alone complete the same assignment? [Easy]

- (A) 18 days
(B) 24 days
(C) 36 days
- (D) 30 days
(E) None of these

570. 15 clerks can complete the pending KYC verification of a bank branch in 20 days. Working at the same rate, how many days will 25 clerks take to complete the same verification? [Easy]

- (A) 10 days
(B) 12 days
(C) 15 days
- (D) 18 days
(E) None of these

571. Kavita alone can prepare a loan-recovery report in 10 days. She works on it for 4 days and then proceeds on leave. What fraction of the report is still left? [Easy]

- (A) $\frac{2}{5}$
(B) $\frac{3}{5}$
- (C) $\frac{1}{2}$
(D) $\frac{3}{10}$
(E) None of these

572. Two cashiers, Deepak and Farhan, together can count and bundle a day's cash collection in 8 days. Deepak alone can do it in 12 days. In how many days can Farhan alone do it? [Easy]

- (A) 16 days
(B) 20 days
(C) 24 days
- (D) 30 days
(E) None of these

573. A field officer completes $\frac{1}{4}$ of a village survey in 5 days. Working at the same rate, in how many days will he complete the whole survey? [Easy]

- (A) 15 days
(B) 20 days
(C) 25 days
- (D) 30 days
(E) None of these

574. Meena is 25% more efficient than Nitin. Nitin alone can complete a stock-verification job in 25 days. In how many days can Meena alone complete the same job? [Easy]

- (A) 20 days
(B) 21 days
(C) 18 days
- (D) $22\frac{1}{2}$ days
(E) None of these

575. Ajay alone can complete a branch renovation job in 20 days and Bipin alone in 30 days. They begin working together, but Ajay leaves after 5 days and Bipin completes the rest alone. In how many days in all is the job finished? [Moderate]

- (A) 20 days
(B) 21 days
(C) $22\frac{1}{2}$ days
- (D) 25 days
(E) None of these

576. Pankaj and Qadir together can complete a task in 12 days, Qadir and Ravi together in 15 days, and Pankaj and Ravi together in 20 days. In how many days can all three working together complete the task? [Moderate]

- (A) 8 days
(B) 10 days
(C) 9 days
- (D) 12 days
(E) None of these

577. Sohan can complete a filing job in 24 days and Tarun in 30 days. They work on alternate days, Sohan starting on the first day. In how many days will the job be completed? [Moderate]

- (A) 26 days
(B) $26\frac{3}{5}$ days
(C) 27 days
- (D) $26\frac{2}{3}$ days
(E) None of these

578. Umesh alone can paint a bank hall in 6 days and Vimal alone in 8 days. With the help of Wasim the three of them together finish it in 3 days and are paid Rs. 4,800 in all. If the amount is divided in the ratio of the work done, what is Wasim's share? [Moderate]

- (A) Rs. 600
(B) Rs. 800
(C) Rs. 900
- (D) Rs. 1,200
(E) None of these

579. 12 men can complete the construction of a bank strong-room in 18 days. After they have worked for 6 days, 4 more men join them. In how many more days will the remaining work be completed?
[Moderate]

- (A) 8 days (D) 12 days
(B) 9 days (E) None of these
(C) 10 days

580. Xavier is thrice as efficient as Yogesh and therefore takes 40 days less than Yogesh to complete a job. Working together, in how many days can they complete the same job? [Moderate]

- (A) 12 days (D) 20 days
(B) 15 days (E) None of these
(C) 18 days

581. 6 men and 8 women can complete a document-digitisation project in 10 days, while 26 men and 48 women can complete the same project in 2 days. In how many days can 15 men and 20 women complete it? [Moderate]

- (A) 3 days (D) 6 days
(B) 4 days (E) None of these
(C) 5 days

582. Girish and Harish together can complete a loan-file migration in 30 days. They work together for 20 days, after which Harish leaves; Girish then completes the remaining work alone in 20 more days. In how many days can Girish alone complete the whole migration? [Difficult]

- (A) 40 days (D) 60 days
(B) 48 days (E) None of these
(C) 50 days

583. Imran alone can complete a branch stock-audit in 15 days and Jyoti alone in 20 days. They start the audit together, but Jyoti leaves 5 days before the audit is completed. In how many days in all is the audit completed? [Difficult]

- (A) 10 days (C) $11\frac{2}{7}$ days
(B) $10\frac{1}{2}$ days (D) 12 days
(E) None of these

584. Kiran, Lalit and Manoj can individually complete a job in 8, 12 and 16 days respectively. They work in rotation for one day each in the order Kiran, Lalit, Manoj, Kiran, Lalit, Manoj, and so on. In how many days is the job completed? [Difficult]

- (A) $10\frac{1}{4}$ days (C) 11 days
(B) $10\frac{3}{4}$ days (D) $10\frac{1}{2}$ days
(E) None of these

585. A contractor engaged 60 men to construct a bank building in 40 days. After 25 days he found that only 40% of the work was complete. How many additional men must he employ so that the building is finished exactly on time? [Difficult]

- (A) 60 men
(B) 75 men
(C) 90 men
- (D) 100 men
(E) None of these

586. Naveen and Om together can complete a project in 6 days. Naveen working alone would take 5 days more than Om working alone. In how many days can Om alone complete the project? [Difficult]

- (A) 8 days
(B) 10 days
(C) 12 days
- (D) 15 days
(E) None of these

587. Prakash is 60% more efficient than Rehana. Working together they can clear a cheque-clearing backlog in 15 days. If Prakash works alone for the first 6 days and then leaves, in how many days will Rehana alone clear the remaining backlog? [Difficult]

- (A) 28 days
(B) $29\frac{2}{5}$ days
(C) 30 days
- (D) $31\frac{1}{2}$ days
(E) None of these

588. 10 women can complete a bank's data-cleaning assignment in 12 days, while 8 men can complete the same assignment in 10 days. If 5 women and 4 men work together, in how many days will they complete an assignment twice as large? [Difficult]

- (A) 20 days
(B) $21\frac{9}{11}$ days
- (C) 22 days
(D) 24 days
(E) None of these

1.6.2 Work with wages; alternate-day work

[checked, 1 flagged]

589. Ramesh alone can complete a painting job in 12 days and Suresh alone can complete it in 18 days. They work together and finish the job, receiving Rs. 4,500 in all. If the money is divided in proportion to the work done, what is Ramesh's share? [Easy]

- (A) Rs. 1,800
(B) Rs. 2,700
(C) Rs. 2,500
- (D) Rs. 3,000
(E) None of these

590. Anita alone can complete a data-entry assignment in 10 days and Babita alone in 15 days. They work on alternate days, Anita starting on the first day. In how many days will the assignment be completed? [Easy]

- (A) 10 days
(B) 11 days
(C) 12 days
- (D) 13 days
(E) 14 days

591. Arun, Bhaskar and Chetan can individually complete a godown-stacking job in 6, 8 and 12 days respectively. All three work together till the job is over and are paid Rs. 2,700 in total. What is Chetan's share? [Easy]

- (A) Rs. 450 (D) Rs. 900
 (B) Rs. 600 (E) Rs. 1,200
 (C) Rs. 750

592. Two masons, Iqbal and Javed, can individually finish a plastering work in 9 days and 18 days. They complete it together and the payment is divided in proportion to the work done. If Iqbal receives Rs. 1,200 more than Javed, what is the total payment for the work? [Easy]

- (A) Rs. 2,400 (D) Rs. 4,800
 (B) Rs. 3,000 (E) None of these
 (C) Rs. 3,600

593. Deepak alone can audit a set of ledgers in 12 days and Farhan alone in 24 days. They audit on alternate days with Deepak working on the first day. What fraction of the work is finished at the end of the 6th day? [Easy]

- (A) $\frac{1}{4}$ (D) $\frac{1}{2}$
 (B) $\frac{1}{3}$ (E) $\frac{5}{8}$
 (C) $\frac{3}{8}$

594. Gopal and Hemant working together can complete a warehouse survey in 8 days, while Gopal alone would take 12 days. They do the work together and are paid Rs. 6,000, divided in proportion to work done. What is Gopal's share? [Easy]

- (A) Rs. 2,000 (D) Rs. 4,000
 (B) Rs. 2,400 (E) Rs. 4,500
 (C) Rs. 3,000

595. Kiran alone can prepare a bank's stock statement in 4 days and Lata alone in 8 days. Working on alternate days with Kiran beginning, on which day is the statement completed? [Easy]

- (A) 4th day (D) 7th day
 (B) 5th day (E) None of these
 (C) 6th day

596. Mahesh alone can service a batch of ATMs in 8 days and Naveen alone in 12 days. They work on alternate days, Naveen taking the first day. In how many days is the servicing completed? [Moderate]

- (A) 9 days (C) $9\frac{2}{3}$ days
 (B) $9\frac{1}{3}$ days (D) 10 days
 (E) $10\frac{1}{2}$ days

597. Pankaj alone can complete a work in 6 days and Qadir alone in 8 days. With the help of Rakesh, the three together finish it in 3 days and receive Rs. 4,800 in all, divided in proportion to the work done. What is Rakesh's share? [Moderate]

- (A) Rs. 400
(B) Rs. 600
(C) Rs. 800
- (D) Rs. 1,200
(E) None of these

598. Sanjay alone can complete a road-repair contract in 20 days and Tarun alone in 30 days. They begin together, but Sanjay leaves 5 days before the work is finished, Tarun continuing till the end. The contract money of Rs. 9,000 is shared in proportion to the work each has done. What is Tarun's share?
[Moderate]

- (A) Rs. 3,600
(B) Rs. 4,000
(C) Rs. 4,500
- (D) Rs. 5,400
(E) None of these

599. Umesh, Vikas and Wasim can individually complete a stock-verification job in 8, 12 and 24 days respectively. They work in rotation one day each, Umesh on day 1, Vikas on day 2, Wasim on day 3, and so on. In how many days is the job completed?
[Moderate]

- (A) 10 days
(B) 11 days
(C) 12 days
- (D) 13 days
(E) 14 days

600. A bank branch hires 8 workmen who complete a renovation in 12 days and are paid Rs. 19,200 in all. If 12 workmen of the same daily wage are engaged on a similar renovation which they complete in 10 days, what total wage bill will the branch face?
[Moderate]

- (A) Rs. 19,200
(B) Rs. 20,000
(C) Rs. 22,400
- (D) Rs. 24,000
(E) Rs. 28,800

601. Yogesh alone can complete a task in 12 days and Zakir alone in 15 days. They work on alternate days with Yogesh starting. In how many days will the task be over?
[Moderate]

- (A) 13 days
(B) $13\frac{1}{4}$ days
(C) $13\frac{1}{2}$ days
- (D) $13\frac{3}{4}$ days
(E) 14 days

602. Ajay, Bimal and Chandan can individually complete a work in 24, 30 and 40 days. All three start together, but Chandan leaves 4 days before the work ends while the other two continue to the finish. The total payment of Rs. 12,000 is shared in proportion to work done. What is Chandan's share?
[Moderate]

- (A) Rs. 1,800
(B) Rs. 2,100
(C) Rs. 2,400
- (D) Rs. 2,750
(E) None of these

603. Dinesh alone can complete a work in 12 days and Elias alone in 18 days. Consider two schemes of alternate-day working: in the first Dinesh begins, in the second Elias begins. By how much time do the two completion times differ?
[Difficult]

- (A) $\frac{1}{2}$ day
(B) $\frac{1}{3}$ day

- (C) $\frac{1}{4}$ day
(D) $\frac{1}{12}$ day
(E) None of these

604. Anil and Bimal together can complete a work in 12 days, Bimal and Chetan together in 15 days, and Anil and Chetan together in 20 days. All three work together till the work is finished and receive Rs. 15,000, shared in proportion to work done. What is Bimal's share? [Difficult]

- (A) Rs. 2,500
(B) Rs. 5,000
(C) Rs. 6,000
(D) Rs. 7,500
(E) None of these

605. Amit alone can complete a work in 10 days and Bharat alone in 15 days; Chandan alone can complete the same work in 9 days. Work is done on this pattern: on the first day Amit and Bharat work together, on the second day Chandan works alone, and this two-day pattern repeats. In how many days is the work completed? [Difficult]

- (A) 6 days
(B) $6\frac{1}{2}$ days
(C) 7 days
(D) $7\frac{1}{2}$ days
(E) 8 days

606. A contractor may engage exactly one of three labourers for a job. Anil finishes it in 12 days charging Rs. 600 per day, Bipin finishes it in 18 days charging Rs. 500 per day, and Chirag finishes it in 24 days charging Rs. 400 per day. Whom should the contractor engage to minimise the total wage, and what is that wage? [Difficult]

- (A) Anil, Rs. 7,200
(B) Bipin, Rs. 9,000
(C) Chirag, Rs. 9,600
(D) Anil, Rs. 6,000
(E) Chirag, Rs. 8,400

607. Harish and Ismail work on alternate days with Harish taking the first day, and the work is completed in exactly 12 days. Harish alone can complete the work in 10 days. If Rs. 7,500 is paid in proportion to the work each has actually done, what is Ismail's share? [Difficult]

- (A) Rs. 2,500
(B) Rs. 3,000
(C) Rs. 3,750
(D) Rs. 4,500
(E) None of these

608. Jagdish alone can complete a work in 20 days and Kailash alone can also complete it in 20 days. Jagdish works every day from the start, and Kailash assists him on every third day only. The work is paid for at Rs. 24,000, divided in proportion to the work done by each. What is Kailash's share? [Difficult]

- (A) Rs. 4,000
(B) Rs. 4,800
(C) Rs. 6,000
(D) Rs. 8,000
(E) Rs. 12,000

609. Lalit, Manoj and Nitin can individually complete a work in 15, 20 and 30 days. They work one day each in rotation in that order, Lalit starting on day 1. In how many days is the work completed? [Difficult]

- (A) 19 days
 (B) $19\frac{1}{3}$ days
 (C) $19\frac{1}{2}$ days
 (D) $19\frac{2}{3}$ days
 (E) 20 days

1.6.3 Pipes and cisterns, including leaks

[checked]

610. An overhead water tank in the staff quarters of a bank branch can be filled by pipe A alone in 12 hours and by pipe B alone in 18 hours. If both pipes are opened together on an empty tank, in how much time will the tank be filled?

[Easy]

- (A) 6 h 30 min
 (B) 7 h
 (C) 7 h 12 min
 (D) 7 h 30 min
 (E) None of these

611. A cistern at Ramesh's dairy unit is filled by an inlet pipe in 10 hours, while a leak at the bottom can empty the completely filled cistern in 15 hours. If the inlet pipe is opened when the leak is also active, how long will the empty cistern take to fill?

[Easy]

- (A) 20 h
 (B) 24 h
 (C) 25 h
 (D) 30 h
 (E) None of these

612. Two inlet pipes attached to a water tanker at a petrol pump can fill it in 20 minutes and 30 minutes respectively. If both are opened together on an empty tanker, what part of the tanker will be filled in 4 minutes?

[Easy]

- (A) $\frac{1}{3}$
 (B) $\frac{1}{4}$
 (C) $\frac{2}{5}$
 (D) $\frac{1}{2}$
 (E) $\frac{3}{10}$

613. A pipe fitted to the underground reservoir of a bank's training centre fills $\frac{1}{4}$ of the reservoir in 3 hours. Working at the same uniform rate, how long will the same pipe take to fill the empty reservoir completely?

[Easy]

- (A) 9 hours
 (B) 12 hours
 (C) 15 hours
 (D) 18 hours
 (E) None of these

614. Three inlet pipes A, B and C can separately fill a storage tank in 10 hours, 15 hours and 30 hours respectively. If all three pipes are opened simultaneously on an empty tank, in how many hours will the tank be full?

[Easy]

- (A) 4 hours
 (B) 6 hours
 (C) 7.5 hours
 (D) 5 hours
 (E) None of these

615. A water tank of capacity 3600 litres at a cooperative bank's guest house is filled by a pump that delivers water at the rate of 45 litres per minute. Assuming there is no leakage, how long will the pump take to fill the empty tank?

[Easy]

- (A) 1 h 15 min
- (B) 1 h 20 min
- (C) 1 h 30 min
- (D) 1 h 45 min
- (E) None of these

616. Pipe A alone can fill a cistern in 9 hours. Pipe B is twice as efficient as pipe A. If both pipes are opened together on the empty cistern, in how many hours will it be filled? [Easy]

- (A) 3 hours
- (B) 4 hours
- (C) 4.5 hours
- (D) 6 hours
- (E) None of these

617. Pipe A can fill a tank in 12 hours and pipe B can fill the same tank in 15 hours. Both are opened together on the empty tank, but pipe A is closed after 3 hours. In how much more time will pipe B alone fill the remaining part of the tank? [Moderate]

- (A) 7 h 30 min
- (B) 8 h
- (C) 8 h 15 min
- (D) 8 h 45 min
- (E) None of these

618. An inlet pipe can fill a cistern in 8 hours. Because of a leak in the bottom of the cistern, it actually takes 10 hours to fill. How long will the leak alone take to empty the completely filled cistern? [Moderate]

- (A) 20 hours
- (B) 25 hours
- (C) 30 hours
- (D) 35 hours
- (E) None of these

619. Two pipes can fill a water tank in 20 minutes and 30 minutes respectively. Both pipes are opened together on the empty tank, but the second pipe is closed after some time and the tank becomes full in 18 minutes altogether. After how many minutes was the second pipe closed? [Moderate]

- (A) 2 minutes
- (B) 3 minutes
- (C) 4 minutes
- (D) 5 minutes
- (E) None of these

620. Two pipes running together can fill a tank in 12 minutes. They are opened together on the empty tank and after 5 minutes one of them is closed; the other pipe then takes 21 more minutes to fill the tank. In how many minutes can the pipe that was closed fill the tank alone? [Moderate]

- (A) 24 minutes
- (B) 20 minutes
- (C) 16 minutes
- (D) 18 minutes
- (E) None of these

621. A leak in the bottom of a cistern at a rice mill can empty the full cistern in 8 hours. A tap that admits 6 litres of water per minute is turned on, and now the full cistern is emptied in 12 hours. What is the capacity of the cistern? [Moderate]

- (A) 7,200 litres
- (B) 8,640 litres
- (C) 9,600 litres
- (D) 10,800 litres
- (E) None of these

622. Two pipes A and B together can fill a tank in 36 minutes. Pipe A is three times as fast as pipe B. How long will pipe B alone take to fill the tank? [Moderate]

- (A) 108 minutes
- (B) 120 minutes
- (C) 144 minutes
- (D) 48 minutes
- (E) None of these

623. A tank of capacity 600 litres has two inlet pipes A and B which can fill it in 15 minutes and 20 minutes respectively, and an outlet pipe C which can empty the full tank in 30 minutes. All three are opened together on the empty tank. How much water is discharged by the outlet pipe C before the tank becomes full? [Moderate]

- (A) 240 litres
- (B) 200 litres
- (C) 260 litres
- (D) 300 litres
- (E) None of these

624. Pipe A can fill a cistern in 6 hours and pipe B can fill it in 8 hours. Starting with pipe A, the two pipes are opened alternately for exactly one hour each on an empty cistern. In how much time will the cistern be completely filled? [Difficult]

- (A) 6 h 30 min
- (B) 7 h
- (C) 7 h 15 min
- (D) 6 h 45 min
- (E) None of these

625. Two inlet pipes can fill a tank in 30 minutes and 40 minutes respectively, while a third pipe at the bottom can empty the full tank. When all three pipes are opened together on the empty tank, it gets filled in 60 minutes. In how many minutes can the third pipe alone empty the completely filled tank? [Difficult]

- (A) 20 minutes
- (B) 24 minutes
- (C) 30 minutes
- (D) 36 minutes
- (E) None of these

626. A pipe can fill an empty tank in 6 hours. The pipe is opened, and exactly 2 hours later a leak develops at the bottom of the tank. Because of this leak the tank finally becomes full only 8 hours after the pipe was opened. In how many hours can the leak alone empty the completely filled tank? [Difficult]

- (A) 12 hours
- (B) 15 hours
- (C) 18 hours
- (D) 24 hours
- (E) None of these

627. A tank of capacity 4800 litres is served by inlet pipe A delivering 60 litres per minute, inlet pipe B delivering 40 litres per minute, and an outlet pipe C discharging 30 litres per minute. A and B are opened together on the empty tank, and C is opened 20 minutes later. Counting from the start, how long does the tank take to fill completely? [Difficult]

- (A) 60 minutes
- (B) 55 minutes
- (C) 65 minutes
- (D) 70 minutes
- (E) None of these

628. Two pipes A and B are fitted to a cistern. Pipe A alone takes 6 minutes more than the time the two together take, and pipe B alone takes 24 minutes more than the time the two together take. How long do A and B together take to fill the cistern? [Difficult]

- (A) 10 minutes (D) 16 minutes
(B) 12 minutes (E) None of these
(C) 14 minutes

629. Pipes A and B can fill a tank in 20 minutes and 30 minutes respectively. Both are opened together on the empty tank. Exactly 5 minutes later pipe A is closed and at the very same moment a leak develops which alone can empty the full tank in 60 minutes. Counting from the start, in how many minutes does the tank become full? [Difficult]

- (A) 30 minutes (D) 40 minutes
(B) 35 minutes (E) None of these
(C) 45 minutes

630. Three pipes P, Q and R are fitted to a reservoir. P and Q together fill it in 8 hours, Q and R together fill it in 12 hours, and P and R together fill it in 16 hours. If all three pipes are opened together on the empty reservoir, how long will it take to fill? [Difficult]

- (A) $\frac{96}{13}$ hours (C) $\frac{13}{96}$ hours
(B) $\frac{48}{13}$ hours (D) $\frac{24}{7}$ hours
(E) None of these

1.6.4 Time, speed, and distance

[checked]

631. A bank's cash-transport van covers 315 km in 4 hours 30 minutes. What is its average speed? [Easy]

- (A) 65 km/h (D) 75 km/h
(B) 68 km/h (E) None of these
(C) 72 km/h

632. The Rajdhani Express runs at a uniform speed of 72 km/h. Express this speed in metres per second. [Easy]

- (A) 15 m/s (D) 24 m/s
(B) 18 m/s (E) 25 m/s
(C) 20 m/s

633. Ramesh cycles from his house to the branch office, a distance of 24 km, at a steady speed of 16 km/h. How long does the ride take? [Easy]

- (A) 1 hour 10 minutes (D) 1 hour 30 minutes
(B) 1 hour 20 minutes (E) 1 hour 40 minutes
(C) 1 hour 25 minutes

634. A long-distance bus leaves Nagpur at 5:30 am and travels at a uniform 60 km/h without any halt. At what time will it reach a town 420 km away? [Easy]

- (A) 11:30 am
- (B) 12:00 noon
- (C) 12:30 pm
- (D) 1:00 pm
- (E) None of these

635. A train 180 metres long passes a stationary electric pole in 9 seconds. What is the speed of the train? [Easy]

- (A) 54 km/h
- (B) 60 km/h
- (C) 66 km/h
- (D) 72 km/h
- (E) 80 km/h

636. A goods train covers 200 km in 2 hours 30 minutes. At what uniform speed must it run to cover the same distance in exactly 2 hours? [Easy]

- (A) 100 km/h
- (B) 105 km/h
- (C) 110 km/h
- (D) 120 km/h
- (E) None of these

637. Suresh jogs at a constant speed of 12 km/h. How much time does he take to cover 900 metres? [Easy]

- (A) 3 minutes
- (B) 4 minutes
- (C) 4 minutes 30 seconds
- (D) 5 minutes
- (E) 6 minutes

638. Meena walks from her home to the training centre at 5 km/h and reaches 10 minutes late. When she walks the same route at 6 km/h she reaches 5 minutes early. What is the distance from her home to the training centre? [Moderate]

- (A) 6 km
- (B) 7 km
- (C) $7\frac{1}{2}$ km
- (D) 8 km
- (E) 9 km

639. A field officer travels the first 60 km of a tour at 30 km/h and the next 90 km at 45 km/h. What is his average speed for the whole tour? [Moderate]

- (A) 36 km/h
- (B) 37.5 km/h
- (C) 38 km/h
- (D) 40 km/h
- (E) None of these

640. A train 240 metres long, running at 72 km/h, crosses a railway platform completely in 27 seconds. What is the length of the platform? [Moderate]

- (A) 280 metres
- (B) 300 metres
- (C) 320 metres
- (D) 360 metres
- (E) None of these

641. A cash van leaves the head office at 9:00 am and travels at 40 km/h along a highway. A security jeep leaves the same office along the same route at 10:30 am at 60 km/h. At what time will the jeep overtake the cash van? [Moderate]

- (A) 12:30 pm
(B) 1:00 pm
(C) 1:30 pm
- (D) 2:00 pm
(E) None of these

642. Two towns P and Q are 270 km apart. A bus starts from P towards Q at 6:00 am at 50 km/h, and another bus starts from Q towards P at 7:00 am at 60 km/h. How far from P do the two buses meet?

[Moderate]

- (A) 150 km
(B) 160 km
(C) 170 km
- (D) 180 km
(E) None of these

643. Kavita usually completes a journey in 3 hours 45 minutes. If she had increased her speed by 25%, how long would the same journey have taken?

[Moderate]

- (A) 2 hours 45 minutes
(B) 3 hours
(C) 3 hours 15 minutes
- (D) 3 hours 30 minutes
(E) None of these

644. An inspection team covers a total distance of 300 km in 6 hours, partly by road at 40 km/h and the remaining part by train at 70 km/h. What distance did the team cover by train?

[Moderate]

- (A) 140 km
(B) 150 km
(C) 160 km
- (D) 180 km
(E) None of these

645. A train 180 metres long running at 90 km/h overtakes another train 120 metres long running at 72 km/h on a parallel track in the same direction. How long does the faster train take to pass the slower one completely?

[Difficult]

- (A) 45 seconds
(B) 50 seconds
(C) 55 seconds
- (D) 60 seconds
(E) None of these

646. Two trains start at the same moment from stations A and B and travel towards each other. After they cross, the train from A takes 9 hours to reach B , and the train from B takes 16 hours to reach A . If the train from A runs at 48 km/h, what is the speed of the train from B ?

[Difficult]

- (A) 30 km/h
(B) 33 km/h
(C) 36 km/h
- (D) 42 km/h
(E) None of these

647. A train leaves a station and runs at a uniform speed. Two hours after starting it is stopped by a signal failure and is held up for 1 hour, after which it proceeds at $\frac{3}{5}$ of its original speed and reaches its destination 4 hours late. Had the failure occurred 60 km further along the route, the train would have reached only 3 hours late. Find the total length of the journey.

[Difficult]

- (A) 260 km
- (B) 280 km
- (C) 300 km
- (D) 320 km
- (E) None of these

648. A motorist covers the first half of a journey at 30 km/h. Over the second half he drives at 60 km/h for half of the time taken on that half and at 40 km/h for the other half of that time. What is his average speed for the entire journey? [Difficult]

- (A) 36 km/h
- (B) 37.5 km/h
- (C) 40 km/h
- (D) 42 km/h
- (E) None of these

649. Arun and Bhavesh start together from the same point on a circular track of length 1200 metres and run in opposite directions at 5 m/s and 3 m/s respectively. After how much time will they meet again for the first time at the starting point? [Difficult]

- (A) 10 minutes
- (B) 15 minutes
- (C) 20 minutes
- (D) 25 minutes
- (E) None of these

650. A man covers a certain distance at a uniform speed. Had he moved 3 km/h faster, he would have taken 40 minutes less; had he moved 2 km/h slower, he would have taken 40 minutes more. What is the distance? [Difficult]

- (A) 40 km
- (B) 42 km
- (C) 45 km
- (D) 48 km
- (E) None of these

651. A train running at a uniform speed crosses a man standing on a platform in 12 seconds and crosses the whole 180-metre platform in 21 seconds. What is the speed of the train? [Difficult]

- (A) 54 km/h
- (B) 60 km/h
- (C) 66 km/h
- (D) 80 km/h
- (E) None of these

1.6.5 Relative speed; problems on trains

[checked, 1 flagged]

652. A train 180 m long is running at a uniform speed of 54 km/h. How much time will it take to pass a telegraph pole standing beside the track? [Easy]

- (A) 10 seconds
- (B) 12 seconds
- (C) 14 seconds
- (D) 15 seconds
- (E) None of these

653. The Nagpur Express, 240 m long, is moving at 72 km/h. How long will it take to cross a railway platform 160 m in length? [Easy]

- (A) 16 seconds
- (B) 18 seconds
- (C) 22 seconds
- (D) 20 seconds
- (E) 24 seconds

654. Two trains of lengths 150 m and 100 m are running on parallel tracks in opposite directions at 60 km/h and 40 km/h respectively. In how many seconds will they cross each other completely? [Easy]

- (A) 12 seconds
- (B) 10 seconds
- (C) 9 seconds
- (D) 8 seconds
- (E) None of these

655. A train 150 m long overtakes Ramesh, who is jogging along the track at 6 km/h in the same direction as the train, and passes him completely in 10 seconds. What is the speed of the train? [Easy]

- (A) 60 km/h
- (B) 62 km/h
- (C) 66 km/h
- (D) 54 km/h
- (E) None of these

656. A train 120 m long, travelling at 45 km/h, crosses a railway bridge in 30 seconds. What is the length of the bridge? [Easy]

- (A) 235 m
- (B) 245 m
- (C) 265 m
- (D) 275 m
- (E) None of these

657. A train 110 m long is running at 60 km/h. Sunil is running at 6 km/h along the track in the direction opposite to that of the train. How long will the train take to pass him completely? [Easy]

- (A) 5 seconds
- (B) $5\frac{1}{2}$ seconds
- (C) 6 seconds
- (D) 7 seconds
- (E) None of these

658. Stations Pune and Solapur are 300 km apart. A passenger train starts from Pune towards Solapur at 60 km/h and, at the very same moment, another train starts from Solapur towards Pune at 40 km/h. After how much time will the two trains meet? [Easy]

- (A) 4 hours
- (B) $3\frac{1}{2}$ hours
- (C) 3 hours
- (D) $2\frac{1}{2}$ hours
- (E) 2 hours

659. A train passes a signal post in 15 seconds and crosses a platform 200 m long in 25 seconds. What is the length of the train? [Moderate]

- (A) 300 m
- (B) 250 m
- (C) 275 m
- (D) 350 m
- (E) None of these

660. Two trains of lengths 200 m and 300 m are running on parallel tracks in the same direction at 72 km/h and 54 km/h respectively. How long will the faster train take to overtake the slower train completely? [Moderate]

- (A) 80 seconds
(B) 90 seconds
(C) 100 seconds
- (D) 120 seconds
(E) None of these

661. A train overtakes two labourers who are walking in the same direction as the train at 4 km/h and 8 km/h, and passes them completely in 9 seconds and 10 seconds respectively. What is the length of the train? [Moderate]

- (A) 45 m
(B) 50 m
(C) 54 m
- (D) 72 m
(E) 100 m

662. Two trains start at the same moment from Lucknow and Kanpur towards each other. After they meet, the train from Lucknow takes 9 hours to reach Kanpur while the train from Kanpur takes 16 hours to reach Lucknow. If the speed of the train from Lucknow is 60 km/h, what is the speed of the other train? [Moderate]

- (A) 48 km/h
(B) 45 km/h
(C) 42 km/h
- (D) 40 km/h
(E) None of these

663. A train 180 m long, running at 54 km/h, crosses another train running in the opposite direction at 36 km/h in 12 seconds. What is the length of the second train? [Moderate]

- (A) 120 m
(B) 130 m
(C) 150 m
- (D) 100 m
(E) None of these

664. A goods train leaves Chennai at 8 a.m. and travels at a steady 40 km/h. An express train leaves Chennai along the same route at 10 a.m. and travels at 60 km/h. At what time will the express train overtake the goods train? [Moderate]

- (A) 1 p.m.
(B) 2 p.m.
(C) 3 p.m.
- (D) 4 p.m.
(E) None of these

665. Two trains of equal length take 10 seconds and 15 seconds respectively to pass a telegraph post. If they run on parallel tracks in opposite directions, how long will they take to cross each other? [Moderate]

- (A) 10 seconds
(B) 12.5 seconds
(C) 25 seconds
- (D) 12 seconds
(E) None of these

666. A train running at 45 km/h crosses another train, whose length is half its own, running in the opposite direction at 27 km/h, in 12 seconds. The same train then passes a bridge in 60 seconds. What is the length of the bridge? [Difficult]

- (A) 540 m
(B) 570 m
(C) 590 m
- (D) 620 m
(E) None of these

667. Two trains, 160 m and 140 m long, run on parallel tracks. Running in the same direction, the faster train passes the slower one completely in 60 seconds; running in opposite directions they pass each other completely in 12 seconds. What is the speed of the faster train? [Difficult]

- (A) 60 km/h (D) 45 km/h
(B) 54 km/h (E) None of these
(C) 50 km/h

668. Two trains start simultaneously from stations A and B and travel towards each other. After they cross, the train from A reaches B in 4 hours and the train from B reaches A in 9 hours. If the speed of the train from A is 60 km/h, what is the distance between A and B? [Difficult]

- (A) 450 km (D) 600 km
(B) 500 km (E) None of these
(C) 540 km

669. Two trains, 150 m and 120 m long, approach each other on parallel tracks at 63 km/h and 45 km/h respectively, the longer train being the faster one. A passenger seated in the slower train times how long the faster train takes to pass him. By how much does the time for the two trains to pass each other completely exceed that time? [Difficult]

- (A) 4 seconds (D) 9 seconds
(B) 3 seconds (E) None of these
(C) 5 seconds

670. A jogger is running at 9 km/h alongside a railway track and is 240 m ahead of the engine of a train 120 m long, which is running at 45 km/h in the same direction. In how much time will the train pass the jogger? [Difficult]

- (A) 40 seconds (D) 24 seconds
(B) 36 seconds (E) None of these
(C) 30 seconds

671. Two stations are 200 km apart. A train leaves the first station at 8 a.m. and travels towards the second at 40 km/h. Another train leaves the second station at 9 a.m. and travels towards the first at 60 km/h. At what time will the two trains meet? [Difficult]

- (A) 10:24 a.m. (D) 10:36 a.m.
(B) 10:30 a.m. (E) None of these
(C) 10:48 a.m.

672. Two trains running in the same direction at 60 km/h and 45 km/h pass one another completely in 48 seconds. If the length of the first train is 150 m, how long would they take to pass one another completely if they ran in opposite directions? [Difficult]

- (A) 8 seconds (C) $6\frac{6}{7}$ seconds
(B) $7\frac{1}{7}$ seconds (D) 6 seconds
(E) None of these

1.6.6 Boats and streams

[checked, 1 flagged]

673. Ramesh's motorboat has a speed of 12 km/h in still water. The Kaveri river flows at 3 km/h. How long will the boat take to cover 45 km downstream? [Easy]

- (A) 3 hours
(B) $3\frac{1}{2}$ hours
(C) 4 hours
(D) 5 hours
(E) None of these

674. A ferry operated by the Kochi Port Trust moves at 18 km/h downstream and at 12 km/h upstream. What is the speed of the current? [Easy]

- (A) 2 km/h
(B) 3 km/h
(C) 4 km/h
(D) 6 km/h
(E) None of these

675. A country boat covers 36 km downstream in 3 hours. If the stream flows at 2 km/h, find the speed of the boat in still water. [Easy]

- (A) 8 km/h
(B) 10 km/h
(C) 12 km/h
(D) 14 km/h
(E) None of these

676. Sunita can row at 15 km/h in still water. If the river current is 5 km/h, how much time will she take to row 30 km against the current? [Easy]

- (A) 2 hours
(B) $2\frac{1}{2}$ hours
(C) 3 hours
(D) 4 hours
(E) None of these

677. A boat whose speed in still water is 12 km/h takes 4 hours to travel 40 km upstream. What is the speed of the stream? [Easy]

- (A) 1 km/h
(B) 2 km/h
(C) 3 km/h
(D) 4 km/h
(E) None of these

678. A speedboat used for river patrol moves downstream at 20 km/h. If the current flows at 4 km/h, at what speed does the boat move upstream? [Easy]

- (A) 10 km/h
(B) 12 km/h
(C) 14 km/h
(D) 16 km/h
(E) None of these

679. The speed of a boat in still water is 5 times the speed of the stream. If the stream flows at 3 km/h, find the speed of the boat downstream. [Easy]

- (A) 12 km/h
(B) 15 km/h
(C) 18 km/h
(D) 20 km/h
(E) None of these

680. Mahesh rows a boat whose speed in still water is 10 km/h. He rows to a jetty 48 km away and comes back to his starting point. If the river flows at 2 km/h, how much time does the entire trip take? [Moderate]

- (A) 8 hours
(B) 9 hours
(C) 10 hours
- (D) 11 hours
(E) None of these

681. A boat travels 24 km downstream in 3 hours. The same boat covers 18 km upstream in 3 hours. How long will the boat take to cover 84 km in still water? [Moderate]

- (A) 10 hours
(B) 11 hours
(C) 12 hours
- (D) 14 hours
(E) None of these

682. A motorboat covers 36 km downstream and 40 km upstream in 8 hours. The same boat covers 48 km downstream and 24 km upstream in 7 hours. Find the speed of the stream. [Moderate]

- (A) 1 km/h
(B) 2 km/h
(C) 3 km/h
- (D) 4 km/h
(E) None of these

683. A boat takes twice as much time to cover a certain distance upstream as it takes to cover the same distance downstream. If the stream flows at 4 km/h, what distance can the boat cover downstream in 3 hours? [Moderate]

- (A) 36 km
(B) 42 km
(C) 48 km
- (D) 54 km
(E) None of these

684. A boat whose speed in still water is 15 km/h goes 30 km downstream to a village and returns to the starting point, taking 4 hours 30 minutes in all. Find the speed of the stream. [Moderate]

- (A) 3 km/h
(B) 4 km/h
(C) 5 km/h
- (D) 6 km/h
(E) None of these

685. Anil can row at 6 km/h in still water. When the river is running at 2 km/h, it takes him 3 hours to row to a temple ghat and return. How far is the ghat from his starting point? [Moderate]

- (A) 6 km
(B) 10 km
(C) 12 km
- (D) 16 km
(E) None of these

686. A boat covers a certain distance downstream in 4 hours and covers the same distance upstream in 6 hours. If the stream flows at 3 km/h, find the distance. [Moderate]

- (A) 60 km
(B) 66 km
(C) 72 km
- (D) 78 km
(E) None of these

687. The speed of a launch in still water is 12 km/h and the river current is 4 km/h. The launch sails from jetty A to jetty B downstream and returns to A. What is its average speed for the whole round trip? [Difficult]

- (A) $\frac{32}{3}$ km/h
 (B) 10 km/h
 (C) 12 km/h
 (D) $\frac{16}{3}$ km/h
 (E) None of these

688. While rowing upstream on the Narmada, Farhan's sealed water bottle falls overboard just as he passes a milestone, and it drifts away with the current. He keeps rowing upstream for another 30 minutes before he notices the loss, then at once turns around and rows back, overtaking the bottle at a point 2 km downstream of the milestone. Assuming his rowing effort is unchanged throughout, find the speed of the current. [Difficult]

- (A) $1\frac{1}{2}$ km/h
 (B) 2 km/h
 (C) $2\frac{1}{2}$ km/h
 (D) 3 km/h
 (E) None of these

689. A steamer takes 3 hours to sail from port A to port B downstream and 5 hours to return from B to A. How long would an engineless raft take to drift from A to B? [Difficult]

- (A) 8 hours
 (B) 12 hours
 (C) 15 hours
 (D) 16 hours
 (E) None of these

690. Vikram rows to a place 48 km away and comes back in 14 hours. He finds that he can row 4 km with the stream in the same time as he can row 3 km against the stream. What is the speed of the stream? [Difficult]

- (A) $\frac{1}{2}$ km/h
 (B) 1 km/h
 (C) $1\frac{1}{2}$ km/h
 (D) 2 km/h
 (E) None of these

691. Rajesh's motorboat travels at 21 km/h in still water. On a certain stretch of the Godavari he observes that the boat takes 25% less time going downstream than it takes coming back upstream over the same stretch. Find the speed of the current. [Difficult]

- (A) 2 km/h
 (B) $2\frac{1}{2}$ km/h
 (C) 3 km/h
 (D) $3\frac{1}{2}$ km/h
 (E) None of these

692. Two boats start at the same moment towards each other from ports A and B, which are 120 km apart on a river. The boat from A sails downstream and has a speed of 18 km/h in still water; the boat from B sails upstream and has a speed of 14 km/h in still water. If the river flows at 2 km/h from A towards B, how far from A do the two boats meet? [Difficult]

- (A) 70 km
 (B) 72 km
 (C) 75 km
 (D) 80 km
 (E) None of these

693. A boatman rows 30 km downstream in 2 hours. He calculates that if the speed of the current were doubled, he would need 5 hours to row the same 30 km upstream. Find the speed of his boat in still water. [Difficult]

- (A) 10 km/h (D) 13 km/h
 (B) 11 km/h (E) None of these
 (C) 12 km/h

1.6.7 Races and circular tracks

[checked, 2 flagged]

694. In a 100 m race, Anil beats Vikram by 20 m. If both run at uniform speed throughout, the ratio of Anil's speed to Vikram's speed is: [Easy]

- (A) 5 : 4 (D) 6 : 5
 (B) 4 : 5 (E) None of these
 (C) 5 : 3

695. Bhavna and Reema take part in a 200 m race. Reema takes 50 seconds to complete the race and Bhavna beats her by 10 seconds. Bhavna's speed is: [Easy]

- (A) 4 m/s (D) 5.5 m/s
 (B) 4.5 m/s (E) 6 m/s
 (C) 5 m/s

696. Two joggers start from the same point on a circular track of length 400 m and run in the same direction with speeds 5 m/s and 3 m/s. After how many seconds will the faster jogger meet the slower one for the first time? [Easy]

- (A) 50 s (D) 200 s
 (B) 100 s (E) 250 s
 (C) 150 s

697. Two cyclists start from the same point of a circular track of length 500 m and ride in opposite directions with speeds 18 km/h and 27 km/h. They will meet for the first time after: [Easy]

- (A) 20 s (D) 45 s
 (B) 30 s (E) 50 s
 (C) 40 s

698. Ashok can run 1 km in 4 minutes 54 seconds while Prem covers the same distance in 5 minutes. By what distance does Ashok beat Prem? [Easy]

- (A) 15 m (D) 24 m
 (B) 18 m (E) 25 m
 (C) 20 m

699. In a 300 m race, Kiran beats Manoj by 30 m, which is the same as beating him by 6 seconds. The time taken by Manoj to complete the 300 m is: [Easy]

- (A) 50 s (D) 60 s
 (B) 54 s (E) 66 s
 (C) 56 s

700. Two employees of a bank start from the same point on a circular jogging track of length 900 m and walk in the same direction at 9 km/h and 6 km/h respectively. After how many minutes will they be side by side again for the first time? [Easy]

- (A) 12 minutes
(B) 15 minutes
(C) 18 minutes
- (D) 20 minutes
(E) 24 minutes

701. In a 100 m race Rajat beats Sohan by 20 m, and in a separate 100 m race Sohan beats Tarun by 25 m. If all three run at their usual uniform speeds, by how many metres will Rajat beat Tarun in a 100 m race? [Moderate]

- (A) 35 m
(B) 37.5 m
(C) 40 m
- (D) 45 m
(E) None of these

702. Meena and Nandini take part in a 500 m race. The ratio of their speeds is 3 : 4 respectively, and Meena is given a head start of 140 m. By what distance does Meena win the race? [Moderate]

- (A) 15 m
(B) 25 m
(C) 30 m
- (D) 40 m
(E) None of these

703. Two runners start together from the same point of a circular track and run in opposite directions at 3 m/s and 5 m/s. They meet for the first time 45 seconds after the start. After how much time from the start will both of them be at the starting point together for the first time? [Moderate]

- (A) 3 minutes
(B) 4 minutes
(C) 5 minutes
- (D) 6 minutes
(E) 7.5 minutes

704. In a 1 km race, Ramesh gives Suresh a start of 200 m and both of them reach the finishing line at the same instant. What start must Ramesh give Suresh in a 600 m race so that the race again ends in a dead heat? [Moderate]

- (A) 100 m
(B) 110 m
(C) 120 m
- (D) 125 m
(E) 150 m

705. Three runners start together from the same point on a circular track of length 500 m and run in the same direction with speeds 3 m/s, 4 m/s and 5 m/s. After how many seconds will all three be together at the starting point for the first time? [Moderate]

- (A) 250 s
(B) 300 s
(C) 400 s
- (D) 500 s
(E) 600 s

706. In a 400 m race Arun beats Bharat by 40 m, and in a 300 m race Bharat beats Chirag by 30 m. In a 600 m race between Arun and Chirag, by how many metres will Arun beat Chirag? [Moderate]

- (A) 108 m
(B) 110 m
(C) 114 m
- (D) 120 m
(E) None of these

707. Two cyclists start from the same point on a circular track of length 400 m and ride in the same direction at 36 km/h and 45 km/h. How many times will the faster cyclist overtake the slower one during a ride lasting 20 minutes? [Moderate]

- (A) 5
- (B) 6
- (C) 7
- (D) 8
- (E) 9

708. Sameer and Farhan start from the same point of a circular track and run continuously in opposite directions with speeds in the ratio 5 : 7. Counting the starting point only if they actually meet there, at how many distinct points on the track do they meet? [Difficult]

- (A) 2
- (B) 5
- (C) 7
- (D) 12
- (E) 35

709. Pramod and Ravi run a 1600 m race. When Pramod gives Ravi a start of 400 m, Pramod wins by 2 minutes. When instead Pramod allows Ravi to start 8 minutes earlier and both cover the full 1600 m, the race ends in a dead heat. How long does Pramod take to run 1600 m? [Difficult]

- (A) 12 minutes
- (B) 14 minutes
- (C) 15 minutes
- (D) 16 minutes
- (E) 18 minutes

710. Anil, Bala and Chandra start together from the same point of a circular track of length 400 m and run in the same direction at 3 m/s, 5 m/s and 7 m/s respectively. After how many seconds will all three be together again at one and the same point of the track (not necessarily the starting point) for the first time? [Difficult]

- (A) 100 s
- (B) 150 s
- (C) 200 s
- (D) 400 s
- (E) 800 s

711. In a 5 km charity run organised by a bank, Deepak's speed is 25% more than Farhan's speed. Being confident, Deepak allows Farhan a head start of 1 km. Which of the following is correct? [Difficult]

- (A) Deepak wins by 200 m
- (B) Farhan wins by 200 m
- (C) Deepak wins by 250 m
- (D) The race ends in a dead heat
- (E) Farhan wins by 500 m

712. In an 800 m race, Amit gives Bipin a start of 160 m and the race ends in a dead heat. If instead Amit gives Bipin a start of only 100 m, Amit wins by 15 seconds. Amit's speed is: [Difficult]

- (A) 4 m/s
- (B) 4.5 m/s
- (C) 5 m/s
- (D) 5.5 m/s
- (E) 6 m/s

713. Two runners start together from the same point of a circular track of length 300 m and run in the same direction at 4 m/s and 10 m/s. At what distance from the starting point, measured along the direction of running, do they meet for the first time? [Difficult]

- (A) 100 m (D) 250 m
 (B) 150 m (E) None of these
 (C) 200 m

714. In a 2400 m run, the ratio of Sunil's speed to Tarun's speed is 5 : 4. Sunil starts 3 minutes after Tarun, yet finishes 2 minutes before him. How long does Tarun take to complete the run? [Difficult]

- (A) 20 minutes (D) 27.5 minutes
 (B) 22.5 minutes (E) 30 minutes
 (C) 25 minutes

Section 1.7

1.7.1 Linear equations in one and two variables

[checked]

715. A stationery dealer in Nagpur sold some gel pens at Rs. 15 each and collected Rs. 675 in all. How many pens did he sell? [Easy]

- (A) 40 (D) 48
 (B) 42 (E) None of these
 (C) 45

716. Solve for x : $7x - 9 = 4x + 12$.

[Easy]

- (A) 5 (D) 11
 (B) 7 (E) None of these
 (C) 9

717. The sum of two numbers is 48 and their difference is 12. What is the larger of the two numbers? [Easy]

- (A) 18 (D) 36
 (B) 24 (E) None of these
 (C) 30

718. The cost of 4 notebooks and 3 pens together is Rs. 290. If one notebook costs Rs. 50, what is the cost of one pen? [Easy]

- (A) Rs. 20 (D) Rs. 30
 (B) Rs. 25 (E) None of these
 (C) Rs. 28

719. If $\frac{2x}{3} + 5 = 13$, what is the value of x ?

[Easy]

- (A) 8 (D) 18
 (B) 12 (E) None of these
 (C) 15

720. Deepak and Suresh together earned Rs. 85 thousand in a month from commission. Deepak's commission exceeded Suresh's by Rs. 15 thousand. What was Suresh's commission? [Easy]

- (A) Rs. 35 thousand (D) Rs. 50 thousand
 (B) Rs. 40 thousand (E) None of these
 (C) Rs. 45 thousand

721. Solve for y : $5(y - 3) = 3(y + 1)$. [Easy]

- (A) 6 (D) 9
 (B) 7 (E) None of these
 (C) 8

722. Anita's father is at present three times as old as Anita. Twelve years from now, he will be only twice as old as she is then. What is Anita's present age (in years)? [Moderate]

- (A) 10 (D) 16
 (B) 12 (E) None of these
 (C) 14

723. The length of a rectangular plot of a housing society is 5 metres more than twice its breadth. If the perimeter of the plot is 100 metres, what is its length? [Moderate]

- (A) 30 m (D) 40 m
 (B) 32 m (E) None of these
 (C) 35 m

724. In a two-digit number the sum of the digits is 11. If the digits are interchanged, the new number is 27 more than the original number. What is the original number? [Moderate]

- (A) 47 (D) 74
 (B) 38 (E) None of these
 (C) 56

725. The denominator of a fraction is 5 more than its numerator. If 3 is added to both the numerator and the denominator, the fraction becomes $\frac{3}{4}$. What is the original fraction? [Moderate]

- (A) $\frac{9}{14}$ (C) $\frac{12}{17}$
 (B) $\frac{7}{12}$ (D) $\frac{13}{18}$
 (E) None of these

726. A bonus of Rs. 6,300 is shared among Arun, Bhavna and Chetan. Bhavna receives Rs. 500 more than Arun, and Chetan receives twice as much as Bhavna. How much does Chetan receive? [Moderate]

- (A) Rs. 1,700 (D) Rs. 3,400
 (B) Rs. 2,400 (E) None of these
 (C) Rs. 3,000

727. A bank branch's cash box contains only Rs. 5 coins and Rs. 10 coins. There are 60 coins in all and their total value is Rs. 480. How many Rs. 10 coins are there? [Moderate]

- (A) 36
(B) 30
(C) 24
- (D) 40
(E) None of these

728. If Sunil's monthly salary were increased by Rs. 20,000 it would become twice Anil's present salary. If Anil's salary were increased by Rs. 10,000 the two salaries would become equal. What is Sunil's present monthly salary? [Moderate]

- (A) Rs. 30,000
(B) Rs. 32,000
(C) Rs. 35,000
- (D) Rs. 45,000
(E) None of these

729. The savings of Priya and Kavita are in the ratio 5 : 7. If each of them saves Rs. 3,000 more per month, the ratio of their savings becomes 11 : 15. What are Kavita's original savings? [Difficult]

- (A) Rs. 30,000
(B) Rs. 36,000
(C) Rs. 42,000
- (D) Rs. 48,000
(E) None of these

730. Ten years ago Maheshbhai was four times as old as his son. Ten years from now he will be twice as old as his son will be then. What is the sum of their present ages (in years)? [Difficult]

- (A) 65
(B) 70
(C) 75
- (D) 80
(E) None of these

731. In a furniture showroom, 2 chairs and 3 tables cost Rs. 12,000, while 3 chairs and 2 tables cost Rs. 10,500. What is the total cost of 7 chairs and 8 tables? [Difficult]

- (A) Rs. 31,500
(B) Rs. 33,000
(C) Rs. 34,500
- (D) Rs. 36,000
(E) None of these

732. A two-digit number is four times the sum of its digits. If 27 is added to the number, the digits get reversed. What is the number? [Difficult]

- (A) 24
(B) 36
(C) 48
- (D) 63
(E) None of these

733. A bank branch has clerks and officers, 45 employees in all. Each clerk was paid a festival bonus of Rs. 1,200 and each officer Rs. 2,000, and the branch paid out Rs. 68,400 in total. How many clerks are there in the branch? [Difficult]

- (A) 24
(B) 25
(C) 26
- (D) 28
(E) None of these

734. A sum of Rs. 24,000 is divided into two parts such that two-fifths of the first part exceeds one-third of the second part by Rs. 3,000. What is the smaller of the two parts? [Difficult]

- (A) Rs. 9,000
(B) Rs. 10,000
(C) Rs. 12,000
- (D) Rs. 15,000
(E) None of these

735. For what value of k does the pair of equations $2x + 3y = 7$ and $(k - 1)x + (k + 2)y = 3k$ have infinitely many solutions? [Difficult]

- (A) 4
(B) 5
(C) 7
- (D) 9
(E) None of these

1.7.2 Quadratic equations: roots, nature of roots

[checked, 2 flagged]

736. The number of accounts opened on two successive days at a branch of Punjab National Bank satisfies $x^2 - 13x + 42 = 0$. What are the roots of this equation? [Easy]

- (A) 6 and 7
(B) -6 and -7
(C) 3 and 14
- (D) 2 and 21
(E) None of these

737. What is the nature of the roots of the equation $2x^2 - 7x + 5 = 0$? [Easy]

- (A) Real and equal
(B) Real, rational and unequal
(C) Real, irrational and unequal
- (D) Imaginary
(E) None of these

738. The monthly targets (in lakhs) of two field officers of Bank of Baroda are the roots of $5x^2 - 20x + 12 = 0$. What is the sum of the roots? [Easy]

- (A) 4
(B) -4
(C) $\frac{12}{5}$
- (D) $\frac{5}{12}$
(E) $-\frac{12}{5}$

739. Which quadratic equation has 3 and -8 as its roots? [Easy]

- (A) $x^2 - 5x - 24 = 0$
(B) $x^2 + 5x - 24 = 0$
(C) $x^2 + 5x + 24 = 0$
- (D) $x^2 - 5x + 24 = 0$
(E) None of these

740. If the equation $x^2 - kx + 16 = 0$ has equal roots and k is positive, then the value of k is: [Easy]

- (A) 4
(B) 8
(C) 16
- (D) 32
(E) 64

741. In the following question two equations are given. Solve them and choose the correct relation.

- I. $x^2 - 7x + 12 = 0$
II. $y^2 - 9y + 20 = 0$

[Easy]

- (A) $x > y$

- (B) $x \geq y$
- (C) $x < y$
- (D) $x \leq y$
- (E) $x = y$ or the relationship cannot be established

742. What is the product of the roots of the equation $7x^2 + 9x - 21 = 0$? [Easy]

- (A) -3
- (B) 3
- (C) $-\frac{9}{7}$
- (D) $\frac{9}{7}$
- (E) -21

743. If α and β are the roots of the equation $x^2 - 6x + 4 = 0$, then the value of $\alpha^2 + \beta^2$ is: [Moderate]

- (A) 24
- (B) 26
- (C) 28
- (D) 32
- (E) 36

744. In the following question two equations are given. Solve them and choose the correct relation.

I. $2x^2 - 11x + 15 = 0$

II. $2y^2 - 7y + 6 = 0$

[Moderate]

- (A) $x > y$
- (B) $x \geq y$
- (C) $x < y$
- (D) $x \leq y$
- (E) $x = y$ or the relationship cannot be established

745. In the equation $x^2 - 11x + k = 0$, one root exceeds the other by 3. What is the value of k ?

[Moderate]

- (A) 24
- (B) 28
- (C) 30
- (D) 18
- (E) None of these

746. The equation $x^2 + 2(k + 2)x + 9k = 0$ has equal roots. What is the sum of all possible values of k ? [Moderate]

- (A) 4
- (B) 5
- (C) 6
- (D) 9
- (E) 10

747. If α and β are the roots of $2x^2 - 9x + 7 = 0$, then the value of $\frac{1}{\alpha} + \frac{1}{\beta}$ is: [Moderate]

- (A) $\frac{7}{9}$
- (B) $\frac{9}{7}$
- (C) $\frac{9}{2}$
- (D) $\frac{2}{9}$
- (E) $\frac{7}{2}$

748. Kirti bought a certain number of notebooks for a total of Rs. 1,200. Had each notebook cost Rs. 4 less, she could have bought 10 more notebooks for the same total amount. How many notebooks did she actually buy? [Moderate]

- (A) 40 (D) 60
 (B) 45 (E) None of these
 (C) 50

749. The roots of the equation $x^2 - px + 20 = 0$ are in the ratio 1 : 5. If p is positive, then p equals:
 [Moderate]

- (A) 10 (D) 9
 (B) 12 (E) None of these
 (C) 15

750. If α and β are the roots of the equation $x^2 - 7x + 5 = 0$, then the value of $\alpha^3 + \beta^3$ is: [Difficult]

- (A) 238 (D) 308
 (B) 252 (E) None of these
 (C) 218

751. If α and β are the roots of $x^2 - 8x + 5 = 0$, then the quadratic equation whose roots are $\frac{\alpha}{\beta}$ and $\frac{\beta}{\alpha}$ is: [Difficult]

- (A) $5x^2 - 54x + 5 = 0$ (D) $x^2 - 54x + 1 = 0$
 (B) $5x^2 + 54x + 5 = 0$ (E) None of these
 (C) $5x^2 - 54x - 5 = 0$

752. In the following question two equations are given. Solve them and choose the correct relation.

I. $3x^2 - 19x + 28 = 0$

II. $2y^2 - 9y + 10 = 0$

[Difficult]

- (A) $x > y$
 (B) $x \geq y$
 (C) $x < y$
 (D) $x \leq y$
 (E) $x = y$ or the relationship cannot be established

753. For which of the following values of k are the roots of the equation $x^2 + (k - 3)x + k = 0$ imaginary? [Difficult]

- (A) $k = 0$ (D) $k = 9$
 (B) $k = 1$ (E) $k = 10$
 (C) $k = 5$

754. A cash-transit van of a bank covers 300 km between two currency chests at a uniform speed. If its speed had been 5 km/h more, the journey would have taken 2 hours less. What was its original speed, in km/h? [Difficult]

- (A) 20 (D) 45
 (B) 25 (E) None of these
 (C) 30

755. The equations $x^2 - 5x + 6 = 0$ and $2x^2 - 9x + k = 0$ have a common root. What is the sum of all possible values of k ? [Difficult]

- (A) 9
- (B) 10
- (C) 19
- (D) 21
- (E) None of these

756. Consider the equation $x^2 - (k + 1)x + (k - 2) = 0$, where k is a real number. Which of the following statements is true? [Difficult]

- (A) The roots are real and equal for every real k
- (B) The roots are real and distinct for every real k
- (C) The roots are imaginary for some real values of k
- (D) The roots are real only when $k > 2$
- (E) None of these

1.7.3 Quadratic comparison (the compare x and y format)

[checked, 6 flagged]

757. Solve the two equations and state the exact relation between x and y (choose $\geq$ or $\leq$ only if equality is possible in at least one case).

I. $x^2 - 7x + 12 = 0$
 II. $y^2 - 9y + 20 = 0$

[Easy]

- (A) $x > y$
- (B) $x \geq y$
- (C) $x < y$
- (D) $x \leq y$
- (E) $x = y$ or no relation can be established

758. Solve the two equations and state the exact relation between x and y (choose $\geq$ or $\leq$ only if equality is possible in at least one case).

I. $x^2 - 10x + 21 = 0$
 II. $y^2 - 5y + 6 = 0$

[Easy]

- (A) $x > y$
- (B) $x \geq y$
- (C) $x < y$
- (D) $x \leq y$
- (E) $x = y$ or no relation can be established

759. Solve the two equations and state the exact relation between x and y (choose $\geq$ or $\leq$ only if equality is possible in at least one case).

I. $x^2 - 11x + 30 = 0$
 II. $y^2 - 7y + 10 = 0$

[Easy]

- (A) $x > y$
- (B) $x \geq y$
- (C) $x < y$
- (D) $x \leq y$
- (E) $x = y$ or no relation can be established

760. Solve the two equations and state the exact relation between x and y .

I. $3x^2 - 10x + 8 = 0$
 II. $2y^2 - 5y + 3 = 0$

[Easy]

- (A) $x < y$
- (B) $x \leq y$

- (C) $x > y$
- (D) $x \geq y$
- (E) $x = y$ or the relationship cannot be established

761. Solve the two equations and state the exact relation between x and y (choose $\geq$ or $\leq$ only if equality is possible in at least one case).

I. $x^2 - 15x + 56 = 0$

II. $y^2 - 5y + 6 = 0$

[Easy]

- (A) $x > y$
- (B) $x \geq y$
- (C) $x < y$
- (D) $x \leq y$
- (E) $x = y$ or no relation can be established

762. Solve the two equations and state the exact relation between x and y (choose $\geq$ or $\leq$ only if equality is possible in at least one case).

I. $x^2 - 3x + 2 = 0$

II. $y^2 - 9y + 20 = 0$

[Easy]

- (A) $x > y$
- (B) $x \geq y$
- (C) $x < y$
- (D) $x \leq y$
- (E) $x = y$ or no relation can be established

763. Solve the two equations and state the exact relation between x and y (choose $\geq$ or $\leq$ only if equality is possible in at least one case).

I. $x = \sqrt[3]{2744}$

II. $y^2 = 169$

[Easy]

- (A) $x > y$
- (B) $x \geq y$
- (C) $x < y$
- (D) $x \leq y$
- (E) $x = y$ or no relation can be established

764. Solve the two equations and state the exact relation between x and y (choose $\geq$ or $\leq$ only if equality is possible in at least one case).

I. $6x^2 - 19x + 15 = 0$

II. $4y^2 - 8y + 3 = 0$

[Moderate]

- (A) $x > y$
- (B) $x \geq y$
- (C) $x < y$
- (D) $x \leq y$
- (E) $x = y$ or no relation can be established

765. Solve the two equations and state the exact relation between x and y .

I. $x^2 - 8\sqrt{3}x + 45 = 0$

II. $y^2 - 6\sqrt{3}y + 24 = 0$

[Moderate]

- (A) $x > y$
- (B) $x \geq y$

- (C) $x < y$
- (D) $x \leq y$
- (E) $x = y$ or no relation can be established

766. Solve the two equations and state the exact relation between x and y (choose $\geq$ or $\leq$ only if equality is possible in at least one case).

I. $\frac{9}{\sqrt{x}} + \frac{5}{\sqrt{x}} = \sqrt{x}$
 II. $\sqrt{y} + \frac{35}{\sqrt{y}} = 12$

[Moderate]

- (A) $x > y$
- (B) $x \geq y$
- (C) $x < y$
- (D) $x \leq y$
- (E) $x = y$ or no relation can be established

767. Solve the two equations and state the exact relation between x and y (choose $\geq$ or $\leq$ only if equality is possible in at least one case).

I. $x^2 - 37x + 342 = 0$
 II. $y^2 - 15y + 56 = 0$

[Moderate]

- (A) $x > y$
- (B) $x \geq y$
- (C) $x < y$
- (D) $x \leq y$
- (E) $x = y$ or no relation can be established

768. Solve the two equations and state the exact relation between x and y (choose $\geq$ or $\leq$ only if equality is possible in at least one case).

I. $x^2 + 13x + 42 = 0$
 II. $y^2 + 11y + 30 = 0$

[Moderate]

- (A) $x > y$
- (B) $x \geq y$
- (C) $x < y$
- (D) $x \leq y$
- (E) $x = y$ or no relation can be established

769. Ramesh solves the two equations below and is asked to state the relationship between x and y .

I. $x^2 - 6x + 8 = 0$
 II. $y^2 - 6y + 9 = 0$

[Moderate]

- (A) $x > y$
- (B) $x < y$
- (C) $x = y$
- (D) $x \geq y$
- (E) None of these

770. Solve the two equations and state the exact relation between x and y (choose $\geq$ or $\leq$ only if equality is possible in at least one case).

I. $x = \sqrt[3]{9261}$
 II. $y^2 - 45y + 506 = 0$

[Moderate]

- (A) $x > y$

- (B) $x \geq y$
- (C) $x < y$
- (D) $x \leq y$
- (E) $x = y$ or no relation can be established

771. Solve the two equations and state the exact relation between x and y (choose $\geq$ or $\leq$ only if equality is possible in at least one case).

I. $x^2 - 7\sqrt{5}x + 60 = 0$

II. $y^2 - 9\sqrt{5}y + 100 = 0$

[Difficult]

- (A) $x > y$
- (B) $x \geq y$
- (C) $x < y$
- (D) $x \leq y$
- (E) $x = y$ or no relation can be established

772. Solve the two equations and state the exact relation between x and y .

I. $\frac{x+2}{x-2} + \frac{x-2}{x+2} = \frac{34}{15}$

II. $y^2 - 15y + 56 = 0$

[Difficult]

- (A) $x > y$
- (B) $x \geq y$
- (C) $x < y$
- (D) $x \leq y$
- (E) $x = y$ or no relation can be established

773. Solve the two equations and state the exact relation between x and y (choose $\geq$ or $\leq$ only if equality is possible in at least one case).

I. $\sqrt{x+7} + \sqrt{x} = 7$

II. $y^2 - 8y - 9 = 0$

[Difficult]

- (A) $x > y$
- (B) $x \geq y$
- (C) $x < y$
- (D) $x \leq y$
- (E) $x = y$ or no relation can be established

774. Solve the two equations and state the exact relation between x and y (choose $\geq$ or $\leq$ only if equality is possible in at least one case).

I. $x^2 - 9\sqrt{7}x + 126 = 0$

II. $y^2 - 17\sqrt{7}y + 490 = 0$

[Difficult]

- (A) $x > y$
- (B) $x \geq y$
- (C) $x < y$
- (D) $x \leq y$
- (E) $x = y$ or no relation can be established

775. Solve the two equations and state the exact relation between x and y (choose $\geq$ or $\leq$ only if equality is possible in at least one case).

I. $x + \frac{24}{x} = 10$

II. $y + \frac{48}{y} = 14$

[Difficult]

- (A) $x > y$
- (B) $x \geq y$
- (C) $x < y$
- (D) $x \leq y$
- (E) $x = y$ or no relation can be established

776. Solve the two equations and state the exact relation between x and y (choose $\geq$ or $\leq$ only if equality is possible in at least one case).

I. $2x^2 - 21x + 54 = 0$

II. $3y^2 - 11y + 6 = 0$

[Difficult]

- (A) $x > y$
- (B) $x \geq y$
- (C) $x < y$
- (D) $x \leq y$
- (E) $x = y$ or no relation can be established

777. Solve the two equations and state the exact relation between x and y (choose $\geq$ or $\leq$ only if equality is possible in at least one case).

I. $4x^2 - 4x - 3 = 0$

II. $4y^2 + 8y + 3 = 0$

[Difficult]

- (A) $x > y$
- (B) $x \geq y$
- (C) $x < y$
- (D) $x \leq y$
- (E) $x = y$ or no relation can be established

1.7.4 Algebraic identities and simplification

[checked]

778. For two numbers a and b it is given that $a + b = 12$ and $ab = 27$. What is the value of $a^2 + b^2$?
[Easy]

- (A) 90
- (B) 108
- (C) 117
- (D) 63
- (E) None of these

779. What is the value of $\frac{(127)^2 - (23)^2}{104}$?

[Easy]

- (A) 127
- (B) 150
- (C) 175
- (D) 104
- (E) None of these

780. If $x - \frac{1}{x} = 5$, then what is the value of $x^2 + \frac{1}{x^2}$?

[Easy]

- (A) 23
- (B) 25
- (C) 27
- (D) 29
- (E) None of these

781. If $(a + b)^2 = 169$ and $(a - b)^2 = 25$, then what is the value of ab ?

[Easy]

- (A) 48 (D) 36
 (B) 24 (E) None of these
 (C) 30

782. A bank's share price rose from Rs. 295 to Rs. 305. What is the value of $(305)^2 - (295)^2$? [Easy]

- (A) 6,000 (D) 3,000
 (B) 10,000 (E) None of these
 (C) 600

783. If $x + \frac{1}{x} = 4$, then what is the value of $x^3 + \frac{1}{x^3}$? [Easy]

- (A) 40 (D) 64
 (B) 52 (E) None of these
 (C) 60

784. What is the value of $\frac{(0.87)^3 + (0.13)^3}{(0.87)^2 - 0.87 \times 0.13 + (0.13)^2}$? [Easy]

- (A) 0.87 (D) 1.13
 (B) 0.74 (E) None of these
 (C) 1

785. If $x + \frac{1}{x} = 3$, then what is the value of $x^4 + \frac{1}{x^4}$? [Moderate]

- (A) 49 (D) 47
 (B) 51 (E) None of these
 (C) 45

786. Three branches of a bank disbursed loans of a , b and c crore rupees respectively, where $a + b + c = 12$ and $a^2 + b^2 + c^2 = 64$. What is the value of $ab + bc + ca$? [Moderate]

- (A) 40 (D) 32
 (B) 80 (E) None of these
 (C) 20

787. If $a + b = 10$ and $ab = 21$, then what is the value of $a^3 + b^3$? [Moderate]

- (A) 340 (D) 400
 (B) 360 (E) None of these
 (C) 380

788. For $x \neq 3$, $x \neq -3$ and $x \neq -4$, the expression $\frac{x^2 - 9}{x^2 + x - 12} \times \frac{x + 4}{x + 3}$ simplifies to which of the following? [Moderate]

- (A) $\frac{x - 3}{x + 4}$ (D) $\frac{x + 3}{x - 3}$
 (B) 1 (E) None of these
 (C) $\frac{x + 4}{x + 3}$

789. If $x = 2 + \sqrt{3}$, then what is the value of $x^2 + \frac{1}{x^2}$? [Moderate]

- (A) $4\sqrt{3}$ (D) 16
(B) 12 (E) None of these
(C) 14

790. Anjali splits Rs. 2,400 into two fixed deposits of Rs. x and Rs. y with $x > y$. If $x^2 - y^2 = 192000$, what is the larger deposit? [Moderate]

- (A) Rs. 1,280 (D) Rs. 1,240
(B) Rs. 1,160 (E) None of these
(C) Rs. 1,200

791. If x is a non-zero number satisfying $x^2 - 6x + 1 = 0$, then what is the value of $x^3 + \frac{1}{x^3}$? [Moderate]

- (A) 198 (D) 186
(B) 216 (E) None of these
(C) 174

792. If a , b and c are non-zero numbers with $a + b + c = 0$, then what is the value of $\frac{a^2}{bc} + \frac{b^2}{ca} + \frac{c^2}{ab}$? [Difficult]

- (A) 1 (D) 0
(B) 3 (E) None of these
(C) -3

793. What is the value of $a^2 + b^2 + c^2 - ab - bc - ca$ when $a = 2023$, $b = 2024$ and $c = 2025$? [Difficult]

- (A) 1 (D) 6
(B) 2 (E) None of these
(C) 3

794. If $x > 1$ and $x^2 + \frac{1}{x^2} = 27$, then what is the value of $x^3 - \frac{1}{x^3}$? [Difficult]

- (A) 155 (D) 140
(B) 110 (E) None of these
(C) 125

795. For $a > b > 0$, the expression $\frac{1}{a-b} + \frac{1}{a+b} + \frac{2a}{a^2+b^2} + \frac{4a^3}{a^4+b^4}$ simplifies to which of the following? [Difficult]

- (A) $\frac{8a^7}{a^8-b^8}$ (C) $\frac{2a}{a^2-b^2}$
(B) $\frac{8a^7}{a^8+b^8}$ (D) $\frac{4a^3}{a^4-b^4}$
(E) None of these

796. Two positive numbers a and b with $a > b$ satisfy $a + b = 7$ and $a^3 + b^3 = 133$. What is the value of $a - b$? [Difficult]

- (A) 2 (D) 1
 (B) 3 (E) None of these
 (C) 5

797. If $p + q + r = 15$ and $pq + qr + rp = 71$, then what is the value of $p^3 + q^3 + r^3 - 3pqr$? [Difficult]

- (A) 249 (D) 225
 (B) 120 (E) None of these
 (C) 180

798. If $x = \frac{\sqrt{5} + 1}{\sqrt{5} - 1}$ and $y = \frac{\sqrt{5} - 1}{\sqrt{5} + 1}$, then what is the value of $x^2 + xy + y^2$? [Difficult]

- (A) 9 (D) 8
 (B) 6 (E) None of these
 (C) 7

1.7.5 Sequences and progressions: AP, GP

[checked]

799. Ramesh, a bank clerk, deposits Rs. 1,200 into his recurring deposit in the first month and increases his deposit by Rs. 150 every subsequent month. How much does he deposit in the 12th month? [Easy]

- (A) Rs. 2,700 (D) Rs. 2,550
 (B) Rs. 2,850 (E) None of these
 (C) Rs. 3,000

800. The first term of a geometric progression is 7 and its common ratio is 3. What is the 5th term of the progression? [Easy]

- (A) 189 (D) 243
 (B) 567 (E) None of these
 (C) 1701

801. Find the sum of the first 20 terms of the arithmetic progression 5, 9, 13, 17, ... [Easy]

- (A) 820 (D) 880
 (B) 840 (E) None of these
 (C) 860

802. What is the sum of all the odd numbers from 1 to 59 (both inclusive)? [Easy]

- (A) 800 (D) 961
 (B) 900 (E) None of these
 (C) 930

803. A loan is to be repaid in three annual instalments whose amounts are in arithmetic progression. If the first instalment is Rs. 8,000 and the third instalment is Rs. 20,000, what is the second instalment? [Easy]

- (A) Rs. 12,000
(B) Rs. 13,000
(C) Rs. 14,000
- (D) Rs. 15,000
(E) None of these

804. Find the sum of the first 6 terms of the geometric progression 2, 6, 18, 54, ... [Easy]

- (A) 728
(B) 242
(C) 486
- (D) 1092
(E) None of these

805. How many terms are there in the arithmetic progression 7, 13, 19, ..., 205? [Easy]

- (A) 32
(B) 33
(C) 35
- (D) 36
(E) None of these

806. Anjali, an insurance agent, earned a commission of Rs. 3,200 in her first month of work, and her commission increased by Rs. 250 in each subsequent month. In which month did her commission first reach Rs. 9,200? [Moderate]

- (A) 23rd month
(B) 24th month
(C) 25th month
- (D) 26th month
(E) None of these

807. In an arithmetic progression, the 7th term is 34 and the 13th term is 64. What is the 20th term? [Moderate]

- (A) 94
(B) 99
(C) 104
- (D) 109
(E) None of these

808. The 3rd term of a geometric progression is 20 and its 6th term is 160. Find the sum of its first 8 terms. [Moderate]

- (A) 1275
(B) 1280
(C) 640
- (D) 2555
(E) None of these

809. The sum of the first 15 terms of an arithmetic progression is 600 and its first term is 12. What is the common difference? [Moderate]

- (A) 3
(B) 5
(C) 6
- (D) 8
(E) None of these

810. A machine purchased by a firm for Rs. 2,00,000 depreciates at the rate of 10% of its value at the beginning of each year. What is its value at the end of 3 years? [Moderate]

- (A) Rs. 1,45,800
(B) Rs. 1,40,000
(C) Rs. 1,48,000
- (D) Rs. 1,46,000
(E) None of these

811. How many terms of the arithmetic progression 9, 17, 25, ... must be taken so that their sum is 636? [Moderate]

- (A) 10
(B) 11
(C) 12
- (D) 14
(E) None of these

812. In an arithmetic progression whose first term is non-zero, the 5th term is three times the 2nd term. What is the ratio of the 8th term to the 4th term? [Moderate]

- (A) 15 : 7
(B) 7 : 15
(C) 5 : 2
- (D) 3 : 1
(E) None of these

813. Three numbers are in arithmetic progression. Their sum is 36 and the sum of their squares is 482. What is the largest of the three numbers? [Difficult]

- (A) 15
(B) 16
(C) 17
- (D) 19
(E) None of these

814. The 2nd, 5th and 9th terms of a non-constant arithmetic progression are, in that order, in geometric progression. What is the common ratio of this geometric progression? [Difficult]

- (A) $\frac{3}{2}$
(B) $\frac{4}{3}$
- (C) $\frac{5}{4}$
(D) $\frac{9}{5}$
(E) None of these

815. The ratio of the sums of the first n terms of two arithmetic progressions is $(7n + 1) : (4n + 27)$ for every n . What is the ratio of their 11th terms? [Difficult]

- (A) 7 : 4
(B) 4 : 3
(C) 11 : 8
- (D) 5 : 4
(E) None of these

816. The sum of an infinite geometric progression is 15 and the sum of the squares of its terms is 45. What is the first term of the progression? [Difficult]

- (A) 3
(B) 4
(C) 5
- (D) 6
(E) None of these

817. Kiran repays a loan of Rs. 1,18,000 by paying Rs. 1,000 in the first month and then increasing the payment by Rs. 100 in every following month. In how many months will the loan be cleared? [Difficult]

- (A) 36 months
(B) 38 months
(C) 40 months
- (D) 42 months
(E) None of these

818. The annual profit of a firm increases in geometric progression. Its profit in the 3rd year was Rs. 2,16,000 and in the 6th year was Rs. 7,29,000. What was the total profit of the firm over its first 4 years? [Difficult]

- (A) Rs. 7,20,000
(B) Rs. 7,80,000
(C) Rs. 8,10,000
- (D) Rs. 9,36,000
(E) None of these

819. The sum of the first n terms of a sequence is given by $S_n = 3n^2 + 5n$. Which term of this sequence is equal to 152? [Difficult]

- (A) 20th
(B) 22nd
(C) 24th
- (D) 25th
(E) None of these

Section 1.8

1.8.1 2-D areas and perimeters: triangle, rectangle, square, parallelogram, rhombus, trapezium [checked, 1 flagged]

820. The floor of a bank branch hall is rectangular, measuring 24 m in length and 18 m in breadth. If vitrified tiles are laid on the entire floor at Rs. 45 per square metre, what is the total tiling cost? [Easy]

- (A) Rs. 17,280
(B) Rs. 19,440
(C) Rs. 21,600
- (D) Rs. 18,900
(E) None of these

821. A square plot of land owned by Mr. Rajesh Kulkarni has a perimeter of 96 m. What is the area of the plot? [Easy]

- (A) 484 sq m
(B) 529 sq m
(C) 576 sq m
- (D) 625 sq m
(E) 676 sq m

822. A triangular signboard outside a bank ATM has a base of 34 cm and a corresponding height of 18 cm. What is its area? [Easy]

- (A) 612 sq cm
(B) 289 sq cm
(C) 324 sq cm
- (D) 306 sq cm
(E) 272 sq cm

823. A parallelogram-shaped glass panel has an area of 216 sq cm. If one of its sides measures 18 cm, what is the distance between that side and the side parallel to it? [Easy]

- (A) 10 cm (D) 14 cm
 (B) 11 cm (E) 16 cm
 (C) 12 cm

824. The two diagonals of a rhombus-shaped decorative tile measure 24 cm and 10 cm. What is the area of the tile? [Easy]

- (A) 240 sq cm (D) 60 sq cm
 (B) 120 sq cm (E) None of these
 (C) 130 sq cm

825. A trapezium-shaped plot has its two parallel sides measuring 18 m and 12 m, and the perpendicular distance between them is 9 m. What is the area of the plot? [Easy]

- (A) 120 sq m (D) 150 sq m
 (B) 126 sq m (E) 270 sq m
 (C) 135 sq m

826. A rectangular godown compound is 45 m long and 30 m wide. The owner wants to fence it all around at Rs. 28 per metre. What will the fencing cost? [Easy]

- (A) Rs. 3,900 (D) Rs. 2,100
 (B) Rs. 4,200 (E) Rs. 5,040
 (C) Rs. 4,500

827. The length and breadth of a rectangular municipal park are in the ratio 5 : 3. A man walking once along its complete boundary covers 256 m. What is the area of the park? [Moderate]

- (A) 3,840 sq m (D) 2,880 sq m
 (B) 4,096 sq m (E) None of these
 (C) 3,600 sq m

828. A rectangular sheet of area equal to that of a certain square measures 40 cm by 10 cm. What is the perimeter of that square? [Moderate]

- (A) 100 cm (D) 72 cm
 (B) 96 cm (E) 64 cm
 (C) 80 cm

829. The perimeter of an equilateral triangular flower bed is 72 cm. What is its area? [Moderate]

- (A) $576\sqrt{3}$ sq cm (D) $72\sqrt{3}$ sq cm
 (B) $288\sqrt{3}$ sq cm (E) $36\sqrt{3}$ sq cm
 (C) $144\sqrt{3}$ sq cm

830. Each side of a rhombus-shaped park is 10 m and one of its diagonals is 16 m. What is the area of the park? [Moderate]

- (A) 80 sq m
- (B) 96 sq m
- (C) 120 sq m
- (D) 60 sq m
- (E) None of these

831. The two parallel sides of a trapezium-shaped field are in the ratio 3 : 5 and the perpendicular distance between them is 12 cm. If the area of the trapezium is 192 sq cm, what is the length of its longer parallel side? [Moderate]

- (A) 12 cm
- (B) 16 cm
- (C) 18 cm
- (D) 20 cm
- (E) 24 cm

832. The length of a rectangular banner is increased by 20% while its breadth is decreased by 10%. What is the resulting change in its area? [Moderate]

- (A) Increase of 10%
- (B) Increase of 8%
- (C) Decrease of 8%
- (D) Increase of 12%
- (E) No change

833. A right-angled triangular metal plate has its two perpendicular sides measuring 9 cm and 12 cm. What is the length of the perpendicular drawn from the right angle to the hypotenuse? [Moderate]

- (A) 6.0 cm
- (B) 6.8 cm
- (C) 7.2 cm
- (D) 7.5 cm
- (E) 8.4 cm

834. A rectangular garden measures 60 m by 40 m. A gravel path of uniform width 3 m is laid all around it on the outside. What is the cost of gravelling the path at Rs. 55 per square metre? [Difficult]

- (A) Rs. 31,680
- (B) Rs. 33,000
- (C) Rs. 34,980
- (D) Rs. 36,300
- (E) None of these

835. A square lawn of side 80 m has two roads, each 4 m wide, running through the middle of it, one parallel to the length and the other parallel to the breadth. What is the total area covered by the two roads? [Difficult]

- (A) 640 sq m
- (B) 624 sq m
- (C) 656 sq m
- (D) 608 sq m
- (E) 632 sq m

836. In an isosceles trapezium-shaped plot, the two parallel sides measure 25 cm and 13 cm, and each of the two equal non-parallel sides measures 10 cm. What is the area of the trapezium? [Difficult]

- (A) 148 sq cm
- (B) 150 sq cm
- (C) 156 sq cm
- (D) 160 sq cm
- (E) None of these

837. A rhombus-shaped plot has an area of 216 sq m and one of its diagonals measures 24 m. The owner wants to fence the plot all around at Rs. 35 per metre. What will the fencing cost? [Difficult]

- (A) Rs. 1,820
(B) Rs. 2,100
(C) Rs. 2,240
- (D) Rs. 1,960
(E) None of these

838. The area of a rectangular field remains unchanged when its length is increased by 5 m and its breadth is decreased by 3 m. The area also remains unchanged when its length is decreased by 5 m and its breadth is increased by 5 m. What is the area of the field? [Difficult]

- (A) 240 sq m
(B) 275 sq m
(C) 300 sq m
- (D) 320 sq m
(E) 375 sq m

839. A triangular plot has sides measuring 13 m, 14 m and 15 m. What is the perpendicular distance from the opposite vertex to its longest side? [Difficult]

- (A) 11.2 m
(B) 12.0 m
(C) 12.4 m
- (D) 10.8 m
(E) None of these

840. The perimeter of a square is equal to the perimeter of a rectangle whose length is three times its breadth. What is the ratio of the area of the square to the area of the rectangle? [Difficult]

- (A) 3 : 4
(B) 4 : 3
(C) 9 : 8
- (D) 16 : 9
(E) 2 : 1

1.8.2 Circle: area, circumference, sector, ring

[checked, 1 flagged]

841. A circular flower bed is laid out in the lawn of a bank's regional training centre. The radius of the bed is 14 m. What is the circumference of the flower bed? (Take $\pi = \frac{22}{7}$) [Easy]

- (A) 44 m
(B) 56 m
(C) 66 m
- (D) 88 m
(E) None of these

842. Meena bought a circular glass top for the reception desk of her branch. The diameter of the glass top is 28 cm. What is its area? (Take $\pi = \frac{22}{7}$) [Easy]

- (A) 308 sq cm
(B) 616 sq cm
(C) 1232 sq cm
- (D) 2464 sq cm
(E) None of these

843. A circular jogging track around a bank colony has a circumference of 176 m. What is the radius of the track? (Take $\pi = \frac{22}{7}$) [Easy]

- (A) 21 m
(B) 24 m
(C) 28 m
- (D) 35 m
(E) None of these

844. The area of a circular plot of land owned by a co-operative bank is 1386 sq m. What is the radius of the plot? (Take $\pi = \frac{22}{7}$) [Easy]

- (A) 21 m (D) 32 m
 (B) 24 m (E) None of these
 (C) 28 m

845. A circular decorative panel of radius 14 cm is divided into four equal quadrants by two perpendicular diameters. What is the area of one quadrant? (Take $\pi = \frac{22}{7}$) [Easy]

- (A) 77 sq cm (D) 308 sq cm
 (B) 132 sq cm (E) None of these
 (C) 154 sq cm

846. A circular pond of radius 14 m has a concrete rim built around it, so that the outer edge of the rim is a circle of radius 21 m. What is the area of the rim (the ring)? (Take $\pi = \frac{22}{7}$) [Easy]

- (A) 550 sq m (D) 770 sq m
 (B) 616 sq m (E) None of these
 (C) 693 sq m

847. In a circular logo of radius 21 cm, a sector subtends an angle of 60° at the centre. What is the length of the arc of this sector? (Take $\pi = \frac{22}{7}$) [Easy]

- (A) 11 cm (D) 44 cm
 (B) 22 cm (E) None of these
 (C) 33 cm

848. A circular plot of area 3850 sq m is to be fenced along its boundary. If fencing costs Rs. 45 per metre, what is the total cost of fencing? (Take $\pi = \frac{22}{7}$) [Moderate]

- (A) Rs. 9,900 (D) Rs. 11,550
 (B) Rs. 8,800 (E) None of these
 (C) Rs. 10,500

849. The wheel of a bank's cash-van has a diameter of 70 cm. How many complete revolutions will the wheel make while covering a distance of 1.1 km? (Take $\pi = \frac{22}{7}$) [Moderate]

- (A) 400 (D) 550
 (B) 450 (E) None of these
 (C) 500

850. A circular garden of radius 35 m has a paved path of uniform width 7 m running all around it on the outside. If paving costs Rs. 25 per square metre, what is the cost of paving the path? (Take $\pi = \frac{22}{7}$) [Moderate]

- (A) Rs. 38,500 (D) Rs. 42,350
 (B) Rs. 40,000 (E) None of these
 (C) Rs. 41,250

851. The circumference of a circular table cover exceeds its diameter by 30 cm. What is the area of the table cover? (Take $\pi = \frac{22}{7}$) [Moderate]

- (A) 132 sq cm (D) 616 sq cm
 (B) 154 sq cm (E) None of these
 (C) 196 sq cm

852. From a square plot of side 28 m, the largest possible circular lawn is marked out. The area left outside the lawn but inside the square is to be gravelled. What is the area to be gravelled? (Take $\pi = \frac{22}{7}$) [Moderate]

- (A) 154 sq m (D) 210 sq m
 (B) 176 sq m (E) None of these
 (C) 196 sq m

853. A sector of a circle of radius 21 cm subtends an angle of 120° at the centre. What is the perimeter of this sector? (Take $\pi = \frac{22}{7}$) [Moderate]

- (A) 74 cm (D) 92 cm
 (B) 80 cm (E) None of these
 (C) 86 cm

854. The areas of two circular medallions are in the ratio 16 : 25, and the difference between their circumferences is 44 cm. What is the area of the larger medallion? (Take $\pi = \frac{22}{7}$) [Moderate]

- (A) 3850 sq cm (D) 4312 sq cm
 (B) 2464 sq cm (E) None of these
 (C) 3080 sq cm

855. A piece of wire is bent to form a circle of radius 28 cm. The same wire is then straightened and re-bent to form a square. By how much does the area of the circle exceed the area of the square? (Take $\pi = \frac{22}{7}$) [Difficult]

- (A) 484 sq cm (D) 616 sq cm
 (B) 528 sq cm (E) None of these
 (C) 560 sq cm

856. A semicircular stained-glass window above the entrance of a bank branch has a total perimeter of 72 cm, measured along the curved edge and the straight base together. What is the area of the window? (Take $\pi = \frac{22}{7}$) [Difficult]

- (A) 154 sq cm (D) 396 sq cm
 (B) 231 sq cm (E) None of these
 (C) 308 sq cm

857. A plot in front of a bank branch is shaped like a rectangle of length 28 m and breadth 14 m, with a semicircle attached externally on each of the two shorter sides. What is the total area of the plot? (Take $\pi = \frac{22}{7}$) [Difficult]

- (A) 546 sq m (D) 588 sq m
 (B) 490 sq m (E) None of these
 (C) 518 sq m

858. If the circumference of a circular seal is increased by 25%, by what percentage does its area increase? [Difficult]

- (A) 25% (D) 62.5%
 (B) 50% (E) None of these
 (C) 56.25%

859. A square field of side 28 m belongs to a farmer who has taken a loan from a rural bank. He ties one cow at each of the four corners with a rope of length 7 m, so each cow grazes a quarter-circle inside the field. What area of the field remains ungrazed? (Take $\pi = \frac{22}{7}$) [Difficult]

- (A) 594 sq m (D) 630 sq m
 (B) 616 sq m (E) None of these
 (C) 648 sq m

860. A sector cut from a circular sheet of radius 42 cm has an area of 462 sq cm. What is the perimeter of this sector? (Take $\pi = \frac{22}{7}$) [Difficult]

- (A) 96 cm (D) 120 cm
 (B) 106 cm (E) None of these
 (C) 112 cm

861. The outer and inner radii of a circular ring-shaped metal washer are in the ratio 5 : 3. If the area of the ring is 2464 sq cm, what is the circumference of the inner circle? (Take $\pi = \frac{22}{7}$) [Difficult]

- (A) 88 cm (D) 154 cm
 (B) 110 cm (E) None of these
 (C) 132 cm

1.8.3 3-D surface area and volume: cube, cuboid, cylinder, cone, sphere, hemisphere [checked, 1 flagged]

862. A solid wooden cubical block used as a paperweight in Ramesh's bank branch has a volume of 512 cu cm. What is its total surface area? [Easy]

- (A) 256 sq cm (D) 512 sq cm
 (B) 384 sq cm (E) None of these
 (C) 448 sq cm

863. A rectangular water tank on the terrace of a bank building measures 8 m in length, 6 m in breadth and 2.5 m in depth. How many litres of water can it hold when completely full? [Easy]

- (A) 12,000 litres (D) 60,000 litres
 (B) 1,20,000 litres (E) None of these
 (C) 12,00,000 litres

864. A cylindrical metal token has radius 7 cm and height 10 cm. Find its curved surface area. (Take $\pi = \frac{22}{7}$) [Easy]

- (A) 220 sq cm
- (B) 308 sq cm
- (C) 440 sq cm
- (D) 594 sq cm
- (E) None of these

865. A spherical glass paperweight has radius 10.5 cm. What is its surface area? (Take $\pi = \frac{22}{7}$) [Easy]

- (A) 1386 sq cm
- (B) 1232 sq cm
- (C) 1540 sq cm
- (D) 693 sq cm
- (E) None of these

866. A conical tent has base radius 7 m and slant height 25 m. Find the area of the canvas required for its curved surface. (Take $\pi = \frac{22}{7}$) [Easy]

- (A) 385 sq m
- (B) 440 sq m
- (C) 550 sq m
- (D) 704 sq m
- (E) None of these

867. A solid hemispherical brass ornament has radius 7 cm. What is its total surface area? (Take $\pi = \frac{22}{7}$) [Easy]

- (A) 308 sq cm
- (B) 154 sq cm
- (C) 462 sq cm
- (D) 616 sq cm
- (E) None of these

868. The total surface area of a cubical carton is 294 sq cm. Find the volume of the carton. [Easy]

- (A) 216 cu cm
- (B) 294 cu cm
- (C) 343 cu cm
- (D) 512 cu cm
- (E) None of these

869. A cylindrical overhead tank of radius 3.5 m and height 4 m is completely full. Water is drained out through an outlet at the rate of 350 litres per second. How long will the tank take to empty completely? (Take $\pi = \frac{22}{7}$) [Moderate]

- (A) 6 minutes
- (B) 7 minutes 20 seconds
- (C) 8 minutes 40 seconds
- (D) 7 minutes
- (E) None of these

870. A solid metallic sphere of radius 9 cm is melted and recast, without any wastage, into small solid cones each of base radius 3 cm and height 3 cm. How many such cones are obtained? [Moderate]

- (A) 54
- (B) 72
- (C) 96
- (D) 108
- (E) None of these

871. A solid conical grain heap has base radius 21 m and vertical height 28 m. A tarpaulin is to cover both its slanting surface and its circular base. Find the total area of tarpaulin required. (Take $\pi = \frac{22}{7}$) [Moderate]

- (A) 1386 sq m (D) 4620 sq m
 (B) 2310 sq m (E) None of these
 (C) 3696 sq m

872. A rectangular tin sheet of size 44 cm $\times$ 20 cm is rolled along its length to form the curved surface of a cylinder (the 44 cm side becoming the circumference). Find the volume of the cylinder so formed.

(Take $\pi = \frac{22}{7}$)

[Moderate]

- (A) 2200 cu cm (D) 6160 cu cm
 (B) 2800 cu cm (E) None of these
 (C) 3080 cu cm

873. A solid cuboidal block of wood measuring 30 cm $\times$ 24 cm $\times$ 18 cm is cut into identical solid cubes of the largest possible size, with no wood left over. How many cubes are obtained?

[Moderate]

- (A) 45 (D) 72
 (B) 54 (E) None of these
 (C) 60

874. A hemispherical bowl of internal radius 10.5 cm is full of milk. This milk is to be filled into cylindrical bottles each of radius 3.5 cm and height 3.5 cm. How many bottles are needed?

[Moderate]

- (A) 12 (D) 21
 (B) 15 (E) None of these
 (C) 18

875. A cylindrical pillar in the lobby of a bank has diameter 50 cm and height 3.5 m. The contractor charges Rs. 12 per square metre for painting its curved surface. What is the cost of painting one such pillar?

(Take $\pi = \frac{22}{7}$)

[Moderate]

- (A) Rs. 55 (D) Rs. 132
 (B) Rs. 66 (E) None of these
 (C) Rs. 72

876. A decorative solid consists of a right circular cylinder of radius 7 cm and height 20 cm, with a solid hemisphere of the same radius fixed on its top face. The bottom face of the cylinder remains flat and exposed. Find the total surface area of the solid.

(Take $\pi = \frac{22}{7}$)

[Difficult]

- (A) 1188 sq cm (D) 1034 sq cm
 (B) 1342 sq cm (E) None of these
 (C) 1496 sq cm

877. A solid right circular cone of height 24 cm is cut by a plane parallel to its base, so that the volume of the small cone removed from the top and the volume of the remaining frustum are in the ratio 1 : 26. At what distance from the base is the cut made?

[Difficult]

- (A) 8 cm (D) 18 cm
 (B) 12 cm (E) None of these
 (C) 16 cm

878. The radius of a cylindrical storage drum is increased by 20% while its height is decreased by 25%. What is the resulting change in its volume? [Difficult]

- (A) an increase of 8%
- (B) a decrease of 8%
- (C) an increase of 5%
- (D) no change
- (E) None of these

879. A well of diameter 14 m is dug to a depth of 10.5 m. The earth taken out is spread evenly all around the well to form a circular embankment of uniform width 7 m. Find the height of the embankment. (Take $\pi = \frac{22}{7}$) [Difficult]

- (A) 2.5 m
- (B) 3 m
- (C) 3.5 m
- (D) 4 m
- (E) None of these

880. The largest possible solid sphere is carved out of a solid wooden cube of edge 14 cm. What is the volume of the wood wasted in the process? (Take $\pi = \frac{22}{7}$) [Difficult]

- (A) $1437\frac{1}{3}$ cu cm
- (B) $1256\frac{2}{3}$ cu cm
- (C) 1300 cu cm
- (D) 1256 cu cm
- (E) None of these

881. The radii of the bases of two right circular cylinders are in the ratio 2 : 3 and their curved surface areas are in the ratio 8 : 9. What is the ratio of their volumes? [Difficult]

- (A) 8 : 9
- (B) 16 : 27
- (C) 20 : 27
- (D) 4 : 9
- (E) None of these

882. A hollow cylindrical metal pipe of length 20 cm has external diameter 14 cm and uniform thickness 3.5 cm. Find the volume of metal used in making the pipe. (Take $\pi = \frac{22}{7}$) [Difficult]

- (A) 1925 cu cm
- (B) 2310 cu cm
- (C) 2640 cu cm
- (D) 3080 cu cm
- (E) None of these

1.8.4 Basic geometry: lines, angles, triangle properties [checked, 1 flagged]

883. Two angles of a design printed on a bank passbook cover are complementary and are in the ratio 4 : 5. What is the measure of the larger angle? [Easy]

- (A) 40°
- (B) 50°
- (C) 55°
- (D) 60°
- (E) None of these

884. The three angles of a triangular signboard outside a bank branch are in the ratio 2 : 3 : 4. Find the measure of the largest angle. [Easy]

- (A) 90° (D) 75°
(B) 85° (E) None of these
(C) 80°

885. In a triangle, an exterior angle measures 110° and one of the two interior opposite angles measures 45° . What is the measure of the other interior opposite angle? [Easy]

- (A) 55° (D) 75°
(B) 60° (E) None of these
(C) 70°

886. Two parallel lines are cut by a transversal. If one of the interior angles on the same side of the transversal is 65° , what is the measure of the other interior angle on that same side? [Easy]

- (A) 115° (D) 95°
(B) 105° (E) None of these
(C) 125°

887. In an isosceles triangle drawn by Ramesh, the vertex angle (the angle between the two equal sides) is 40° . What is the measure of each base angle? [Easy]

- (A) 55° (D) 70°
(B) 65° (E) None of these
(C) 75°

888. The supplement of a certain angle is four times its complement. Find the angle. [Easy]

- (A) 75° (D) 30°
(B) 60° (E) None of these
(C) 45°

889. Two sides of a triangular plot measure 8 m and 15 m. Which of the following can NOT be the length of the third side? [Easy]

- (A) 9 m (D) 22 m
(B) 12 m (E) 7 m
(C) 20 m

890. The three angles of a triangle are $(2x)^\circ$, $(3x - 15)^\circ$ and $(4x + 15)^\circ$. What is the measure of the largest angle of the triangle? [Moderate]

- (A) 85° (D) 95°
(B) 90° (E) None of these
(C) 100°

891. In triangle ABC , $\angle A = 70^\circ$. The internal bisectors of $\angle B$ and $\angle C$ meet at the point I . What is the measure of $\angle BIC$? [Moderate]

- (A) 125° (D) 135°
 (B) 120° (E) None of these
 (C) 130°

892. AB and CD are two parallel lines and E is a point lying between them. Segments AE and CE are drawn. If $\angle BAE = 55^\circ$ and $\angle DCE = 40^\circ$, find $\angle AEC$. [Moderate]

- (A) 105° (D) 115°
 (B) 95° (E) None of these
 (C) 85°

893. In triangle PQR , PD is the median drawn to side QR and its length is 21 cm. If G is the centroid of the triangle, what is the length of PG ? [Moderate]

- (A) 7 cm (D) 12 cm
 (B) 10.5 cm (E) None of these
 (C) 14 cm

894. In triangle ABC , $\angle A = 60^\circ$ and $\angle B = 80^\circ$. The internal bisector of $\angle C$ meets side AB at the point D . Find $\angle ADC$. [Moderate]

- (A) 90° (D) 110°
 (B) 95° (E) None of these
 (C) 105°

895. At a particular moment in the afternoon, a vertical pole of height 12 m outside a bank branch casts a shadow of length 8 m on level ground. At the same moment the bank building beside it casts a shadow of length 30 m. What is the height of the building? [Moderate]

- (A) 40 m (D) 48 m
 (B) 42.5 m (E) None of these
 (C) 45 m

896. In triangle ABC , $\angle B = 90^\circ$, $AB = 9$ cm and $BC = 12$ cm. BD is drawn perpendicular to the hypotenuse AC , with D on AC . Find the length of BD . [Moderate]

- (A) 6.75 cm (D) 8.4 cm
 (B) 7.2 cm (E) None of these
 (C) 7.5 cm

897. In triangle ABC , $\angle B = 76^\circ$ and $\angle C = 34^\circ$. From vertex A , both the internal bisector of $\angle A$ and the altitude to BC are drawn. What is the angle between these two lines? [Difficult]

- (A) 15° (D) 24°
 (B) 18° (E) None of these
 (C) 21°

898. In triangle ABC , $\angle A = 40^\circ$. The bisectors of the exterior angles at B and at C meet at the point O . Find $\angle BOC$. [Difficult]

- (A) 65° (D) 80°
 (B) 70° (E) None of these
 (C) 75°

899. In triangle ABC , $AB = 10$ cm, $AC = 12$ cm and $BC = 14$ cm. AD is the median drawn to side BC . Find the length of AD . [Difficult]

- (A) $\sqrt{73}$ cm (D) 9 cm
 (B) $\sqrt{61}$ cm (E) None of these
 (C) $\sqrt{85}$ cm

900. A right-angled triangular plot has its two perpendicular sides measuring 12 m and 16 m. Find the sum of the inradius and the circumradius of this triangle. [Difficult]

- (A) 10 m (D) 14 m
 (B) 12 m (E) None of these
 (C) 13 m

901. In triangle ABC , $AB = AC$. A point D lies on side AC such that $AD = BD = BC$. What is the measure of $\angle A$? [Difficult]

- (A) 30° (D) 50°
 (B) 40° (E) None of these
 (C) 45°

902. In triangle ABC , $\angle A = 80^\circ$. The internal bisector of $\angle B$ and the external bisector of $\angle C$ meet at the point P . Find $\angle BPC$. [Difficult]

- (A) 35° (D) 50°
 (B) 40° (E) None of these
 (C) 45°

903. Two vertical poles of heights 15 m and 30 m stand on level ground some distance apart. A wire is stretched from the top of each pole to the foot of the other pole. At what height above the ground do the two wires cross each other? [Difficult]

- (A) 7.5 m (D) 10 m
 (B) 12 m (E) None of these
 (C) 9 m

1.8.5 Coordinate geometry basics

[checked, 1 flagged]

904. On a survey map of a district, the Ramgarh branch of a bank is located at the point (2, 3) and the Sitapur branch at (6, 6). If one unit on the map represents one kilometre, what is the straight-line distance between the two branches? [Easy]

- (A) 5 km (D) 7 km
 (B) 4 km (E) None of these
 (C) 6 km

905. A bank proposes to open an ATM exactly midway between its Currency Chest at $(-3, 7)$ and its Regional Office at $(9, 1)$. What are the coordinates of the proposed ATM? [Easy]

- (A) (6, 8) (D) (4, 3)
 (B) (3, 4) (E) None of these
 (C) (−6, 3)

906. The monthly deposit growth of a branch is plotted as a straight line passing through the points (2, 5) and (6, 13). What is the slope of this line? [Easy]

- (A) $\frac{1}{2}$ (C) 2
 (B) 3 (D) 4
 (E) None of these

907. On a co-ordinate grid, a courier hub is at the origin and a bank's back-office is at the point (9, 12). How far is the back-office from the hub? [Easy]

- (A) 21 units (D) 18 units
 (B) 15 units (E) None of these
 (C) 12 units

908. The boundary of a bank's service zone is given by the line $3x + 4y = 24$. At which point does this boundary cut the x -axis? [Easy]

- (A) (0, 6) (D) (0, 8)
 (B) (6, 0) (E) None of these
 (C) (8, 0)

909. What is the slope of the straight line whose equation is $2x + 3y = 12$? [Easy]

- (A) $\frac{2}{3}$ (C) $\frac{3}{2}$
 (B) $-\frac{2}{3}$ (D) $-\frac{3}{2}$
 (E) None of these

910. A triangular plot bought by a bank for a training centre has its corners at (0, 0), (10, 0) and (0, 7), all measurements in metres. What is the area of the plot? [Easy]

- (A) 70 sq m (D) 24 sq m
 (B) 17 sq m (E) None of these
 (C) 35 sq m

911. A cable is laid in a straight line from a bank's data centre at $A(2, -3)$ to its disaster-recovery site at $B(7, 12)$. A repeater is installed at the point which divides AB internally in the ratio 2 : 3. What are the coordinates of the repeater? [Moderate]

- (A) (5, 6) (D) (4, 6)
 (B) (4, 3) (E) None of these
 (C) (3, 4)

912. Three marker pillars on a plot stand at (1, 2), (5, 6) and (7, −2). What is the area of the triangle formed by them? [Moderate]

- (A) 40 sq units
(B) 24 sq units
(C) 20 sq units
- (D) 16 sq units
(E) None of these

913. Three ATM kiosks located at $(2, 3)$, $(4, k)$ and $(6, -3)$ are found to lie exactly on one straight highway. What is the value of k ? [Moderate]

- (A) 3
(B) 1
(C) -1
- (D) 0
(E) None of these

914. A boundary wall is to be built through the point $(3, 4)$ perpendicular to the existing wall represented by $2x + y = 7$. What is the equation of the new wall? [Moderate]

- (A) $2x + y = 10$
(B) $x - 2y + 5 = 0$
(C) $x + 2y = 11$
- (D) $2x - y = 2$
(E) None of these

915. Three corners of a parallelogram-shaped plot taken in order are $A(1, 2)$, $B(4, 3)$ and $C(6, 7)$. What are the coordinates of the fourth corner D ? [Moderate]

- (A) $(9, 8)$
(B) $(3, 6)$
(C) $(2, 5)$
- (D) $(5, 4)$
(E) None of these

916. A bank wishes to set up a cash-processing centre somewhere on a straight east-west road taken as the x -axis, so that it is equidistant from two branches situated at $(7, 6)$ and $(-3, 4)$. At which point on the road should it be built? [Moderate]

- (A) $(2, 0)$
(B) $(4, 0)$
(C) $(3, 0)$
- (D) $(5, 0)$
(E) None of these

917. Two parallel service lanes in a township are represented by $3x + 4y = 10$ and $3x + 4y = 30$. What is the perpendicular distance between them? [Moderate]

- (A) 4 units
(B) 20 units
(C) 5 units
- (D) 2 units
(E) None of these

918. A triangular plot has vertices $A(1, 2)$, $B(5, 9)$ and C , and the centroid of the triangle is at $(3, 4)$. What is the area of triangle ABC ? [Difficult]

- (A) 18 sq units
(B) 9 sq units
(C) 12 sq units
- (D) 27 sq units
(E) None of these

919. A circular irrigation zone on a survey map is given by $x^2 + y^2 - 10x - 6y + 9 = 0$. A straight canal runs along the x -axis. What is the length of the portion of the canal lying inside the circle? [Difficult]

- (A) 6 units
- (B) 10 units
- (C) 9 units
- (D) 8 units
- (E) None of these

920. In what ratio does the x -axis divide the line segment joining $A(2, -3)$ and $B(5, 6)$? [Difficult]

- (A) 2 : 1
- (B) 1 : 2
- (C) 3 : 2
- (D) 1 : 3
- (E) None of these

921. A pipeline must run from a pumping station at $A(2, 3)$ to a booster point somewhere on a straight canal taken as the x -axis, and then on to a reservoir at $B(8, 5)$. What is the least possible total length of the pipeline? [Difficult]

- (A) $2\sqrt{10}$ units
- (B) 8 units
- (C) 10 units
- (D) 12 units
- (E) None of these

922. A four-sided plot has its corners, taken in order, at $(0, 0)$, $(8, 0)$, $(10, 6)$ and $(2, 9)$. What is its area? [Difficult]

- (A) 54 sq units
- (B) 72 sq units
- (C) 63 sq units
- (D) 66 sq units
- (E) None of these

923. A road represented by $8x + 15y = 120$ forms a triangular plot with the two coordinate axes. A circular water tank is built inside this triangle touching all three sides. What is the radius of the tank? [Difficult]

- (A) 2 units
- (B) 2.5 units
- (C) 3 units
- (D) 3.5 units
- (E) None of these

924. A straight expressway on a survey map is represented by $x - 2y + 4 = 0$. A bank's branch stands at $A(3, 1)$ on one side of it. The bank plans a second branch at the mirror-image position of A in the expressway, so that the expressway lies exactly midway between them and at right angles to the line joining them. What are the coordinates of the new branch? [Difficult]

- (A) $(1, 5)$
- (B) $(-1, 5)$
- (C) $(1, -5)$
- (D) $(5, 1)$
- (E) None of these

Section 1.9

1.9.1 Permutation

[checked]

925. In how many different ways can the letters of the word BANK be arranged? [Easy]

- (A) 24 (D) 48
(B) 12 (E) None of these
(C) 16

926. How many different 3-letter arrangements (meaningful or not) can be made from the letters of the word CLERK if no letter is repeated? [Easy]

- (A) 10 (D) 20
(B) 60 (E) 125
(C) 120

927. What is the value of ${}^7P_3$? [Easy]

- (A) 5040 (D) 35
(B) 840 (E) None of these
(C) 210

928. A bank branch has to fill two different posts, one of Cashier and one of Clerk, from among 6 shortlisted candidates. In how many ways can the two posts be filled if no candidate can hold both posts? [Easy]

- (A) 12 (D) 36
(B) 15 (E) None of these
(C) 30

929. In how many ways can 5 officers of a bank stand in a row for a photograph? [Easy]

- (A) 24 (D) 20
(B) 60 (E) None of these
(C) 720

930. How many 4-digit numbers can be formed using the digits 1, 2, 3, 4, 5, 6, 7 if no digit is repeated in a number? [Easy]

- (A) 2401 (D) 840
(B) 210 (E) None of these
(C) 35

931. Three different prizes – Best Employee, Best Team Player and Best Newcomer – are to be awarded among 8 employees of a branch. If no employee can receive more than one prize, in how many ways can the prizes be distributed? [Easy]

- (A) 24 (D) 512
(B) 56 (E) None of these
(C) 336

932. In how many different ways can the letters of the word BANKING be arranged? [Moderate]

- (A) 5040
(B) 2520
(C) 1260
- (D) 720
(E) None of these

933. How many arrangements of the letters of the word DEPOSIT begin with D and end with T?
[Moderate]

- (A) 60
(B) 720
(C) 120
- (D) 240
(E) None of these

934. How many 4-digit even numbers can be formed using the digits 1, 2, 3, 4, 5 if no digit is repeated?
[Moderate]

- (A) 24
(B) 48
(C) 60
- (D) 120
(E) None of these

935. In how many ways can 6 employees of a branch be seated in a row for a training session if two particular employees, Ramesh and Suresh, must never sit next to each other?
[Moderate]

- (A) 240
(B) 600
(C) 120
- (D) 480
(E) None of these

936. How many 3-digit numbers greater than 500 can be formed from the digits 2, 3, 5, 6, 7, 9 if no digit is repeated in a number?
[Moderate]

- (A) 60
(B) 72
(C) 80
- (D) 100
(E) None of these

937. In how many different ways can the letters of the word COMMITTEE be arranged?
[Moderate]

- (A) 90720
(B) 45360
(C) 20160
- (D) 15120
(E) None of these

938. In how many ways can 4 boys and 3 girls be seated in a row so that all the three girls sit together?
[Moderate]

- (A) 1440
(B) 5040
(C) 144
- (D) 720
(E) None of these

939. If all the distinct arrangements of the letters of the word BANK are written down in dictionary (alphabetical) order, what is the rank of the word BANK?
[Difficult]

- (A) 6 (D) 9
(B) 7 (E) None of these
(C) 8

940. In how many different ways can the letters of the word BANKING be arranged so that the two vowels always come together? [Difficult]

- (A) 360 (D) 240
(B) 720 (E) None of these
(C) 1440

941. In how many ways can 5 different Hindi books and 4 different English books be arranged on a shelf so that no two English books are placed next to each other? [Difficult]

- (A) 2880 (D) 43200
(B) 14400 (E) None of these
(C) 86400

942. How many 5-digit numbers divisible by 5 can be formed using the digits 0, 1, 2, 3, 4, 5 if no digit is repeated in a number? [Difficult]

- (A) 120 (D) 96
(B) 216 (E) None of these
(C) 240

943. In how many ways can 8 managers be seated around a circular table for a review meeting if two particular managers always sit together? [Difficult]

- (A) 720 (D) 5040
(B) 2880 (E) None of these
(C) 1440

944. What is the sum of all the 4-digit numbers that can be formed using the digits 1, 2, 3, 4 when no digit is repeated in a number? [Difficult]

- (A) 6660 (D) 66660
(B) 66600 (E) None of these
(C) 60000

945. If ${}^nP_4 = 20 \times {}^nP_2$, then what is the value of n ? [Difficult]

- (A) 5 (D) 9
(B) 6 (E) None of these
(C) 8

1.9.2 Combination

[checked, 1 flagged]

946. A bank branch has 8 officers. In how many ways can a committee of 3 officers be formed to review loan files? [Easy]

- (A) 56
(B) 24
(C) 112
- (D) 336
(E) None of these

947. At a branch meeting, 12 employees are present and every employee shakes hands exactly once with every other employee. Find the total number of handshakes. [Easy]

- (A) 132
(B) 144
(C) 78
- (D) 66
(E) 72

948. From 6 clerks and 4 officers, in how many ways can Mr. Sharma pick 3 clerks and 2 officers for a cash-verification duty? [Easy]

- (A) 90
(B) 120
(C) 100
- (D) 140
(E) 240

949. In how many ways can 7 candidates be shortlisted out of 9 applicants for a clerical post? [Easy]

- (A) 72
(B) 84
(C) 126
- (D) 18
(E) 36

950. A bank has drawn its new logo in the shape of a regular octagon (8 vertices). How many diagonals does this octagon have? [Easy]

- (A) 16
(B) 28
(C) 20
- (D) 24
(E) 40

951. A bank's sports club must send a team of 11 players out of the 15 players enrolled. In how many ways can the team be chosen? [Easy]

- (A) 1,365
(B) 1,001
(C) 3,003
- (D) 455
(E) None of these

952. Ten branch locations are marked on a map and no three of them lie on one straight line. How many straight lines can be drawn by joining these locations in pairs? [Easy]

- (A) 90
(B) 50
(C) 100
- (D) 45
(E) 20

953. A committee of 4 members is to be formed from 6 men and 4 women such that the committee contains exactly 2 women. In how many ways can this be done? [Moderate]

- (A) 60 (D) 150
(B) 90 (E) 210
(C) 120

954. A customer is shown 7 different fixed-deposit schemes and may invest in any number of them, but must invest in at least one. In how many ways can he make his choice? [Moderate]

- (A) 128 (D) 49
(B) 64 (E) 127
(C) 120

955. From 6 male and 4 female employees, a team of 5 is to be selected containing at least 3 males. In how many ways can the team be selected? [Moderate]

- (A) 120 (D) 196
(B) 180 (E) None of these
(C) 186

956. A panel of 4 is to be chosen from 10 officers. The Branch Manager, who is one of the 10, must necessarily be on the panel. In how many ways can the panel be formed? [Moderate]

- (A) 84 (D) 120
(B) 126 (E) 56
(C) 210

957. In a training batch, every trainee shook hands with every other trainee exactly once and the total number of handshakes was 190. How many trainees were there in the batch? [Moderate]

- (A) 19 (D) 20
(B) 21 (E) 95
(C) 38

958. A committee of 4 is to be formed from 9 employees. Two of these employees, Ravi and Suresh, have refused to serve together on the same committee. In how many ways can the committee be formed? [Moderate]

- (A) 126 (D) 84
(B) 105 (E) 120
(C) 91

959. In how many ways can 12 employees of a branch be divided into two groups of 6 employees each, the two groups being of equal status and not named or distinguished in any way? [Moderate]

- (A) 924 (D) 720
(B) 1848 (E) None of these
(C) 462

960. A committee of 5 is to be formed from 5 men and 6 women so that the committee has at least 2 men and at least 2 women. In how many ways can this be done? [Difficult]

- (A) 200 (D) 400
(B) 150 (E) 462
(C) 350

961. From 6 boys and 5 girls of a bank's staff colony, a group of 5 is to be selected in which the girls are in a majority (that is, the number of girls exceeds the number of boys). In how many ways can this be done? [Difficult]

- (A) 181 (D) 150
(B) 180 (E) 156
(C) 281

962. In how many ways can 4 letters be selected from the letters of the word BANKING? (Two selections are different only if they differ in the letters they contain; the order of the letters is immaterial.) [Difficult]

- (A) 20 (D) 28
(B) 24 (E) None of these
(C) 26

963. If ${}^{18}C_r = {}^{18}C_{r+2}$, then the value of ${}^rC_5$ is [Difficult]

- (A) 28 (D) 126
(B) 56 (E) 252
(C) 70

964. A bank's cricket team of 11 players is to be chosen from 15 players, of whom 5 are bowlers. The team must contain exactly 4 bowlers. In how many ways can the team be selected? [Difficult]

- (A) 1365 (D) 450
(B) 1200 (E) 600
(C) 720

965. Eight chairs are placed in a single row in a bank's waiting area. Three customers are to be seated on these chairs so that no two of them occupy adjacent chairs. In how many ways can the three chairs for them be chosen? [Difficult]

- (A) 56 (D) 35
(B) 30 (E) 120
(C) 20

966. Twelve points are marked on a bank's network chart. Of these, 5 points lie on one straight line and no other set of three points is collinear. How many triangles can be formed with these points as vertices? [Difficult]

- (A) 210 (D) 190
(B) 220 (E) None of these
(C) 200

1.9.3 Probability: single and multiple events

[checked]

967. A promotional box kept at the counter of a bank branch contains 5 red, 4 green and 3 blue balls. One ball is drawn at random by a customer. What is the probability that the ball drawn is NOT blue?

[Easy]

- | | |
|-------------------|--------------------|
| (A) $\frac{1}{4}$ | (D) $\frac{2}{3}$ |
| (B) $\frac{3}{4}$ | (E) $\frac{5}{12}$ |
| (C) $\frac{1}{3}$ | |

968. Two fair dice are rolled together in a board game. What is the probability that the sum of the numbers appearing on the two dice is 9?

[Easy]

- | | |
|--------------------|--------------------|
| (A) $\frac{1}{6}$ | (D) $\frac{1}{12}$ |
| (B) $\frac{5}{36}$ | (E) $\frac{1}{8}$ |
| (C) $\frac{1}{9}$ | |

969. One card is drawn at random from a well-shuffled pack of 52 playing cards. What is the probability that the card drawn is either a king or a queen?

[Easy]

- | | |
|--------------------|--------------------|
| (A) $\frac{1}{13}$ | (D) $\frac{2}{13}$ |
| (B) $\frac{4}{13}$ | (E) $\frac{1}{26}$ |
| (C) $\frac{3}{26}$ | |

970. Three fair coins are tossed simultaneously. What is the probability of getting exactly two heads?

[Easy]

- | | |
|-------------------|-------------------|
| (A) $\frac{1}{8}$ | (D) $\frac{5}{8}$ |
| (B) $\frac{1}{4}$ | (E) $\frac{3}{8}$ |
| (C) $\frac{1}{2}$ | |

971. In a lucky draw held by a bank, tickets numbered 1 to 25 are placed in a drum and one ticket is drawn at random. What is the probability that the number on the ticket drawn is a multiple of 4?

[Easy]

- | | |
|--------------------|--------------------|
| (A) $\frac{4}{25}$ | (C) $\frac{1}{5}$ |
| (B) $\frac{6}{25}$ | (D) $\frac{7}{25}$ |
| | (E) None of these |

972. One letter is selected at random from the letters of the word INSURANCE. What is the probability that the selected letter is a vowel?

[Easy]

- (A) $\frac{5}{9}$
 (B) $\frac{1}{3}$
 (C) $\frac{4}{9}$

- (D) $\frac{2}{9}$
 (E) $\frac{1}{2}$

973. A fair die is rolled once. What is the probability that the number shown on the top face is greater than 4? [Easy]

- (A) $\frac{1}{6}$
 (B) $\frac{1}{4}$
 (C) $\frac{1}{2}$

- (D) $\frac{1}{3}$
 (E) $\frac{2}{3}$

974. A bag contains 4 red, 5 green and 3 yellow balls. Two balls are drawn at random from the bag. What is the probability that both the balls drawn are green? [Moderate]

- (A) $\frac{2}{11}$
 (B) $\frac{5}{66}$
 (C) $\frac{5}{33}$

- (D) $\frac{10}{33}$
 (E) $\frac{1}{6}$

975. A drawer in a bank locker room contains 6 white envelopes and 4 black envelopes. Two envelopes are picked at random. What is the probability that one is white and the other is black? [Moderate]

- (A) $\frac{4}{15}$
 (B) $\frac{7}{15}$
 (C) $\frac{2}{5}$

- (D) $\frac{8}{15}$
 (E) $\frac{1}{3}$

976. Two cards are drawn together at random from a well-shuffled pack of 52 cards. What is the probability that both the cards drawn are aces? [Moderate]

- (A) $\frac{1}{169}$
 (B) $\frac{2}{221}$
 (C) $\frac{1}{26}$

- (D) $\frac{1}{13}$
 (E) $\frac{1}{221}$

977. The probability that Anil solves a particular reasoning puzzle is $\frac{3}{5}$ and the probability that Bhavna solves it is $\frac{2}{3}$. If both attempt the puzzle independently, what is the probability that the puzzle gets solved by at least one of them? [Moderate]

- (A) $\frac{13}{15}$
 (B) $\frac{11}{15}$
 (C) $\frac{2}{5}$

- (D) $\frac{4}{5}$
 (E) $\frac{2}{15}$

978. Two fair dice are thrown together. What is the probability that the product of the two numbers obtained is an even number? [Moderate]

- (A) $\frac{1}{4}$ (D) $\frac{3}{4}$
(B) $\frac{1}{2}$ (E) $\frac{5}{6}$
(C) $\frac{2}{3}$

979. A regional office has 5 male and 4 female employees. A team of 3 employees is to be selected at random for an audit assignment. What is the probability that the team contains exactly 2 female employees? [Moderate]

- (A) $\frac{3}{14}$ (D) $\frac{5}{42}$
(B) $\frac{5}{14}$ (E) $\frac{2}{7}$
(C) $\frac{10}{21}$

980. A tray holds 15 loan application files, of which 5 are incomplete. An officer picks 2 files at random for verification. What is the probability that at least one of the picked files is incomplete? [Moderate]

- (A) $\frac{3}{7}$ (D) $\frac{3}{14}$
(B) $\frac{2}{7}$ (E) $\frac{4}{7}$
(C) $\frac{5}{7}$

981. An urn contains 4 red, 5 green and 6 blue balls. Three balls are drawn at random from the urn. What is the probability that the three balls drawn are of three different colours? [Difficult]

- (A) $\frac{12}{91}$ (C) $\frac{24}{91}$
(B) $\frac{8}{35}$ (D) $\frac{24}{455}$
(E) None of these

982. Two fair dice are thrown together and it is observed that the sum of the numbers obtained is an even number. Given this information, what is the probability that the sum is exactly 8? [Difficult]

- (A) $\frac{5}{36}$ (D) $\frac{5}{18}$
(B) $\frac{1}{6}$ (E) $\frac{1}{4}$
(C) $\frac{5}{12}$

983. A bank branch has 4 officers, 5 clerks and 3 peons. A team of 4 members is to be formed at random for a customer-service drive. What is the probability that the team includes at least 2 officers? [Difficult]

(A) $\frac{56}{165}$
 (B) $\frac{8}{33}$

(C) $\frac{67}{165}$
 (D) $\frac{13}{33}$
 (E) None of these

984. Three candidates Deepak, Meera and Farhan appear independently for a bank interview. Their respective probabilities of being selected are $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$. What is the probability that exactly one of the three is selected? [Difficult]

(A) $\frac{5}{12}$
 (B) $\frac{1}{3}$
 (C) $\frac{7}{24}$

(D) $\frac{17}{24}$
 (E) $\frac{11}{24}$

985. A box contains 5 red and 3 black tokens. Tokens are drawn one by one at random without replacement until a black token is obtained. What is the probability that exactly 3 draws are required? [Difficult]

(A) $\frac{5}{56}$
 (B) $\frac{5}{28}$
 (C) $\frac{15}{56}$

(D) $\frac{3}{28}$
 (E) $\frac{1}{8}$

986. Bag P contains 4 white and 5 red balls, while Bag Q contains 6 white and 3 red balls. One of the two bags is chosen at random and a single ball is drawn from it; the ball turns out to be white. What is the probability that the ball came from Bag Q? [Difficult]

(A) $\frac{2}{5}$
 (B) $\frac{3}{5}$
 (C) $\frac{1}{2}$

(D) $\frac{2}{3}$
 (E) $\frac{4}{9}$

987. All the letters of the word BANKING are arranged at random to form seven-letter sequences. What is the probability that in the arrangement formed, the two N's occupy adjacent positions? [Difficult]

(A) $\frac{1}{7}$
 (B) $\frac{3}{7}$
 (C) $\frac{2}{7}$

(D) $\frac{5}{7}$
 (E) $\frac{1}{21}$

1.9.4 Set theory and Venn diagrams

[checked, 2 flagged]

988. In a branch of Union Bank at Nagpur, out of 120 customers surveyed, 70 hold a savings account and 60 hold a current account, while 25 hold both. How many customers hold at least one of the two accounts? [Easy]

- (A) 95 (D) 110
(B) 100 (E) None of these
(C) 105

989. In a training batch of 200 probationary officers, 130 cleared the Reasoning module and 110 cleared the Quantitative module. If 60 cleared both modules, how many officers cleared neither module? [Easy]

- (A) 15 (D) 30
(B) 20 (E) None of these
(C) 25

990. In a bank office, 50 employees are surveyed for language skills. 32 can speak Hindi and 25 can speak Tamil, while 12 can speak both. How many employees can speak exactly one of the two languages? [Easy]

- (A) 30 (D) 45
(B) 33 (E) None of these
(C) 37

991. A bank offers a set of 5 distinct insurance riders. A customer may choose any combination of these riders, including choosing none of them. In how many different ways can the customer make his selection? [Easy]

- (A) 10 (D) 32
(B) 25 (E) None of these
(C) 31

992. For two sets A and B of account holders, $n(A) = 45$, $n(B) = 38$ and $n(A \cup B) = 70$. What is $n(A \cap B)$? [Easy]

- (A) 7 (D) 25
(B) 13 (E) None of these
(C) 17

993. Out of 90 customers of a bank, 55 possess a debit card and 48 possess a credit card. If 30 possess both cards, how many customers possess a credit card but not a debit card? [Easy]

- (A) 13 (D) 30
(B) 18 (E) None of these
(C) 25

994. Set A is a subset of set B , where $n(A) = 12$ and $n(B) = 20$. What is the value of $n(A \cup B) + n(A \cap B)$? [Easy]

- (A) 20 (D) 40
(B) 24 (E) None of these
(C) 32

995. 150 candidates appeared in a sectional mock test. 45 cleared Quant, 52 cleared Reasoning and 48 cleared English. Further, 18 cleared both Quant and Reasoning, 20 cleared both Reasoning and English, 15 cleared both Quant and English, and 8 cleared all three sections. How many candidates cleared none of the three sections? [Moderate]

- (A) 40
(B) 45
(C) 50
- (D) 55
(E) None of these

996. In a bank branch, 80 employees have enrolled in at least one of three welfare schemes. It is known that 22 are enrolled in both Scheme I and Scheme II, 18 are enrolled in both Scheme II and Scheme III, and 25 are enrolled in both Scheme I and Scheme III, while 10 are enrolled in all three schemes. How many employees are enrolled in exactly two of the three schemes? [Moderate]

- (A) 25
(B) 30
(C) 35
- (D) 40
(E) None of these

997. In a survey of investors, 40 hold Mutual Funds, 35 hold Fixed Deposits and 30 hold Bonds. Also 15 hold Mutual Funds and Fixed Deposits, 12 hold Fixed Deposits and Bonds, 10 hold Mutual Funds and Bonds, and 5 hold all three instruments. How many investors hold exactly one instrument? [Moderate]

- (A) 41
(B) 44
(C) 46
- (D) 52
(E) None of these

998. 120 customers of a bank each use at least one of three digital services: UPI, Net Banking and Mobile App. The numbers using them are 65, 55 and 45 respectively. If 25 customers use exactly two of the three services, how many use all three services? [Moderate]

- (A) 5
(B) 10
(C) 15
- (D) 20
(E) None of these

999. In a colony of 100 households surveyed by a bank, 72 use an ATM card and 58 use net banking. What is the minimum possible number of households that use both? [Moderate]

- (A) 28
(B) 30
(C) 32
- (D) 42
(E) None of these

1000. In a recruitment test taken by 800 candidates, 65% passed in Quantitative Aptitude, 48% passed in Reasoning and 15% failed in both subjects. How many candidates passed in both subjects? [Moderate]

- (A) 208
(B) 216
(C) 224
- (D) 232
(E) None of these

1001. For two sets A and B of depositors, $n(A \cup B) = 90$, $n(A - B) = 35$ and $n(B - A) = 25$. What is $n(B)$? [Moderate]

- (A) 30
(B) 50
(C) 55
- (D) 65
(E) None of these

1002. A bank has issued token numbers 1 to 300, one to each of 300 applicants. How many of these token numbers are divisible by none of 2, 3 and 5? [Difficult]

- (A) 70
- (B) 75
- (C) 80
- (D) 85
- (E) None of these

1003. In a bank's internal assessment of 100 employees, 78 passed the Hindi test, 85 passed the English test and 92 passed the Computer test. What is the minimum possible number of employees who passed all three tests? [Difficult]

- (A) 50
- (B) 55
- (C) 60
- (D) 65
- (E) None of these

1004. In a universal set of 700 account holders, $n(A) = 350$ and $n(B) = 280$, where A and B are the sets holding a locker and a demat account respectively. If 180 account holders hold neither, what is $n(A' \cap B)$, i.e. the number holding a demat account but no locker? [Difficult]

- (A) 110
- (B) 140
- (C) 170
- (D) 200
- (E) None of these

1005. Each of the 250 staff members of a bank zone knows at least one of Marathi, Hindi and English. The numbers knowing them are 130, 145 and 100 respectively. If 95 staff members know exactly two of these languages, how many know exactly one language? [Difficult]

- (A) 120
- (B) 130
- (C) 140
- (D) 155
- (E) None of these

1006. Two sets A and B are such that the number of subsets of A exceeds the number of subsets of B by 96, and A has 2 more elements than B . What is $n(A) + n(B)$? [Difficult]

- (A) 8
- (B) 10
- (C) 11
- (D) 12
- (E) None of these

1007. In a survey conducted by a bank, 63% of the customers hold a fixed deposit and 44% hold a recurring deposit. Exactly 132 customers hold both, while 90 customers hold neither. How many customers were surveyed in all? [Difficult]

- (A) 480
- (B) 540
- (C) 600
- (D) 660
- (E) None of these

1008. 400 candidates appeared in a three-section mock test. 210 cleared Quant, 195 cleared Reasoning and 175 cleared English, while 40 cleared no section. If the number clearing exactly two sections is twice the number clearing all three sections, how many candidates cleared all three sections? [Difficult]

- (A) 45 (D) 60
(B) 50 (E) None of these
(C) 55

Section 1.10

1.10.1 Missing-number series

[checked]

1009. Anjali, a trainee at a bank branch, notes the daily count of new accounts opened as the series 7, 14, 28, 56, ?, 224. What number should replace the question mark? [Easy]

- (A) 96 (D) 128
(B) 112 (E) None of these
(C) 108

1010. What value should come in place of the question mark in the series 6, 7, 13, 20, 33, ? [Easy]

- (A) 53 (D) 59
(B) 46 (E) None of these
(C) 51

1011. What should replace the question mark in the series 12, 15, 21, 30, ?, 57 [Easy]

- (A) 40 (D) 45
(B) 41 (E) None of these
(C) 42

1012. What number should come in place of the question mark in the series 4, 9, 16, 25, ?, 49 [Easy]

- (A) 30 (D) 36
(B) 32 (E) 40
(C) 35

1013. Vikram writes the series 8, 11, 17, 29, 53, ? in his practice notebook. What is the next term? [Easy]

- (A) 101 (D) 105
(B) 96 (E) None of these
(C) 99

1014. What should replace the question mark in the series 972, 324, 108, 36, ?, 4 [Easy]

- (A) 9 (D) 24
(B) 6 (E) None of these
(C) 18

1015. What number should come in place of the question mark in the series 3, 8, 18, 38, ?, 158 [Easy]

- (A) 68 (D) 88
(B) 72 (E) None of these
(C) 78

1016. What value should come in place of the question mark in the series 2, 3, 10, 39, ?, 885 [Moderate]

- (A) 158 (D) 176
(B) 164 (E) 180
(C) 172

1017. What should replace the question mark in the series 15, 17, 22, 32, 49, ? [Moderate]

- (A) 70 (D) 75
(B) 72 (E) None of these
(C) 74

1018. What number should come in place of the question mark in the series 108, 52, 24, ?, 3 [Moderate]

- (A) 8 (D) 12
(B) 10 (E) None of these
(C) 11

1019. What should replace the question mark in the series 3, 4, 12, 8, 21, 16, ?, 32 [Moderate]

- (A) 24 (D) 33
(B) 28 (E) None of these
(C) 30

1020. What number should come in place of the question mark in the series 13, 14, 22, ?, 113, 238 [Moderate]

- (A) 49 (D) 52
(B) 44 (E) 58
(C) 46

1021. The monthly loan disbursal figures of a branch (in Rs. lakh) form the series 24, 36, 54, 81, ?. What is the next figure? [Moderate]

- (A) 108 (D) 121.5
(B) 112.5 (E) None of these
(C) 118.5

1022. What value should come in place of the question mark in the series 5, 11, 29, 83, ?, 731 [Moderate]

- (A) 235 (D) 249
(B) 240 (E) None of these
(C) 245

1023. What should replace the question mark in the series 4, 6, 15, 52.5, ? [Difficult]

- (A) 236.25 (D) 240.5
 (B) 210 (E) None of these
 (C) 225.75

1024. What number should come in place of the question mark in the series 5, 3, 12, 7, 27, 15, 58, ?
 [Difficult]

- (A) 29 (D) 33
 (B) 30 (E) None of these
 (C) 31

1025. What value should come in place of the question mark in the series 1, 9, 35, 91, ?, 341 [Difficult]

- (A) 165 (D) 195
 (B) 178 (E) None of these
 (C) 189

1026. What should replace the question mark in the series $\frac{1}{2}, \frac{3}{4}, \frac{9}{8}, \frac{27}{16}, ?$ [Difficult]

- (A) $\frac{54}{32}$ (C) $\frac{27}{32}$
 (B) $\frac{81}{64}$ (D) $\frac{81}{32}$
 (E) None of these

1027. What number should come in place of the question mark in the series 13, 30, 66, 140, ?, 592
 [Difficult]

- (A) 276 (D) 302
 (B) 290 (E) None of these
 (C) 284

1028. What value should come in place of the question mark in the series 720, 120, 24, 6, 2, ? [Difficult]

- (A) 0.5 (D) 2
 (B) 1 (E) None of these
 (C) 1.5

1029. What should replace the question mark in the series 200, 100, 300, 75, 375, ? [Difficult]

- (A) 60 (D) 125
 (B) 62.5 (E) None of these
 (C) 75

1.10.2 Wrong-number series

[checked, 1 flagged]

1030. In the following series one number is wrong. Find the wrong number.
 5, 11, 23, 47, 96, 191, 383

[Easy]

- (A) 11 (D) 96
(B) 23 (E) 191
(C) 47

1031. Sunita is preparing a chart of prime numbers for her son and writes the following list, in which exactly one entry does not belong. Which number is wrong?

2, 3, 5, 7, 11, 13, 17, 19, 21

[Easy]

- (A) 11 (D) 19
(B) 13 (E) 21
(C) 17

1032. One term in the series below is incorrect. Identify it.

4, 9, 16, 25, 36, 48, 64

[Easy]

- (A) 16 (D) 48
(B) 25 (E) 64
(C) 36

1033. Find the wrong number in the series given below.

12, 15, 21, 30, 42, 57, 74

[Easy]

- (A) 21 (D) 57
(B) 30 (E) 74
(C) 42

1034. In the sequence below one number has been printed incorrectly. Which one?

8, 27, 64, 125, 218, 343

[Easy]

- (A) 27 (D) 343
(B) 64 (E) None of these
(C) 125

1035. Find the wrong term in the following series.

7, 9, 13, 19, 26, 37, 49

[Easy]

- (A) 9 (D) 26
(B) 13 (E) 37
(C) 19

1036. One number in the series below does not fit the pattern. Find it.

1024, 512, 256, 128, 60, 32, 16

[Easy]

- (A) 512 (D) 60
(B) 256 (E) 32
(C) 128

1037. One term in the series below is wrong. Identify the wrong term.

2, 4, 12, 48, 240, 1450, 10080

[Moderate]

- (A) 4 (D) 1450
(B) 12 (E) 10080
(C) 240

1038. The value of an investment made by Mahesh is recorded (in Rs. thousand) as the series below, but the clerk has entered one figure wrongly. Which figure is wrong?

8, 4, 6, 15, 50, 236.25

[Moderate]

- (A) 4 (D) 50
(B) 6 (E) 236.25
(C) 15

1039. Find the wrong number in the series.

5, 6, 14, 41, 104, 230

[Moderate]

- (A) 6 (D) 104
(B) 14 (E) 230
(C) 41

1040. In the following series exactly one number is wrong. Find it.

3, 7, 19, 55, 163, 484, 1459

[Moderate]

- (A) 7 (D) 163
(B) 19 (E) 484
(C) 55

1041. One number in the sequence below is incorrect. Which one?

2, 9, 28, 65, 124, 217, 344

[Moderate]

- (A) 9 (D) 124
(B) 28 (E) 217
(C) 65

1042. Find the wrong number in the series given below.

10, 15, 24, 41, 75, 139, 268

[Moderate]

- (A) 15 (D) 75
(B) 24 (E) 139
(C) 41

1043. One term of the following series does not fit the pattern. Find that term.

336, 210, 120, 62, 24, 6

[Moderate]

- (A) 210 (D) 24
(B) 120 (E) None of these
(C) 62

1044. One term in the following series has been written incorrectly. Which term is it?

7, 9, 15, 27, 45, 77, 119

[Difficult]

- (A) 9 (D) 45
(B) 15 (E) 77
(C) 27

1045. Find the wrong number in the following series.

4, 7, 16, 43, 122, 367

[Difficult]

- (A) 7 (D) 122
(B) 16 (E) 367
(C) 43

1046. One number in the series below is wrong. Identify it.

3, 6, 18, 88, 630, 6930

[Difficult]

- (A) 6 (D) 630
(B) 18 (E) 6930
(C) 88

1047. In the series below exactly one term is incorrect. Which term is it?

2, 12, 36, 80, 155, 252

[Difficult]

- (A) 12 (D) 155
(B) 36 (E) 252
(C) 80

1048. Find the wrong number in the series given below.

5, 3, 10, 6, 20, 12, 41, 24

[Difficult]

- (A) 10 (D) 12
(B) 6 (E) 41
(C) 20

1049. One number in the following series does not belong. Find it.

6, 10, 19, 44, 95, 214

[Difficult]

- (A) 10 (D) 95
(B) 19 (E) 214
(C) 44

1050. In the series below one term has been written incorrectly. Which one?

12, 26, 82, 328, 1645, 9876

[Difficult]

- (A) 26 (D) 1645
(B) 82 (E) 9876
(C) 328

1.10.3 Pattern types: difference, ratio, square/cube-based, prime-based, mixed, double-difference [checked]

1051. Ramesh, a clerk at a bank branch, records the number of new savings accounts opened in successive months as 7, 11, 17, 25, 35, ? If the pattern continues, how many accounts will be opened in the next month?

[Easy]

- (A) 45 (D) 48
(B) 46 (E) None of these
(C) 47

1052. Find the next term in the series: 3, 6, 18, 72, 360, ? [Easy]

- (A) 2160 (D) 2880
(B) 1800 (E) None of these
(C) 2520

1053. What should come in place of the question mark in the series 4, 9, 25, 49, 121, ? [Easy]

- (A) 144 (D) 225
(B) 169 (E) None of these
(C) 196

1054. Find the missing term: 9, 28, 65, 126, 217, ? [Easy]

- (A) 336 (D) 344
(B) 342 (E) None of these
(C) 350

1055. The daily footfall (in hundreds) at a bank ATM over successive days follows the series 10, 12, 15, 20, 27, ?
What is the next term? [Easy]

- (A) 34 (D) 42
(B) 36 (E) None of these
(C) 40

1056. What should replace the question mark: 5, 10, 13, 26, 29, 58, ? [Easy]

- (A) 58 (D) 64
(B) 59 (E) None of these
(C) 61

1057. One term in the following series is wrong: 3, 8, 15, 24, 34, 48. Which term is wrong? [Easy]

- (A) 8 (D) 34
(B) 15 (E) None of these
(C) 24

1058. Find the value that should come in place of the question mark: 6, 7, 11, 20, 36, ? [Moderate]

- (A) 57 (D) 65
(B) 60 (E) None of these
(C) 61

1059. A bank's outstanding loan book (in Rs. crore) shrinks over successive quarters as 480, 240, 160, 120, 96, ?
What will the figure be in the next quarter? [Moderate]

- (A) 76 (D) 84
(B) 80 (E) None of these
(C) 82

1060. What should come in place of the question mark in the series 5, 6, 14, 41, 105, ? [Moderate]

- (A) 215 (D) 240
(B) 225 (E) None of these
(C) 232

1061. Find the next term: 4, 8, 24, 120, 840, ? [Moderate]

- (A) 8400 (D) 10920
(B) 9600 (E) None of these
(C) 9240

1062. Sunita deposits money in a recurring scheme and her passbook shows the balances 4, 11, 25, 53, 109, ? (in thousands of rupees). What is the next balance? [Moderate]

- (A) 221 (D) 229
(B) 217 (E) None of these
(C) 225

1063. What should replace the question mark: 1548, 1596, 1656, 1728, 1812, ? [Moderate]

- (A) 1896 (D) 1908
(B) 1900 (E) None of these
(C) 1904

1064. In the series 7, 12, 22, 40, 82, 162, one term does not fit the pattern. Which one? [Moderate]

- (A) 12 (D) 82
(B) 22 (E) None of these
(C) 40

1065. Find the term that should come in place of the question mark: 4, 18, 48, 100, 180, ? [Difficult]

- (A) 294 (D) 300
(B) 288 (E) None of these
(C) 280

1066. What should come in place of the question mark: 5, 11, 8, 17, 11, 23, 14, ? [Difficult]

- (A) 26 (D) 32
(B) 29 (E) None of these
(C) 20

1067. Find the missing term: 6, 8, 16, 19, 38, 43, 86, ? [Difficult]

- (A) 89 (D) 95
(B) 91 (E) None of these
(C) 93

1068. What should replace the question mark in the series 6, 15, 35, 77, 143, ? [Difficult]

- (A) 187 (D) 247
(B) 221 (E) None of these
(C) 209

1069. The monthly disbursement of a microfinance branch (in Rs. lakh) runs as 972, 324, 216, 216, 288, ?
What is the next figure? [Difficult]

- (A) 432 (D) 480
(B) 456 (E) None of these
(C) 512

1070. In the series 3, 4, 12, 45, 200, 1005, 6066, exactly one term is incorrect. Identify it. [Difficult]

- (A) 4 (D) 1005
(B) 45 (E) None of these
(C) 200

1071. Find the next term of the series: 8, 12, 24, 60, 180, 630, ? [Difficult]

- (A) 2520 (D) 2835
(B) 2205 (E) None of these
(C) 2400

Section 1.11

1.11.1 Tabular DI

[checked, 1 flagged]

1072. Study the following table carefully and answer the question given below it.

Number of new accounts opened at five branches of a bank during a month:

Branch	Savings A/c	Current A/c
Adyar	240	160
Borivali	320	180
Chembur	275	145
Dadar	190	210
Egmore	305	155

What is the total number of new accounts opened at the Chembur branch during the month? [Easy]

- (A) 400 (D) 440
(B) 410 (E) None of these
(C) 430

1073. Study the following table carefully and answer the question given below it.

Loans disbursed (in Rs. lakh) by four branches of a bank in three years:

Branch	2019	2020	2021
Ranchi	45	60	75
Patna	55	50	65
Bhopal	40	70	60
Indore	60	45	80

What was the total amount of loan disbursed by all four branches together in the year 2020? [Easy]

- (A) Rs. 225 lakh (D) Rs. 230 lakh
 (B) Rs. 215 lakh (E) None of these
 (C) Rs. 220 lakh

1074. Study the following table carefully and answer the question given below it.

Number of male and female employees working in four branches of a bank:

Branch	Male	Female
Karol Bagh	84	56
Rohini	90	72
Saket	65	39
Dwarka	96	64

What is the ratio of the number of male employees to the number of female employees at the Saket branch? [Easy]

- (A) 3 : 2 (D) 8 : 5
 (B) 4 : 3 (E) None of these
 (C) 5 : 3

1075. Study the following table carefully and answer the question given below it.

Number of housing-loan applications received and approved at four branches:

Branch	Applications received	Applications approved
Nashik	500	375
Aurangabad	800	520
Solapur	450	288
Kolhapur	600	462

What percent of the applications received at the Aurangabad branch were approved? [Easy]

- (A) 60% (D) 65%
 (B) 62.5% (E) None of these
 (C) 68%

1076. Study the following table carefully and answer the question given below it.

Number of insurance policies sold by three agents over five months:

Agent	April	May	June	July	August
Rakesh	32	28	36	30	34
Suman	40	35	25	45	30
Farhan	22	34	30	28	36

What is the average number of policies sold per month by Suman over these five months? [Easy]

- (A) 35
(B) 32
(C) 33
- (D) 34
(E) None of these

1077. Study the following table carefully and answer the question given below it.
Deposits and withdrawals (in Rs. lakh) recorded at a bank branch during one week:

Day	Deposits	Withdrawals
Monday	42	35
Tuesday	38	44
Wednesday	50	41
Thursday	46	46
Friday	55	39

On how many of these days were the deposits greater than the withdrawals?

[Easy]

- (A) 2
(B) 3
(C) 4
- (D) 5
(E) None of these

1078. Study the following table carefully and answer the question given below it.
Target and actual achievement (number of new accounts) of five branches for a quarter:

Branch	Target	Achievement
Alwar	250	200
Bikaner	300	264
Churu	180	153
Dausa	400	320
Erode	320	240

Which branch achieved the highest percentage of its target?

[Easy]

- (A) Alwar
(B) Bikaner
(C) Churu
- (D) Dausa
(E) Erode

1079. Study the following table carefully and answer the question given below it.
Candidates who appeared for and qualified in a bank recruitment test at four centres:

Centre	Appeared	Qualified
Chennai	4500	1350
Madurai	3800	1026
Trichy	5200	?
Salem	4000	1320

If the total number of candidates who qualified at all four centres together is 5256, what percent of the candidates who appeared at Trichy qualified?

[Moderate]

- (A) 26% (D) 30%
 (B) 28% (E) None of these
 (C) 32%

1080. Study the following table carefully and answer the question given below it.

Credit-card applications received at four branches and the percentage of them rejected:

Branch	Applications received	Rejected (%)
Guwahati	1200	25
Shillong	900	40
Imphal	1500	20
Agartala	800	35

What is the total number of applications accepted at all four branches together?

[Moderate]

- (A) 3040 (D) 3240
 (B) 3160 (E) None of these
 (C) 3100

1081. Study the following table carefully and answer the question given below it.

Total staff strength of four branches and the ratio of male to female employees in each:

Branch	Total staff	Male : Female
Jaipur	96	5 : 3
Ajmer	84	4 : 3
Kota	120	7 : 5
Udaipur	108	5 : 4

What is the total number of female employees in all four branches taken together?

[Moderate]

- (A) 170 (D) 175
 (B) 160 (E) None of these
 (C) 165

1082. Study the following table carefully and answer the question given below it.

Sales of an electrical-appliance dealer during a festival month:

Item	Units sold	Cost price per unit (Rs.)	Selling price per unit (Rs.)
Fan	120	850	1000
Mixer	80	1500	1800
Iron	200	600	750
Heater	60	1200	1450

What is the total profit earned by the dealer on all four items together?

[Moderate]

- (A) Rs. 82,000 (D) Rs. 87,000
 (B) Rs. 85,000 (E) None of these
 (C) Rs. 90,000

1083. Study the following table carefully and answer the question given below it.

Total deposits (in Rs. crore) held by five branches of a bank at the end of two years:

Branch	2022	2023
Ambala	120	138
Bhiwani	150	165
Chandigarh	180	216
Dhuri	200	230
Ferozpur	160	176

The average deposit per branch in 2023 is how much more than the average deposit per branch in 2022? [Moderate]

- (A) Rs. 20 crore (D) Rs. 27 crore
 (B) Rs. 21 crore (E) None of these
 (C) Rs. 25 crore

1084. Study the following table carefully and answer the question given below it.

Annual expenditure (in Rs. lakh) of three branches of a bank under four heads:

Branch	Salaries	Rent	Stationery	Other expenses
Nagpur	84	36	12	48
Pune	120	60	20	50
Nashik	90	45	15	30

Expenditure on salaries at the Nagpur branch is approximately what percent of the total expenditure of that branch? [Moderate]

- (A) 42% (C) $46\frac{2}{3}\%$
 (B) $44\frac{4}{9}\%$ (D) 48%
 (E) None of these

1085. Study the following table carefully and answer the question given below it.

New mobile-banking users registered (in thousands) by three banks in four quarters of a year:

Bank	Q1	Q2	Q3	Q4
Bank P	40	45	75	90
Bank Q	80	60	90	60
Bank R	55	45	50	70

What is the ratio of the users registered by Bank P in Q1 and Q2 together to the users registered by Bank R in Q3 and Q4 together? [Moderate]

- (A) 5 : 7 (D) 7 : 10
 (B) 17 : 24 (E) None of these
 (C) 3 : 4

1086. Study the following table carefully and answer the question given below it.

Candidates who applied for a clerical post at four branches, with the ratio of selected to rejected candidates:

Branch	Candidates applied	Selected : Rejected
Bandra	4500	2 : 13
Colaba	3600	1 : 5
Dadar	4900	1 : 6
Worli	3000	1 : 5

Taking all four branches together, what percent of the candidates who applied were selected? [Difficult]

- (A) 15% (D) 16%
 (B) 12.5% (E) None of these
 (C) 14%

1087. Study the following table carefully and answer the question given below it.

Deposits made by four customers at a bank, with the rate, period and type of interest. The “Type of interest” column governs each row; where compound interest applies, it is compounded annually:

Customer	Principal (Rs.)	Rate (% p.a.)	Time (years)	Type of interest
Ramesh	24000	10	2	Compound
Suresh	32000	12.5	3	Simple
Mahesh	18000	8	2	Simple
Dinesh	15000	20	2	Compound

What is the difference between the interest earned by Suresh and the interest earned by Ramesh? [Difficult]

- (A) Rs. 6,840 (D) Rs. 6,960
 (B) Rs. 7,040 (E) None of these
 (C) Rs. 7,160

1088. Study the following table carefully and answer the question given below it.

Manpower deployed on four tasks during the renovation of a bank branch:

Task	Number of men	Days taken	Hours per day
Painting	12	8	6
Flooring	15	12	5
Wiring	9	10	8
Plumbing	10	6	7

If the painting work were instead carried out by 16 men working 9 hours a day, in how many days would it be completed? [Difficult]

- (A) 3 days (D) $4\frac{1}{2}$ days
 (B) $3\frac{1}{2}$ days (E) None of these
 (C) 4 days

1089. Study the following table carefully and answer the question given below it.

Marks scored by four candidates in three sections of a mock test, together with the average marks per section:

Candidate	Reasoning	Quantitative	English	Average
Anil	32	28	24	28
Bhavna	35	?	31	33
Chetan	27	33	30	30
Deepa	40	29	?	35

What is the difference between Bhavna's marks in Quantitative and Deepa's marks in English?[Difficult]

- (A) 2 (D) 5
 (B) 3 (E) None of these
 (C) 4

1090. Study the following table carefully and answer the question given below it.

Capital contributed by four partners of a trading firm and the period for which it remained invested:

Partner	Investment (Rs.)	Period (months)
Vikram	40000	12
Yogesh	60000	8
Zubin	50000	9
Ashok	30000	10

If the firm earns an annual profit of Rs. 85,500 which is divided in proportion to capital-months, what is Zubin's share of the profit? [Difficult]

- (A) Rs. 22,500 (D) Rs. 24,500
 (B) Rs. 21,500 (E) None of these
 (C) Rs. 23,500

1091. Study the following table carefully and answer the question given below it.

Revenue (in Rs. crore) of four companies and their profit expressed as a percentage of that revenue:

Company	Revenue 2022	Profit 2022 (%)	Revenue 2023	Profit 2023 (%)
Anand Ltd.	250	12	300	15
Bharat Ltd.	400	10	480	12.5
Chandra Ltd.	320	15	352	12.5
Dinkar Ltd.	180	20	216	15

For which company was the increase in the actual amount of profit from 2022 to 2023 the greatest? [Difficult]

- (A) Anand Ltd. (D) Bharat Ltd.
 (B) Chandra Ltd. (E) None of these
 (C) Dinkar Ltd.

1092. Study the following table carefully and answer the question given below it.

Marked price, discount allowed and profit earned by a garment shop on four items:

Item	Marked price (Rs.)	Discount (%)	Profit (%)
Saree	4000	20	25
Shirt	1500	10	12.5
Jeans	2400	25	20
Kurta	1200	15	20

What is the total cost price of one saree, one shirt and one jeans taken together?

[Difficult]

- (A) Rs. 5,160
- (B) Rs. 5,360
- (C) Rs. 5,260
- (D) Rs. 5,460
- (E) None of these

1.11.2 Bar graph: simple, grouped, stacked

[checked, 1 flagged]

1093. Directions: The bar graph shows the number of loan applications (in hundreds) received by the Karol Bagh branch of Bank of Baroda during six months. January = 24, February = 30, March = 18, April = 36, May = 27, June = 45.

What is the total number of loan applications received during January, February and March together?
[Easy]

- (A) 6,800
- (B) 7,200
- (C) 7,600
- (D) 8,000
- (E) None of these

1094. Directions: The bar graph shows the number of loan applications (in hundreds) received by the Karol Bagh branch of Bank of Baroda during six months. January = 24, February = 30, March = 18, April = 36, May = 27, June = 45.

The number of applications received in June is what per cent more than the number received in February?
[Easy]

- (A) $33\frac{1}{3}\%$
- (B) 40%
- (C) 50%
- (D) 60%
- (E) None of these

1095. Directions: A grouped bar graph shows the total deposits (in Rs. crore) of Bank P and Bank Q for four years. Bank P: 2019 = 120, 2020 = 150, 2021 = 180, 2022 = 200. Bank Q: 2019 = 100, 2020 = 140, 2021 = 160, 2022 = 220.

What are the total deposits of Bank Q over the four years taken together?
[Easy]

- (A) Rs. 600 crore
- (B) Rs. 620 crore
- (C) Rs. 640 crore
- (D) Rs. 650 crore
- (E) None of these

1096. Directions: A stacked bar graph shows the number of employees in five branches of Dena Bank, each bar split into male and female. Ambala: male 240, female 160 (total 400). Bhilai: male 280, female 220 (total 500). Chittoor: male 210, female 140 (total 350). Durgapur: male 320, female 280 (total 600). Erode: male 250, female 200 (total 450).

What is the total number of female employees in the Ambala and Chittoor branches together?
[Easy]

- (A) 280
- (B) 300
- (C) 320
- (D) 340
- (E) None of these

1097. Directions: A stacked bar graph shows the number of employees in five branches of Dena Bank, each bar split into male and female. Ambala: male 240, female 160. Bhilai: male 280, female 220. Chittoor: male 210, female 140. Durgapur: male 320, female 280. Erode: male 250, female 200.

In which branch is the number of male employees the highest?
[Easy]

- (A) Ambala (D) Durgapur
(B) Bhilai (E) Erode
(C) Chittoor

1098. Directions: A simple bar graph shows the number of ATM cards issued (in thousands) during a year by five banks. SBI = 45, PNB = 30, BOB = 25, Canara = 20, Union = 30.

What is the ratio of the number of ATM cards issued by BOB to that issued by Canara? [Easy]

- (A) 4 : 5 (D) 5 : 6
(B) 5 : 4 (E) None of these
(C) 6 : 5

1099. Directions: The bar graph shows the number of loan applications (in hundreds) received by the Karol Bagh branch of Bank of Baroda during six months. January = 24, February = 30, March = 18, April = 36, May = 27, June = 45.

What is the difference between the number of applications received in the month with the highest figure and that in the month with the lowest figure? [Easy]

- (A) 2,400 (D) 1,800
(B) 2,700 (E) None of these
(C) 3,000

1100. Directions: A grouped bar graph shows the total deposits (in Rs. crore) of Bank P and Bank Q for four years. Bank P: 2019 = 120, 2020 = 150, 2021 = 180, 2022 = 200. Bank Q: 2019 = 100, 2020 = 140, 2021 = 160, 2022 = 220.

In which year was the ratio of Bank Q's deposits to Bank P's deposits the highest? [Moderate]

- (A) 2019 (D) 2022
(B) 2020 (E) None of these
(C) 2021

1101. Directions: A grouped bar graph shows the total deposits (in Rs. crore) of Bank P and Bank Q for four years. Bank P: 2019 = 120, 2020 = 150, 2021 = 180, 2022 = 200. Bank Q: 2019 = 100, 2020 = 140, 2021 = 160, 2022 = 220.

The combined deposits of both banks in 2021 are approximately what per cent of their combined deposits in 2022? [Moderate]

- (A) 78% (D) 87%
(B) 81% (E) None of these
(C) 84%

1102. Directions: A stacked bar graph shows the number of employees in five branches of Dena Bank. Ambala: male 240, female 160. Bhilai: male 280, female 220. Chittoor: male 210, female 140. Durgapur: male 320, female 280. Erode: male 250, female 200.

The average number of female employees per branch is approximately what per cent of the average number of male employees per branch? [Moderate]

- (A) 75% (D) 81%
(B) 77% (E) None of these
(C) 79%

1103. Directions: A grouped bar graph shows the revenue (in Rs. lakh) earned by a housing finance company from Home loans and Car loans in four quarters. Home: $Q1 = 80, Q2 = 95, Q3 = 110, Q4 = 120$. Car: $Q1 = 60, Q2 = 55, Q3 = 70, Q4 = 90$.

What is the percentage increase in the company's total revenue from Q2 to Q4?

[Moderate]

- (A) 30%
- (B) 35%
- (C) 40%
- (D) 45%
- (E) None of these

1104. Directions: A grouped bar graph shows the revenue (in Rs. lakh) from Home loans and Car loans in four quarters. Home: $Q1 = 80, Q2 = 95, Q3 = 110, Q4 = 120$. Car: $Q1 = 60, Q2 = 55, Q3 = 70, Q4 = 90$.

In how many of the four quarters is the Car-loan revenue more than 60% of the Home-loan revenue of the same quarter?

[Moderate]

- (A) One
- (B) Two
- (C) Four
- (D) In none of the quarters
- (E) None of these

1105. Directions: The bar graph shows the number of loan applications (in hundreds) received by a bank branch during six months. January = 24, February = 30, March = 18, April = 36, May = 27, June = 45.

If 15% of the applications received in April and 20% of those received in June were rejected on scrutiny, how many applications of these two months together were accepted?

[Moderate]

- (A) 6,480
- (B) 6,660
- (C) 6,750
- (D) 6,840
- (E) None of these

1106. Directions: A simple bar graph shows the number of ATM cards issued (in thousands) during a year by five banks. SBI = 45, PNB = 30, BOB = 25, Canara = 20, Union = 30.

If in the next year SBI issues 20% more cards than this year while Canara issues 15% fewer, what will be the combined number of cards issued by these two banks next year?

[Moderate]

- (A) 69,000
- (B) 70,500
- (C) 71,000
- (D) 72,000
- (E) None of these

1107. Directions: A stacked bar graph shows the employees of five branches of Dena Bank. Ambala: male 240, female 160. Bhilai: male 280, female 220. Chittoor: male 210, female 140. Durgapur: male 320, female 280. Erode: male 250, female 200.

After a reorganisation, 20% of the male employees and 25% of the female employees of the Durgapur branch are transferred out of the bank, while 60 new male employees join the Erode branch. What is the new ratio of the total number of male employees to the total number of female employees in the five branches taken together?

[Difficult]

- (A) 216 : 155
- (B) 155 : 216
- (C) 108 : 77
- (D) 72 : 53
- (E) None of these

1108. Directions: A grouped bar graph shows the total deposits (in Rs. crore) of Bank P and Bank Q. Bank P: 2019 = 120, 2020 = 150, 2021 = 180, 2022 = 200. Bank Q: 2019 = 100, 2020 = 140,

2021 = 160, 2022 = 220.

In 2023 Bank P's deposits grow over 2022 at the same percentage rate at which they grew from 2021 to 2022, while Bank Q's deposits grow over 2022 at the same percentage rate at which they grew from 2020 to 2021. What will be the approximate combined deposits of the two banks in 2023? [Difficult]

- (A) Rs. 466 crore
- (B) Rs. 474 crore
- (C) Rs. 482 crore
- (D) Rs. 490 crore
- (E) None of these

1109. Directions: A grouped bar graph shows the revenue (in Rs. lakh) from Home loans and Car loans in four quarters. Home: Q1 = 80, Q2 = 95, Q3 = 110, Q4 = 120. Car: Q1 = 60, Q2 = 55, Q3 = 70, Q4 = 90.

The company retains a margin of 8% on its Home-loan revenue and 12% on its Car-loan revenue. What is the total margin retained by the company over the four quarters? [Difficult]

- (A) Rs. 62.8 lakh
- (B) Rs. 65.4 lakh
- (C) Rs. 68.2 lakh
- (D) Rs. 70.5 lakh
- (E) None of these

1110. Directions: The bar graph shows the number of loan applications (in hundreds) received by a bank branch during six months. January = 24, February = 30, March = 18, April = 36, May = 27, June = 45.

In every month whose figure is strictly above the six-month average, housing and personal applications are in the ratio 5 : 4; in every other month they are in the ratio 4 : 5. What is the total number of housing loan applications received over the six months? [Difficult]

- (A) 8,600
- (B) 8,900
- (C) 9,100
- (D) 9,400
- (E) None of these

1111. Directions: A stacked bar graph shows the employees of five branches. Ambala: male 240, female 160. Bhilai: male 280, female 220. Chittoor: male 210, female 140. Durgapur: male 320, female 280. Erode: male 250, female 200.

In each branch, 40% of the male employees and 25% of the female employees are commerce graduates. Which branch has the largest number of commerce graduates, and how many are there? [Difficult]

- (A) Bhilai, 167
- (B) Durgapur, 198
- (C) Durgapur, 186
- (D) Erode, 150
- (E) None of these

1112. Directions: A stacked bar graph shows the policies sold (in thousands) by an insurance agency, each bar split into Life, Health and Motor. 2020: Life 12, Health 8, Motor 10. 2021: Life 15, Health 12, Motor 9. 2022: Life 18, Health 14, Motor 13. 2023: Life 20, Health 19, Motor 15.

By approximately how many percentage points did the share of Health policies in the year's total rise from 2020 to 2023? [Difficult]

- (A) 6.2
- (B) 7.4
- (C) 8.5
- (D) 9.8
- (E) None of these

1113. Directions: A stacked bar graph shows the policies sold (in thousands) by an insurance agency. 2020: Life 12, Health 8, Motor 10. 2021: Life 15, Health 12, Motor 9. 2022: Life 18, Health 14, Motor

13. 2023: Life 20, Health 19, Motor 15.

In 2024 the agency expects Life policies to be 25% more than in 2023, Health policies 20% more, and Motor policies 10% fewer. By approximately what per cent will the agency's total sales in 2024 exceed those of 2023? [Difficult]

- | | |
|-----------|-------------------|
| (A) 11.5% | (D) 17.4% |
| (B) 13.5% | (E) None of these |
| (C) 15.2% | |

1.11.3 Line graph

[checked, 1 flagged]

1114. The line graph shows the number of new savings accounts (in hundreds) opened at the Nagpur branch of a bank during six months: January 24, February 30, March 18, April 36, May 27, June 45. What is the difference between the number of accounts opened in the month with the highest figure and the month with the lowest figure? [Easy]

- | | |
|----------|-------------------|
| (A) 2400 | (D) 3000 |
| (B) 2700 | (E) None of these |
| (C) 2900 | |

1115. The line graph shows the number of new savings accounts (in hundreds) opened at the Nagpur branch of a bank during six months: January 24, February 30, March 18, April 36, May 27, June 45. What is the average number of accounts opened per month over these six months? [Easy]

- | | |
|----------|-------------------|
| (A) 3000 | (D) 3600 |
| (B) 2800 | (E) None of these |
| (C) 3200 | |

1116. The line graph shows the number of new savings accounts (in hundreds) opened at the Nagpur branch of a bank during six months: January 24, February 30, March 18, April 36, May 27, June 45. The number of accounts opened in April is what percent more than the number opened in March? [Easy]

- | | |
|----------|-------------------|
| (A) 50% | (D) 100% |
| (B) 75% | (E) None of these |
| (C) 200% | |

1117. A line graph shows the loans disbursed (in Rs. crore) by two branches P and Q of a bank over five years. Branch P: 2018 : 40, 2019 : 55, 2020 : 50, 2021 : 70, 2022 : 65. Branch Q: 2018 : 30, 2019 : 45, 2020 : 60, 2021 : 55, 2022 : 80. In how many of the given years was the disbursement of branch Q more than that of branch P? [Easy]

- | | |
|-------|-------------------|
| (A) 4 | (D) 1 |
| (B) 3 | (E) None of these |
| (C) 2 | |

1118. A line graph shows the loans disbursed (in Rs. crore) by two branches P and Q of a bank over five years. Branch P: 2018 : 40, 2019 : 55, 2020 : 50, 2021 : 70, 2022 : 65. Branch Q: 2018 : 30, 2019 : 45, 2020 : 60, 2021 : 55, 2022 : 80. What is the difference between the total disbursement of branch P and that of branch Q over the five years? [Easy]

- (A) Rs. 5 crore
(B) Rs. 15 crore
(C) Rs. 20 crore
- (D) Rs. 10 crore
(E) None of these

1119. A line graph shows the loans disbursed (in Rs. crore) by two branches P and Q of a bank over five years. Branch P: 2018 : 40, 2019 : 55, 2020 : 50, 2021 : 70, 2022 : 65. Branch Q: 2018 : 30, 2019 : 45, 2020 : 60, 2021 : 55, 2022 : 80. What is the ratio of the disbursement of branch P in 2021 to that of branch Q in the same year? [Easy]

- (A) 7 : 5
(B) 11 : 14
(C) 3 : 2
- (D) 5 : 4
(E) None of these

1120. A line graph shows the number of ATM transactions (in thousands) at a branch on five working days: Monday 12, Tuesday 15, Wednesday 9, Thursday 18, Friday 21. The number of transactions on Thursday is approximately what percent of the total transactions of the five days? [Easy]

- (A) 20%
(B) 22%
(C) 24%
- (D) 25%
(E) None of these

1121. A line graph shows the percent profit earned by Shreeja Traders over five years, where percent profit = $\frac{\text{Income} - \text{Expenditure}}{\text{Expenditure}} \times 100$. The values are 2017 : 20, 2018 : 25, 2019 : 40, 2020 : 50, 2021 : 30. If the expenditure of the company in 2019 was Rs. 60 lakh, what was its income in that year? [Moderate]

- (A) Rs. 78 lakh
(B) Rs. 80 lakh
(C) Rs. 84 lakh
- (D) Rs. 90 lakh
(E) None of these

1122. A line graph shows the percent profit earned by Shreeja Traders over five years, where percent profit = $\frac{\text{Income} - \text{Expenditure}}{\text{Expenditure}} \times 100$. The values are 2017 : 20, 2018 : 25, 2019 : 40, 2020 : 50, 2021 : 30. If the income of the company in 2020 was Rs. 90 lakh, what was its profit in that year? [Moderate]

- (A) Rs. 25 lakh
(B) Rs. 30 lakh
(C) Rs. 35 lakh
- (D) Rs. 45 lakh
(E) None of these

1123. A line graph shows the percent profit earned by Shreeja Traders over five years, where percent profit = $\frac{\text{Income} - \text{Expenditure}}{\text{Expenditure}} \times 100$. The values are 2017 : 20, 2018 : 25, 2019 : 40, 2020 : 50, 2021 : 30. If the expenditure in 2018 and in 2021 was Rs. 80 lakh in each year, what is the difference between the profits of these two years? [Moderate]

- (A) Rs. 2 lakh
(B) Rs. 8 lakh
(C) Rs. 5 lakh
- (D) Rs. 4 lakh
(E) None of these

1124. The line graph shows the number of new savings accounts (in hundreds) opened at the Nagpur branch of a bank during six months: January 24, February 30, March 18, April 36, May 27, June 45. The total number of accounts opened during the last three months (April to June) is what percent more than the total opened during the first three months (January to March)? [Moderate]

- (A) 60% (D) $33\frac{1}{3}\%$
 (B) 50% (E) None of these
 (C) 40%

1125. Two lines on a graph show, for five months, the number of loan applications received (in thousands) by a bank and the percentage of them approved. Applications received: January 40, February 50, March 45, April 60, May 55. Percentage approved: January 30, February 40, March 20, April 50, May 40. How many applications in total were approved in January and March together? [Moderate]

- (A) 21000 (D) 20000
 (B) 18000 (E) None of these
 (C) 24000

1126. A line graph shows the loans disbursed (in Rs. crore) by two branches P and Q of a bank over five years. Branch P: 2018 : 40, 2019 : 55, 2020 : 50, 2021 : 70, 2022 : 65. Branch Q: 2018 : 30, 2019 : 45, 2020 : 60, 2021 : 55, 2022 : 80. In which year was the percentage increase in the disbursement of branch Q over the previous year the highest? [Moderate]

- (A) 2022 (D) 2019
 (B) 2021 (E) None of these
 (C) 2020

1127. A line graph shows the number of two-wheeler loans (X) and four-wheeler loans (Y) sanctioned by a branch over five years. X: 2019 : 120, 2020 : 150, 2021 : 180, 2022 : 160, 2023 : 200. Y: 2019 : 80, 2020 : 100, 2021 : 90, 2022 : 140, 2023 : 150. In the year in which the gap between the two lines was the widest, what was the total number of loans of both types sanctioned? [Moderate]

- (A) 250 (D) 300
 (B) 270 (E) None of these
 (C) 260

1128. A line graph shows the percent profit earned by Shreeja Traders over five years, where percent profit = $\frac{\text{Income} - \text{Expenditure}}{\text{Expenditure}} \times 100$. The values are 2017 : 20, 2018 : 25, 2019 : 40, 2020 : 50, 2021 : 30. If the income of the company was exactly the same in 2018 as in 2019, what is the ratio of its expenditure in 2018 to its expenditure in 2019? [Difficult]

- (A) 28 : 25 (D) 8 : 5
 (B) 25 : 28 (E) None of these
 (C) 5 : 8

1129. Two lines on a graph show, for five months, the number of loan applications received (in thousands) by a bank and the percentage of them approved. Applications received: January 40, February 50, March 45, April 60, May 55. Percentage approved: January 30, February 40, March 20, April 50, May 40. If the approval rate in April had been the same as that in March, the number of applications approved in April would have been what percent less than the actual number approved in April? [Difficult]

- (A) 40%
 (B) 50%
 (C) 60%
 (D) $66\frac{2}{3}\%$
 (E) None of these

1130. A line graph shows the loans disbursed (in Rs. crore) by two branches P and Q of a bank over five years. Branch P: 2018 : 40, 2019 : 55, 2020 : 50, 2021 : 70, 2022 : 65. Branch Q: 2018 : 30, 2019 : 45, 2020 : 60, 2021 : 55, 2022 : 80. If in 2023 the disbursement of branch P rises over 2022 by the same percentage as its rise from 2020 to 2021, what will be the disbursement of branch P in 2023?
 [Difficult]

- (A) Rs. 85 crore
 (B) Rs. 91 crore
 (C) Rs. 88 crore
 (D) Rs. 95 crore
 (E) None of these

1131. A line graph shows the number of two-wheeler loans (X) and four-wheeler loans (Y) sanctioned by a branch over five years. X: 2019 : 120, 2020 : 150, 2021 : 180, 2022 : 160, 2023 : 200. Y: 2019 : 80, 2020 : 100, 2021 : 90, 2022 : 140, 2023 : 150. If in 2024 the two-wheeler loans increase by 15% over 2023 while the four-wheeler loans decrease by 20% over 2023, the total number of loans in 2024 will be
 [Difficult]

- (A) 8% more than the total of 2023
 (B) 8% less than the total of 2023
 (C) 4% more than the total of 2023
 (D) exactly equal to the total of 2023
 (E) None of these

1132. The line graph shows the number of new savings accounts (in hundreds) opened at the Nagpur branch of a bank during six months: January 24, February 30, March 18, April 36, May 27, June 45. If $\frac{2}{3}$ of the accounts opened in April and $\frac{5}{6}$ of the accounts opened in June were of the zero-balance type and the remaining accounts of these two months were of the regular type, how many regular-type accounts were opened in April and June together?
 [Difficult]

- (A) 1650
 (B) 1950
 (C) 1800
 (D) 2100
 (E) None of these

1133. The line graph shows the number of new savings accounts (in hundreds) opened at the Nagpur branch of a bank during six months: January 24, February 30, March 18, April 36, May 27, June 45. The branch had a target of opening 12000 new accounts during these six months. At the end of which month did the cumulative number of accounts opened first reach at least 75% of this target? [Difficult]

- (A) February
 (B) March
 (C) April
 (D) May
 (E) None of these

1134. Two lines on a graph show, for five months, the number of loan applications received (in thousands) by a bank and the percentage of them approved. Applications received: January 40, February 50, March 45, April 60, May 55. Percentage approved: January 30, February 40, March 20, April 50, May 40. The bank earns a processing fee of Rs. 800 on every approved application and Rs. 200 on every rejected application. What is the total processing fee earned from the applications of February and April together?
 [Difficult]

- (A) Rs. 4.6 crore (D) Rs. 5.2 crore
 (B) Rs. 5.6 crore (E) None of these
 (C) Rs. 5.0 crore

1.11.4 Pie chart: single, double, degree- and percentage-based

[checked]

1135. A pie chart shows the percentage distribution of the total loan amount of Rs. 48 lakh disbursed by the Nashik branch of Sahyadri Bank in a month: Home loan 30%, Vehicle loan 20%, Education loan 15%, Personal loan 12%, Gold loan 13%, Agricultural loan 10%. What amount was disbursed as Home loans?

[Easy]

- (A) Rs. 14.40 lakh (D) Rs. 13.80 lakh
 (B) Rs. 12.60 lakh (E) None of these
 (C) Rs. 15.20 lakh

1136. A pie chart represents the city-wise distribution of the 10,800 employees of Girija Financial Services. The sector for Mumbai subtends a central angle of 84° at the centre. How many employees work in Mumbai?

[Easy]

- (A) 2,340 (D) 2,700
 (B) 2,450 (E) None of these
 (C) 2,520

1137. In a pie chart showing the break-up of the annual expenditure of Deshmukh Traders, the sector representing expenditure on transportation subtends an angle of 63° at the centre. Transportation expenditure is what percent of the total annual expenditure?

[Easy]

- (A) 16% (D) 17%
 (B) 17.5% (E) None of these
 (C) 18%

1138. A pie chart gives the percentage break-up of the 9,000 insurance policies sold by an agency in a year: Life 28%, Health 22%, Motor 18%, Travel 12%, Home 11%, Others 9%. How many more Life policies than Health policies were sold?

[Easy]

- (A) 600 (D) 540
 (B) 480 (E) None of these
 (C) 450

1139. In a pie chart of a family's monthly budget, the sector for Food subtends 96° and the sector for House rent subtends 72° . What is the ratio of the amount spent on Food to the amount spent on House rent?

[Easy]

- (A) 4 : 3 (D) 8 : 5
 (B) 3 : 4 (E) None of these
 (C) 5 : 4

1140. The total annual revenue of Kaveri Textiles is Rs. 36,00,000 and it is shown branch-wise in a pie chart. The Salem branch contributed Rs. 5,40,000. What is the central angle of the sector representing the Salem branch?

[Easy]

- (A) 48° (D) 54°
 (B) 50° (E) None of these
 (C) 60°

1141. Two pie charts describe the same 3,600 employees of Konkan Bank. Chart I gives the branch-wise percentage distribution, in which the Andheri branch has 22%. Chart II gives the grade-wise distribution in degrees, in which the sector for Officers subtends 100° . How many more employees are Officers than are posted at the Andheri branch? [Easy]

- (A) 216 (D) 180
 (B) 192 (E) None of these
 (C) 208

1142. A pie chart shows the department-wise break-up of the monthly revenue of Rs. 5,40,000 of a retail chain: Electronics 24%, Apparel 18%, Groceries 30%, Furniture 16%, Others 12%. The combined revenue from Electronics and Furniture is what percent of the combined revenue from Apparel and Groceries? [Moderate]

- (A) 80% (D) $85\frac{1}{2}\%$
 (B) $83\frac{1}{3}\%$ (E) None of these
 (C) 120%

1143. Mr. Anil Kulkarni's investment portfolio is shown in a pie chart: Mutual funds 24%, Fixed deposits 18%, Equity 27%, Gold 11%, Insurance 20%. By how many degrees does the central angle of the Equity sector exceed that of the Fixed deposits sector? [Moderate]

- (A) 30.6° (D) 28.8°
 (B) 34.2° (E) None of these
 (C) 36°

1144. The total expenditure of Sharma Enterprises is distributed in a pie chart as Salaries 32%, Rent 15%, Marketing 18%, Research 20% and Miscellaneous 15%. If the expenditure on Rent is Rs. 2,70,000, what is the expenditure on Marketing? [Moderate]

- (A) Rs. 2,88,000 (D) Rs. 3,06,000
 (B) Rs. 3,60,000 (E) None of these
 (C) Rs. 3,24,000

1145. Two pie charts are given for a university. Chart I shows the distribution of all 12,000 students among five colleges, and Chart II shows the distribution of the 4,800 girl students among the same five colleges. College A has 20% of the students in Chart I and 25% of the girls in Chart II. How many boys study in College A? [Moderate]

- (A) 1,440 (D) 1,200
 (B) 1,000 (E) None of these
 (C) 900

1146. Two pie charts show the product-wise sales of Vidarbha Agro Ltd. In 2018 the total sales were Rs. 60 lakh, of which fertilisers accounted for 20%. In 2019 the total sales were Rs. 75 lakh, of which fertilisers accounted for 24%. What is the percentage increase in the sales value of fertilisers from 2018 to 2019? [Moderate]

- (A) 60% (D) 40%
 (B) 50% (E) None of these
 (C) 45%

1147. A pie chart shows how 7,200 books in a library are distributed among five sections, the central angles of the five sectors being in the ratio 2 : 3 : 4 : 5 : 6. How many books are in the largest section?

[Moderate]

- (A) 2,400 (D) 2,160
 (B) 2,040 (E) None of these
 (C) 1,800

1148. The total deposits of Rs. 96 crore of a bank are shown in a pie chart: Savings 22.5%, Current 12.5%, Fixed deposits 30%, Recurring deposits 15%, NRI deposits 12%, Others 8%. By how much do the Fixed deposits exceed the average deposit per category?

[Moderate]

- (A) Rs. 12.8 crore (D) Rs. 13.6 crore
 (B) Rs. 14.4 crore (E) None of these
 (C) Rs. 11.2 crore

1149. Two pie charts show the country-wise exports of Meenakshi Exports. In 2022 the total exports were Rs. 4.8 crore, distributed as USA 24%, UK 13%, UAE 20%, Germany 12%, Japan 15%, Others 16%. In 2023 the total exports were Rs. 7.2 crore, distributed as USA 22%, UK 14%, UAE 18%, Germany 16%, Japan 12%, Others 18%. What is the ratio of the exports to UK and Germany together in 2022 to the exports to UAE and Japan together in 2023?

[Difficult]

- (A) 4 : 9 (D) 5 : 8
 (B) 2 : 3 (E) None of these
 (C) 5 : 9

1150. The monthly expenditure of the Iyer household is shown by a pie chart with central angles Food 108° , House rent 72° , Education 45° , Transport 36° , Savings 54° and Miscellaneous 45° . If the amount spent on Food exceeds that on House rent by Rs. 10,800, what is the total amount spent on Education and Transport together?

[Difficult]

- (A) Rs. 21,600 (D) Rs. 27,000
 (B) Rs. 24,300 (E) None of these
 (C) Rs. 25,200

1151. A pie chart of a company's annual budget shows Marketing 25%, Salaries 30%, Rent 12%, Research 18% and Miscellaneous 15%. Next year the Marketing spend is increased by 20% while every other head is kept unchanged in rupee terms. In the pie chart of the new budget, what share does Marketing occupy?

[Difficult]

- (A) $28\frac{4}{7}\%$ (D) $29\frac{1}{6}\%$
 (B) 30% (E) None of these
 (C) $27\frac{1}{2}\%$

1152. Two pie charts are given for a recruitment drive. Chart I shows the zone-wise distribution of the 30,000 applicants: North 24%, South 20%, East 18%, West 26%, Central 12%. Chart II shows

the zone-wise distribution of the 4,500 selected candidates: North 20%, South 25%, East 15%, West 30%, Central 10%. Which zone has the highest selection rate (selected as a percentage of its own applicants)? [Difficult]

- (A) North
- (B) South
- (C) East
- (D) West
- (E) Central

1153. In the pie chart of a firm's monthly expenditure, the sector for Transport subtends 48° . In the next month the Transport expense rises by Rs. 6,000 while every other head remains unchanged, and the Transport sector in the new pie chart subtends 54° . What was the firm's total expenditure in the first month? [Difficult]

- (A) Rs. 2,88,000
- (B) Rs. 3,24,000
- (C) Rs. 3,60,000
- (D) Rs. 4,08,000
- (E) None of these

1154. A coaching centre has 1,200 students and collects fees of Rs. 36,00,000 in a year. Chart I shows the batch-wise distribution of students: P 25%, Q 15%, R 20%, S 22%, T 18%. Chart II shows the batch-wise distribution of the fees collected: P 20%, Q 24%, R 18%, S 26%, T 12%. By how much does the average fee per student of batch Q exceed that of batch P? [Difficult]

- (A) Rs. 1,800
- (B) Rs. 2,000
- (C) Rs. 2,800
- (D) Rs. 2,400
- (E) None of these

1155. The annual expenditure of Rs. 90,000 of a small trading firm is shown in a pie chart with five heads. The central angles of the four heads Purchases, Wages, Rent and Power are in the ratio 3 : 4 : 5 : 6, and the central angle of the fifth head, Miscellaneous, equals the average of these four angles. How much is spent on Miscellaneous? [Difficult]

- (A) Rs. 16,000
- (B) Rs. 18,000
- (C) Rs. 20,000
- (D) Rs. 15,000
- (E) None of these

1.11.5 Caselet DI (paragraph form)

[checked, 1 flagged]

1156. During one month a bank branch at Nashik opened a total of 480 new accounts. Of these, 45% were savings accounts and 30% were current accounts, while all the remaining accounts were fixed deposit accounts. How many fixed deposit accounts were opened during the month? [Easy]

- (A) 108
- (B) 120
- (C) 132
- (D) 144
- (E) None of these

1157. A retail store in Indore earned a total revenue of Rs. 84,000 last week from three product lines — stationery, groceries and toiletries. The revenues from stationery, groceries and toiletries were in the ratio 3 : 4 : 5 respectively. By how much did the revenue from toiletries exceed the revenue from stationery? [Easy]

- (A) Rs. 7,000
(B) Rs. 12,000
(C) Rs. 14,000
- (D) Rs. 21,000
(E) None of these

1158. A coaching institute in Patna enrolled 250 candidates for a banking batch. Of these candidates, 60% were male. Exactly 40% of the male candidates cleared the prelims examination. How many male candidates cleared the prelims examination? [Easy]

- (A) 50
(B) 60
(C) 75
- (D) 100
(E) None of these

1159. In a financial year a branch of a public sector bank disbursed loans worth Rs. 45 lakh in all, spread over home loans, car loans and personal loans only. Home loans accounted for 40% of the total disbursement, and the amount disbursed as car loans was twice the amount disbursed as personal loans. What was the amount disbursed as personal loans? [Easy]

- (A) Rs. 6 lakh
(B) Rs. 9 lakh
(C) Rs. 12 lakh
- (D) Rs. 13.5 lakh
(E) None of these

1160. In a district-level drive, Branch P opened 320 Jan Dhan accounts in a fortnight. In the same fortnight Branch Q opened 25% more such accounts than Branch P did. How many Jan Dhan accounts did the two branches open together in that fortnight? [Easy]

- (A) 680
(B) 700
(C) 720
- (D) 740
(E) None of these

1161. A district cooperative society in Solapur sells milk through two counters, Counter I and Counter II. On a particular day the society sold a total of 800 litres of milk through the two counters taken together. Of this quantity, Counter I sold 480 litres and the whole of the remaining quantity was sold through Counter II. The quantity of milk sold through Counter II that day was what percent of the total quantity sold through the two counters? [Easy]

- (A) 30%
(B) 35%
(C) 40%
- (D) 45%
(E) None of these

1162. Kavita runs a garment shop that is open six days a week, Monday to Saturday. From Monday to Friday her sales averaged Rs. 6,400 per day, and on Saturday her sales were Rs. 10,000. What were her average daily sales over the six days of that week? [Easy]

- (A) Rs. 6,800
(B) Rs. 6,900
(C) Rs. 7,200
- (D) Rs. 7,500
(E) None of these

1163. A bank reports that 1,800 of its customers use its digital channels. These customers are classified by their most-used channel as mobile banking, internet banking and ATM in the ratio 5 : 4 : 3 respectively. Among the mobile banking users, 30% are senior citizens. How many mobile banking users are NOT senior citizens? [Moderate]

- (A) 450 (D) 600
(B) 495 (E) None of these
(C) 525

1164. A survey was conducted among 4,500 account holders of a bank. It was found that 40% of them use net banking. Of the account holders who do NOT use net banking, two-thirds use only the mobile app and the rest visit only the branch for their transactions. How many of the surveyed account holders visit only the branch? [Moderate]

- (A) 600 (D) 1,200
(B) 720 (E) None of these
(C) 900

1165. Suresh, a bank clerk in Bhopal, earns a monthly income of Rs. 48,000. He spends 25% of his income on house rent. Of the amount left after paying rent, he spends 30% on food. He then spends a further Rs. 6,000 on all other expenses and saves whatever remains. What are Suresh's monthly savings? [Moderate]

- (A) Rs. 17,600 (D) Rs. 25,200
(B) Rs. 19,200 (E) None of these
(C) Rs. 21,600

1166. Three franchise outlets of an electrical goods dealer sold the same model of ceiling fan last month. Outlet A sold 240 fans at Rs. 150 profit per fan and Outlet B sold 180 fans at Rs. 175 profit per fan. The profit earned by Outlet C was Rs. 5,500 less than the profits of Outlets A and B put together. What was the total profit earned by the three outlets together? [Moderate]

- (A) Rs. 1,24,000 (D) Rs. 1,35,000
(B) Rs. 1,29,500 (E) None of these
(C) Rs. 1,33,000

1167. A bank branch has a staff strength of 120, made up of officers, clerks and sub-staff in the ratio 3 : 5 : 2 respectively. On an average working day each officer processes 45 files, each clerk processes 30 files and each member of the sub-staff processes 12 files. How many files does the whole branch process on an average working day? [Moderate]

- (A) 3,420 (D) 3,960
(B) 3,600 (E) None of these
(C) 3,708

1168. A cooperative bank in Kolhapur had 8,000 depositors at the end of 2022. During 2023 its depositor base grew by 20%, but during 2024 it fell by 15% from the 2023 level. By what percent was the number of depositors at the end of 2024 greater than that at the end of 2022? [Moderate]

- (A) 2% (D) 5%
(B) 3% (E) None of these
(C) 4%

1169. A bank has two branches in the same city. Branch X employs 150 people whose average monthly salary is Rs. 32,000, while Branch Y employs 100 people whose average monthly salary is Rs. 40,000. What is the average monthly salary of all the employees of the two branches taken together? [Moderate]

- (A) Rs. 34,000
(B) Rs. 35,200
(C) Rs. 36,000
- (D) Rs. 36,800
(E) None of these

1170. A trading firm recorded total sales of Rs. 30 lakh in a year, arising entirely from its three regions — South, North and East. The sales in the North region were Rs. 4 lakh more than those in the South region, and the sales in the East region were Rs. 2 lakh less than twice the sales in the South region. What were the sales in the East region? [Difficult]

- (A) Rs. 7 lakh
(B) Rs. 9 lakh
(C) Rs. 11 lakh
- (D) Rs. 12 lakh
(E) None of these

1171. In a recruitment test conducted at a centre in Lucknow, 4,000 candidates appeared, of whom 55% were male. Exactly 20% of the male candidates and 25% of the female candidates cleared the prelims stage. What percent of all the candidates who appeared cleared the prelims stage? [Difficult]

- (A) 21.50%
(B) 22.25%
(C) 22.50%
- (D) 23.75%
(E) None of these

1172. At the end of 2022 the deposits of Branch A stood at Rs. 60 lakh and those of Branch B at Rs. 45 lakh. During 2023 the deposits of Branch A increased by 20%, while those of Branch B also increased, so that the combined deposits of the two branches at the end of 2023 were Rs. 130.5 lakh. By what percent did the deposits of Branch B increase during 2023? [Difficult]

- (A) 15%
(B) 20%
(C) 25%
- (D) 30%
(E) None of these

1173. The average age of the 8 officers posted at a bank branch is 42 years. Two more officers are then transferred in, after which the average age of all the officers at the branch becomes 41 years. What is the average age of the two officers who joined? [Difficult]

- (A) 35 years
(B) 36 years
(C) 38 years
- (D) 39 years
(E) None of these

1174. A wholesaler in Rajkot purchased 500 kg of rice at Rs. 40 per kg. He sold 60% of this stock at a profit of 25% and disposed of the entire remaining stock at a loss of 10%. What was his overall profit percent on the whole transaction? [Difficult]

- (A) 7.5%
(B) 9%
(C) 11%
- (D) 15%
(E) None of these

1175. At a bank branch in Surat the number of savings accounts and the number of current accounts are in the ratio 5 : 3 respectively. During a special campaign the branch opened 40 new current accounts and no new savings accounts, after which the ratio of savings accounts to current accounts became 5 : 4. How many savings accounts does the branch have? [Difficult]

- (A) 120 (D) 240
 (B) 160 (E) None of these
 (C) 200

1176. Anil, Bhavna and Chetan started a trading business together. Anil invested Rs. 40,000 and stayed for the full 12 months, Bhavna invested Rs. 60,000 and stayed for 9 months, and Chetan invested Rs. 80,000 and stayed for 6 months. At the end of the year they shared a profit of Rs. 50,000 in the ratio of their respective capital-months. What was Bhavna's share of the profit? [Difficult]

- (A) Rs. 15,000 (D) Rs. 20,000
 (B) Rs. 16,000 (E) None of these
 (C) Rs. 18,000

1.11.6 Missing-data DI

[checked]

1177. The table below shows the loan amount disbursed (in Rs. lakh) by five branches of Bharat Bank during a quarter.

Branch	Amount
Anna Nagar	145
Basant Nagar	132
Chromepet	?
Dindigul	168
Erode	150
Total	750

What amount (in Rs. lakh) was disbursed by the Chromepet branch? [Easy]

- (A) 145 (D) 160
 (B) 150 (E) None of these
 (C) 155

1178. A pie chart shows how 12,000 accounts of a bank branch are distributed by type: Savings 35%, Current 20%, Fixed Deposit 18%, Recurring Deposit 15% and Loan accounts (percentage not printed). How many Loan accounts does the branch have? [Easy]

- (A) 1440 (D) 1620
 (B) 1500 (E) None of these
 (C) 1560

1179. A staff table for the Salem branch of a bank records 480 employees in total. The number of male employees is printed as 280 but the number of female employees has been left blank. It is also stated that male and female employees are in the ratio 7 : 5. How many female employees work at the branch? [Easy]

- (A) 180 (D) 240
 (B) 200 (E) None of these
 (C) 210

1180. A bar chart records the number of ATM transactions at a branch on five working days: Monday 610, Tuesday 655, Wednesday 700, Thursday 590 and Friday (bar not labelled). The average number of transactions per day over the five days is 640. How many transactions took place on Friday? [Easy]

- (A) 615 (D) 645
(B) 625 (E) None of these
(C) 635

1181. A table shows new savings accounts opened by the Trichy branch. The entry for 2022 is 2400 and the entry for 2023 has been smudged, but a footnote states that the 2023 figure was 15% higher than the 2022 figure. How many accounts were opened in 2023? [Easy]

- (A) 2640 (D) 2820
(B) 2700 (E) None of these
(C) 2760

1182. A recruitment table for a bank shows that at the Madurai centre 1440 candidates qualified the preliminary examination, and that this was exactly 32% of the candidates who appeared. The number who appeared has been left blank. How many candidates appeared at the Madurai centre? [Easy]

- (A) 4200 (D) 5000
(B) 4400 (E) None of these
(C) 4800

1183. A table lists insurance policies sold by two agents of a bank in a month. Rakesh sold 120 policies; Suman's entry is missing, but the table notes that Suman sold 25% more policies than Rakesh. How many policies did Suman sell? [Easy]

- (A) 130 (D) 150
(B) 140 (E) None of these
(C) 145

1184. A table shows deposits and withdrawals (in Rs. thousand) at two branches on a given day. Branch P: deposits 8400, withdrawals not printed. Branch Q: deposits not printed, withdrawals 5520. It is given that the deposits of P and Q together amount to 15,000, and that the withdrawals at P equal 60% of the deposits at P. What is the ratio of the net inflow (deposits minus withdrawals) at P to that at Q? [Moderate]

- (A) 25 : 8 (D) 56 : 19
(B) 28 : 9 (E) None of these
(C) 14 : 5

1185. A table shows candidates who appeared for and were selected in a bank clerical exam at two cities. City A: appeared 7200, selected 8% of those appeared. City B: number appeared not printed, selected 630, which was 7% of those appeared at B. What is the total number of candidates who appeared at the two cities together? [Moderate]

- (A) 16200 (D) 18000
(B) 16800 (E) None of these
(C) 17400

1186. A table records debit cards issued by a bank: 2020 shows 4500, the 2021 entry is missing, and 2022 shows 6912. A note states that the 2021 figure was 20% higher than the 2020 figure. By what percentage did the number of cards issued increase from 2021 to 2022? [Moderate]

- (A) 24% (D) 30%
 (B) 26% (E) None of these
 (C) 28%

1187. A staffing table for five branches reads: $P = 42$, $Q = 38$, $R = ?$, $S = 45$, $T = ?$. The average staff strength across the five branches is 43, and branch T has 8 more staff than branch R. How many staff work at branch T? [Moderate]

- (A) 43 (D) 49
 (B) 45 (E) None of these
 (C) 47

1188. A survey of 2400 customers records the digital channel each one uses most: UPI 30%, Net banking (percentage missing), Mobile app 25%, Cards 15%, Others 10%. How many more customers use UPI than use Net banking? [Moderate]

- (A) 220 (D) 280
 (B) 240 (E) None of these
 (C) 260

1189. A chart of a bank's loan portfolio shows Home loans of Rs. 560 crore, which the footnote says is 35% of the total portfolio. Vehicle loans form 12% of the total, but the rupee figure is not printed. What is the value of the Vehicle loan portfolio? [Moderate]

- (A) Rs. 176 crore (D) Rs. 208 crore
 (B) Rs. 184 crore (E) None of these
 (C) Rs. 204 crore

1190. A table shows participants in a bank's training programme. In 2022: male 480, female not printed, with males and females in the ratio 8 : 7. In 2023: male not printed, female 620, and the total number of participants in 2023 was 1220. By what percentage did the number of male participants increase from 2022 to 2023? [Moderate]

- (A) 20% (D) 30%
 (B) 22.5% (E) None of these
 (C) 25%

1191. A table shows loans disbursed (in Rs. lakh) by three branches in two years.

Branch	2022	2023
P	240	?
Q	?	360
R	300	272

The total disbursed in 2022 was Rs. 800 lakh, and the 2023 total was 15%

higher than the 2022 total. Which branch recorded the highest percentage growth from 2022 to 2023? [Difficult]

- (A) Branch P (D) Branches P and R equally
 (B) Branch Q (E) None of these
 (C) Branch R

1192. A bank has 1200 employees across four departments: Retail 420, Corporate (blank), Treasury (blank), Operations 300. The Corporate and Treasury departments are staffed in the ratio 5 : 3. If 20% of the Corporate employees are transferred to Treasury, what will the new ratio of Corporate to Treasury employees be? [Difficult]

- (A) 1 : 1
(B) 3 : 4
(C) 4 : 3
- (D) 5 : 6
(E) None of these

1193. A table records digital transactions (in lakh) handled by a bank: 2021 (blank), 2022 = 288, 2023 (blank). Footnotes state that the 2022 figure was 20% more than the 2021 figure, and the 2023 figure was 12.5% more than the 2022 figure. What is the average number of transactions per year (in lakh) over these three years? [Difficult]

- (A) 276
(B) 280
(C) 284
- (D) 288
(E) None of these

1194. A dealer's sales table has two rows. Product A: cost price Rs. 450 per unit, 200 units sold, profit 20% per unit. Product B: cost price Rs. 600 per unit, number of units sold not printed, profit 15% per unit. The total profit from both products together was Rs. 31,500. How many units of Product B were sold? [Difficult]

- (A) 120
(B) 135
(C) 140
- (D) 150
(E) None of these

1195. A results table for a bank exam centre reads: total candidates 300 with overall average marks 58; boys 180 with average marks 62; girls 120 with average marks not printed. What was the average marks scored by the girls? [Difficult]

- (A) 48
(B) 50
(C) 52
- (D) 54
(E) None of these

1196. A table distributes 45,000 job applications across five states: Maharashtra 22%, Tamil Nadu 18%, Uttar Pradesh (percentage not printed), Karnataka 16% and West Bengal 14%. A further note says that 60% of the Uttar Pradesh applications came from rural areas, and that 25% of those rural applicants were shortlisted. How many rural applicants from Uttar Pradesh were shortlisted? [Difficult]

- (A) 1950
(B) 2025
(C) 2100
- (D) 2250
(E) None of these

1197. A deposit register shows simple interest earned by two customers. Ramesh: principal Rs. 40,000, rate 8% per annum, period not printed, interest Rs. 9,600. Sunita: principal not printed, rate 9% per annum, period 2 years, interest Rs. 10,800. What is the difference between the two principals? [Difficult]

- (A) Rs. 16,000
(B) Rs. 18,000
(C) Rs. 20,000
- (D) Rs. 24,000
(E) None of these

1.11.7 Mixed / combined DI

[checked, 1 flagged]

1198. Study the combined data. A pie chart shows how the total loan book of Rs. 7,200 crore of Sunrise Bank is divided among five sectors, the central angles being: Agriculture 90°, Housing 72°, Education 54°, MSME 108°, Personal 36°. What is the amount (in Rs. crore) lent to the MSME sector? [Easy]

- (A) 1440 (D) 2400
 (B) 1800 (E) None of these
 (C) 2160

1199. A bar graph gives the number of savings accounts (in hundreds) opened during 2023 by four branches of Konkan Bank: Andheri 24, Borivali 18, Chembur 30, Dadar 28. A line graph drawn over the same bars gives the percentage of these accounts that belong to women: Andheri 25%, Borivali 40%, Chembur 30%, Dadar 50%. How many women's accounts were opened at the Chembur branch?
 [Easy]

- (A) 720 (D) 1080
 (B) 840 (E) None of these
 (C) 960

1200. A line graph shows the number of air-conditioners sold by Rajesh Electronics: January 320, February 280, March 400, April 360, May 440. A table alongside gives the selling price per unit (in Rs.): January 1200, February 1250, March 1150, April 1300, May 1100. What was the total revenue of the shop in March?
 [Easy]

- (A) Rs. 4,20,000 (D) Rs. 5,20,000
 (B) Rs. 4,60,000 (E) None of these
 (C) Rs. 4,80,000

1201. A pie chart shows the distribution of 1800 candidates who appeared for a recruitment test at five centres: Delhi 20%, Mumbai 25%, Kolkata 15%, Chennai 30%, Pune 10%. A table gives the percentage of candidates who qualified at each centre: Delhi 40, Mumbai 30, Kolkata 50, Chennai 20, Pune 60. How many candidates qualified from the Mumbai centre?
 [Easy]

- (A) 108 (D) 150
 (B) 120 (E) None of these
 (C) 135

1202. A table gives the year-end deposits (in Rs. crore) of Bank P: 2019 : 120, 2020 : 150, 2021 : 180, 2022 : 210, 2023 : 240. A line graph superimposed on the table gives the deposits of Bank Q for the same years: 2019 : 100, 2020 : 140, 2021 : 200, 2022 : 190, 2023 : 260. In how many of the given years were the deposits of Bank Q more than those of Bank P?
 [Easy]

- (A) 1 (D) 4
 (B) 2 (E) None of these
 (C) 3

1203. A bar graph shows the total number of shirts (in thousands) produced by Vasant Garments: July 60, August 75, September 90, October 45, November 80. A pie chart shows how the September production alone is split by size: S 20%, M 35%, L 25%, XL 15%, XXL 5%. How many L-size shirts were produced in September?
 [Easy]

- (A) 18000 (D) 24500
 (B) 20500 (E) None of these
 (C) 22500

1204. A table shows the number of loan applications received by Grameen Bank: January 640, February 720, March 560, April 800, May 680. A line graph gives the percentage of applications rejected in each month: January 25%, February 20%, March 30%, April 15%, May 25%. How many applications were approved in April? [Easy]

- | | |
|---------|-------------------|
| (A) 640 | (D) 700 |
| (B) 660 | (E) None of these |
| (C) 680 | |

1205. A pie chart shows the distribution of the 4500 employees of Zenith Bank across five departments: Operations 30%, Credit 20%, IT 16%, HR 10%, Sales 24%. A table gives the male : female ratio in each department: Operations 5 : 4, Credit 3 : 2, IT 5 : 3, HR 1 : 1, Sales 5 : 4. Find the total number of female employees in the Credit and Sales departments taken together. [Moderate]

- | | |
|---------|-------------------|
| (A) 780 | (D) 870 |
| (B) 810 | (E) None of these |
| (C) 840 | |

1206. A bar graph gives the number of two-wheelers sold by Meenakshi Motors: 2020 : 1200, 2021 : 1500, 2022 : 1800, 2023 : 2100. A line graph gives the average profit earned per vehicle (in Rs.): 2020 : 2500, 2021 : 2400, 2022 : 2600, 2023 : 2800. The total profit of the dealer in 2023 is what percent more than the total profit in 2021? [Moderate]

- | | |
|-----------------------|-------------------|
| (A) 60% | (D) 65% |
| (B) 62.5% | (E) None of these |
| (C) $63\frac{1}{3}\%$ | |

1207. A pie chart shows how the annual budget of Rs. 18,00,000 of a co-operative bank is divided: Salaries 35%, Rent 15%, Technology 20%, Marketing 18%, Miscellaneous 12%. A bar graph gives the percentage increase planned in each head for the next year: Salaries 10%, Rent 20%, Technology 25%, Marketing 5%, Miscellaneous 0%. What will be the bank's total budget for the next year? [Moderate]

- | | |
|-------------------|-------------------|
| (A) Rs. 19,86,000 | (D) Rs. 21,06,000 |
| (B) Rs. 20,23,200 | (E) None of these |
| (C) Rs. 20,52,000 | |

1208. A line graph shows the number of mobile-banking users (in thousands) of Deccan Bank: 2019 : 40, 2020 : 55, 2021 : 75, 2022 : 100, 2023 : 130. A table gives the percentage of these users who transacted through UPI in that year: 2019 : 45%, 2020 : 60%, 2021 : 68%, 2022 : 72%, 2023 : 80%. What is the total number of UPI users of the bank over the five years taken together? [Moderate]

- | | |
|--------------|-------------------|
| (A) 2,64,000 | (D) 2,86,000 |
| (B) 2,72,000 | (E) None of these |
| (C) 2,78,000 | |

1209. A pie chart shows the distribution of 24,000 policies sold by the insurance arm of a bank across four types: Term 25%, Endowment 30%, ULIP 20%, Health 25%. A table gives the average annual premium per policy (in Rs.): Term 8000, Endowment 15000, ULIP 25000, Health 10000. What is the difference between the total premium collected from Endowment policies and that collected from Health policies? [Moderate]

- (A) Rs. 3,60,00,000
(B) Rs. 4,20,00,000
(C) Rs. 5,20,00,000
- (D) Rs. 5,60,00,000
(E) None of these

1210. A bar graph gives the number of students enrolled in five batches of a coaching institute: B1 120, B2 150, B3 180, B4 90, B5 160. A line graph gives the percentage of each batch that cleared the prelims: B1 60%, B2 40%, B3 50%, B4 80%, B5 45%. The number of students of batches B2 and B4 together who cleared the prelims is what fraction of the total enrolment of these two batches? [Moderate]

- (A) $\frac{11}{20}$
(B) $\frac{9}{20}$
- (C) $\frac{3}{5}$
(D) $\frac{13}{25}$
(E) None of these

1211. A table gives the number of ATMs of five banks in a district: SBI 45, PNB 30, HDFC 25, ICICI 20, Axis 30. A pie chart gives the share of each bank in the total daily cash withdrawal of Rs. 1,50,00,000 in the district: SBI 30%, PNB 20%, HDFC 18%, ICICI 12%, Axis 20%. For which bank is the average daily withdrawal per ATM the highest? [Moderate]

- (A) SBI
(B) PNB
(C) HDFC
- (D) ICICI
(E) Axis

1212. A pie chart shows the distribution of the 3600 loan accounts of Vindhya Bank in 2022: Home 25%, Auto 20%, Personal 30%, Education 15%, Gold 10%. A bar graph shows the change in each category during 2023: Home increased by 20%, Auto decreased by 15%, Personal increased by 10%, Education increased by 40% and Gold decreased by 25%. What is the percentage increase in the total number of loan accounts of the bank in 2023 over 2022? [Difficult]

- (A) 7.5%
(B) 8.5%
(C) 9%
- (D) 9.5%
(E) None of these

1213. A table gives the total staff strength of three branches of Sahyadri Bank: Alpha 640, Beta 900, Gamma 750. A second table gives the officers : clerks ratio in each branch — Alpha 3 : 5, Beta 4 : 5, Gamma 2 : 3. It is further given that 25% of the officers in every branch are women, while the percentage of women among clerks is 40% in Alpha, 20% in Beta and 50% in Gamma. Find the total number of women employees in the three branches together. [Difficult]

- (A) 690
(B) 705
(C) 720
- (D) 735
(E) None of these

1214. A line graph shows the monthly sales (in Rs. lakh) of a showroom: January 48, February 60, March (value smudged), April 72, May 54. It is stated that the average monthly sales over these five months is Rs. 58.8 lakh. A table gives the profit as a percentage of sales for each month: January 12.5%, February 15%, March 20%, April 10%, May 25%. What is the total profit (in Rs. lakh) earned by the showroom over the five months? [Difficult]

- (A) 45.2
(B) 46.8
(C) 47.7
- (D) 48.6
(E) None of these

1215. A bar graph gives the number of laptops sold (in hundreds) by an online retailer in five cities: Delhi 12, Mumbai 15, Pune 9, Jaipur 6, Lucknow 8. A line graph gives the share of brand X in each city's sales: Delhi 25%, Mumbai 20%, Pune 40%, Jaipur 50%, Lucknow 25%. The number of brand X laptops sold in Delhi, Mumbai and Pune together is what percent of the total number of laptops sold in all five cities? [Difficult]

- (A) 18%
(B) 19.2%
(C) 20%
- (D) 21.5%
(E) None of these

1216. A table gives, for four branches of a bank, the number of tellers and the number of transactions each teller handles per hour — P: 5 tellers, 12 transactions per hour; Q: 4 tellers, 15 per hour; R: 6 tellers, 10 per hour; S: 3 tellers, 18 per hour. A bar graph gives the daily counter hours of each branch: P 8, Q 7, R 9, S 8. What is the ratio of the total transactions handled daily by branches P and R together to those handled by Q and S together? [Difficult]

- (A) 85 : 71
(B) 5 : 4
(C) 17 : 14
- (D) 40 : 33
(E) None of these

1217. A pie chart shows the distribution of 45,000 candidates who registered for a bank examination across five zones: North 24%, South 20%, East 16%, West 28%, Central 12%. A table gives, for each zone, the percentage of registered candidates who actually appeared and the percentage of those who appeared who finally qualified — North: appeared 75%, qualified 8%; South: appeared 80%, qualified 10%; East: appeared 60%, qualified 10%; West: appeared 90%, qualified 5%; Central: appeared 50%, qualified 20%. What is the total number of candidates who qualified? [Difficult]

- (A) 2754
(B) 2835
(C) 2907
- (D) 3024
(E) None of these

1218. A bar graph gives the total revenue (in Rs. crore) of Shakti Appliances: 2021 : 250, 2022 : 320, 2023 : 400. A line graph gives the total expenditure as a percentage of that year's revenue: 2021 : 80%, 2022 : 75%, 2023 : 70%. A third table gives the number of units sold (in lakh): 2021 : 25, 2022 : 32, 2023 : 50. By what percent did the profit earned per unit change from 2021 to 2023? [Difficult]

- (A) Increase of 15%
(B) Increase of 20%
(C) Increase of 25%
- (D) Decrease of 20%
(E) None of these

1.11.8 Radar, funnel, and other non-standard charts

[checked, 2 flagged]

1219. A radar (spider) chart rates the Pune main branch of Konkan Bank on five parameters, each on a scale of 0 to 100. The plotted values are: Customer Service 72, Loan Recovery 65, Digital Adoption 80, Cross-selling 58 and Compliance 85. What is the average of the five parameter scores of the branch? [Easy]

- (A) 70
(B) 72
(C) 74
- (D) 76
(E) None of these

1220. A funnel chart shows the home-loan pipeline of Vidarbha Bank for the month of June: Enquiries received 12,000; Formal applications 7,500; Documents verified 4,800; Loans sanctioned 3,600; Loans disbursed 2,700. What percentage of the enquiries received finally resulted in a disbursed loan? [Easy]

- (A) 18.5%
(B) 20%
(C) 22.5%
- (D) 25%
(E) None of these

1221. A radar chart superimposes the performance indices (scale 0–100) of two branches of Sahyadri Bank on six parameters. Branch A: Deposits 80, Advances 70, Fee income 55, Digital usage 90, NPA control 60, Staff productivity 74. Branch B: Deposits 65, Advances 75, Fee income 55, Digital usage 72, NPA control 68, Staff productivity 70. On how many of the six parameters does Branch A score strictly higher than Branch B? [Easy]

- (A) 2
(B) 3
(C) 4
- (D) 5
(E) None of these

1222. A funnel chart for the credit-card campaign of Metro Bank shows: Leads generated 25,000; Pre-approved 16,000; Applications submitted 9,600; Cards approved 6,000; Cards activated 4,200. What is the percentage drop-off between the “Pre-approved” stage and the “Applications submitted” stage? [Easy]

- (A) 32%
(B) 36%
(C) 40%
- (D) 44%
(E) None of these

1223. A bubble chart plots five branches of Deccan Bank, with the number of employees on the x -axis and total deposits (in Rs. crore) on the y -axis. Alwar (20, 60), Bhuj (25, 100), Cuttack (40, 120), Dhule (15, 54), Erode (30, 105). Which branch has the highest deposits per employee? [Easy]

- (A) Alwar
(B) Cuttack
(C) Dhule
- (D) Bhuj
(E) Erode

1224. A waterfall chart shows how the quarterly profit of Ganga Bank is built up (all figures in Rs. crore): starting operating profit 480; then + Fee income 120; then – Provisions 210; then – Operating expenses 150; then + Treasury gains 90. What is the closing profit before tax shown by the last bar? [Easy]

- (A) 300
(B) 310
(C) 320
- (D) 330
(E) None of these

1225. In a coaching institute’s radar chart, each of the five axes is graduated from 0 to 50 in steps of 10. Meera’s sectional marks are plotted as: Reasoning 40, English 30, Quantitative Aptitude 45, General Awareness 25, Computer Knowledge 35. What is the ratio of her Quantitative Aptitude marks to her General Awareness marks? [Easy]

- (A) 9 : 5
(B) 5 : 9
(C) 7 : 5
- (D) 9 : 4
(E) None of these

1226. Two funnel charts show the lending pipelines of Kaveri Bank for a quarter. Personal loans: Enquiries 8,000, Applications 5,000, Sanctioned 3,000, Disbursed 2,100. Auto loans: Enquiries 7,000, Applications 4,200, Sanctioned 2,800, Disbursed 1,960. By how many percentage points does the overall enquiry-to-disbursal conversion of auto loans exceed that of personal loans? [Moderate]

- (A) 1.25
(B) 1.5
(C) 1.75
- (D) 2
(E) None of these

1227. A radar chart plots the performance indices (scale 0–100) of the Nashik branch of Godavari Bank for two years. Year 2022: Deposits 60, Advances 50, Digital transactions 40, Customer satisfaction 70, Recovery 70. Year 2024: Deposits 75, Advances 65, Digital transactions 70, Customer satisfaction 88, Recovery 63. On how many parameters did the index rise by more than 20% over 2022? [Moderate]

- (A) 1
(B) 2
(C) 3
- (D) 4
(E) None of these

1228. A funnel chart of the clerical recruitment drive of Sarva Gramin Bank shows five stages. Of the applications received, 40% were shortlisted; 25% of those shortlisted cleared the preliminary examination; 30% of those clearing the preliminary examination cleared the mains; and 50% of those clearing the mains were finally selected. If 900 candidates were finally selected, how many applications were received? [Moderate]

- (A) 45,000
(B) 54,000
(C) 60,000
- (D) 72,000
(E) None of these

1229. A bubble chart plots five mutual-fund schemes distributed by Yamuna Bank, with the risk score on the x -axis and the three-year annualised return (in %) on the y -axis: P (4, 9), Q (6, 15), R (5, 11.5), S (8, 18), T (3, 7.5). For how many schemes is the return-to-risk ratio at least 2.4? [Moderate]

- (A) 1
(B) 2
(C) 3
- (D) 4
(E) None of these

1230. A waterfall chart shows the movement of the deposit book of Chenab Bank during a quarter (in Rs. crore): Opening balance 8,000; + Fresh CASA 1,240; + Fresh term deposits 2,150; – Withdrawals 1,890; – Matured but not renewed 1,420. By what percentage does the closing balance exceed the opening balance? [Moderate]

- (A) 0.8%
(B) 1.2%
(C) 1.5%
- (D) 2%
(E) None of these

1231. A radar chart shows the appraisal ratings (each out of 10) of officer Rajesh Menon on five competencies: Sales 8, Compliance 6, Teamwork 7, Technology 9, Communication 5. The bank computes a weighted score using the weights Sales 30%, Compliance 20%, Teamwork 15%, Technology 25%, Communication 10%. What is his weighted score out of 10? [Moderate]

- (A) 7.4
(B) 7
(C) 7.2
- (D) 7.5
(E) None of these

1232. A funnel chart tracks the insurance cross-selling drive at the Sangli branch of Krishna Bank. Customers contacted 4,500; 60% of those contacted showed interest; 75% of the interested customers were given a quotation; 40% of those given a quotation were issued a policy; and 90% of the policies issued had the first premium actually paid. Premium-paying customers form what percentage of the customers contacted? [Moderate]

- (A) 14.4%
(B) 16.2%
(C) 18%
- (D) 20.25%
(E) None of these

1233. A radar chart rates three branches of Malwa Bank on five parameters (scale 0–100). Kolhapur: Deposit growth 72, Advances growth 64, Fee income 80, Digital adoption 56, Recovery 68. Latur: 66, 78, 62, 74, 70 in the same order. Mysuru: 80, 60, 74, 66, 60 in the same order. The head office computes a composite score using weights of 25%, 25%, 20%, 15% and 15% for the five parameters respectively. Which branch tops the composite ranking, and by how much does it lead the runner-up? [Difficult]

- (A) Latur, by 1.3
(B) Latur, by 1.4
(C) Mysuru, by 1.3
- (D) Kolhapur, by 1.4
(E) None of these

1234. A funnel chart of the digital lending campaign of FinBank for one month shows: Advertisement impressions 50,00,000; click-through rate 2% of impressions; app downloads 15% of clicks; loan applications 20% of downloads; loans disbursed 25% of applications. The campaign cost Rs. 30,00,000. If the average disbursed loan is Rs. 80,000 and the bank charges a processing fee of 4% of the loan amount, what is the net marketing cost per disbursed loan after adjusting the processing-fee income? [Difficult]

- (A) Rs. 600
(B) Rs. 800
(C) Rs. 1,000
- (D) Rs. 1,200
(E) None of these

1235. A waterfall chart depicts the annual profit-and-loss build-up of Narmada Bank (in Rs. crore): Net interest income 2,400; + Other income 860; – Operating expenses 1,320; – Provisions 640; and finally – Tax at 26% of profit before tax. The profit after tax is what approximate percentage of the bank's total income (net interest income plus other income)? [Difficult]

- (A) 27.5%
(B) 29.5%
(C) 31.5%
- (D) 33.5%
(E) None of these

1236. A radar chart plots the average service time in minutes (lower is better) taken by five branches of Tapi Bank for five services, in the order Account opening, Cheque book issue, Loan query, Locker operation, Remittance. Ahmednagar: 25, 10, 40, 30, 15. Bhandara: 20, 12, 45, 28, 18. Chandrapur: 30, 8, 35, 25, 20. Dhar: 22, 14, 38, 32, 12. Erandol: 28, 9, 42, 22, 16. By how many minutes is the per-service average of the fastest branch below the overall per-service average of all five branches taken together? [Difficult]

- (A) 0.36 (D) 0.52
(B) 0.40 (E) None of these
(C) 0.48

1237. A funnel chart shows the Kisan Credit Card pipeline of Grameen Bank for 2023: Applications 24,000; Verified 18,000; Sanctioned 12,600; Disbursed 10,080. In 2024 the applications rose by 25%, the verification rate improved by 5 percentage points, the sanction rate (sanctioned as a percentage of verified) stayed unchanged, and the disbursal rate (disbursed as a percentage of sanctioned) improved by 4 percentage points. How many loans were disbursed in 2024? [Difficult]

- (A) 13,440 (D) 15,120
(B) 14,112 (E) None of these
(C) 14,700

1238. A bubble chart plots five ATMs of Suvarna Bank, with the average number of daily transactions on the x -axis and the average ticket size in rupees on the y -axis, the bubble area representing monthly downtime in hours. Panvel (320, 2500), downtime 6 h; Ratnagiri (180, 3200), downtime 10 h; Satara (250, 2800), downtime 4 h; Thane (400, 2200), downtime 8 h; Udgir (150, 3600), downtime 12 h. Taking a month as 30 days, for the ATM with the highest ratio of monthly cash dispensed to downtime hours, by what percentage does this ratio exceed that of Panvel? [Difficult]

- (A) 25% (D) $33\frac{1}{3}\%$
(B) 28.125% (E) None of these
(C) 31.25%

1239. A butterfly (population-pyramid) chart shows the customers of Sindhu Bank in thousands, males on the left and females on the right, by age group. 18–25: males 42, females 38. 26–35: males 68, females 52. 36–45: males 55, females 45. 46–60: males 40, females 30. Above 60: males 25, females 15. In the 36–45 group, 40% of the male customers and 55% of the female customers use the mobile banking app. How many customers of this age group (in thousands) do NOT use the app? [Difficult]

- (A) 50.25 (D) 54.75
(B) 51.75 (E) None of these
(C) 53.25

1.11.9 Arithmetic DI (DI built on commercial and time-based concepts) [checked, 8 flagged]

1240. The table below gives the cost price and selling price of one washing machine at five electronics showrooms in Nagpur.

Showroom	Cost price (Rs.)	Selling price (Rs.)
Anand	4,500	5,400
Bharti	6,000	6,900
Chetna	7,200	8,280
Deepak	5,000	5,750
Eshwar	8,000	9,200

What is the profit percent earned by Anand Show-

room?

[Easy]

- (A) 15% (D) 22%
(B) 18% (E) 25%
(C) 20%

1241. Five customers opened fixed deposits in a branch of a nationalised bank. The table shows the principal, the rate of simple interest per annum and the tenure.

Customer	Principal (Rs.)	Rate (% p.a.)	Time (years)
Ramesh	25,000	8	3
Sunita	40,000	6	2
Vikram	30,000	9	4
Meena	50,000	7	2
Farhan	20,000	10	5

How much simple interest does Ramesh

earn on his deposit?

[Easy]

(A) Rs. 4,500

(D) Rs. 6,000

(B) Rs. 5,000

(E) Rs. 6,400

(C) Rs. 5,600

1242. The table shows the number of days five data-entry operators of a bank take to complete one full batch of cheque digitisation, each working alone.

Operator	Days taken alone
Arjun	12
Bindu	18
Charu	24
Dinesh	36
Ekta	9

If Arjun and Bindu work together on one batch, in how many days

will the batch be completed?

[Easy]

(A) 6 days

(C) $7\frac{1}{5}$ days

(B) $6\frac{2}{3}$ days

(D) 8 days

(E) $9\frac{1}{2}$ days

1243. The table gives the distance covered and the time taken by five express trains on the Mumbai division.

Train	Distance (km)	Time (hours)
Konkan Express	480	6
Deccan Queen	385	5
Sahyadri Express	540	9
Godavari Express	620	8
Panchvati Express	350	4

What is the average speed of the Konkan Ex-

press?

[Easy]

(A) 60 km/h

(D) 80 km/h

(B) 72 km/h

(E) 90 km/h

(C) 75 km/h

1244. A garment store in Surat displays the following data for five items during its festive sale.

Item	Marked price (Rs.)	Discount (%)
Shirt	3,200	15
Trousers	2,500	20
Kurta	1,800	10
Saree	6,400	25
Jacket	4,000	30

What amount does a customer actually pay for the

shirt?

[Easy]

- (A) Rs. 2,680
(B) Rs. 2,700
(C) Rs. 2,750
- (D) Rs. 2,800
(E) None of these

1245. Five friends run a mobile-accessories business together, each of them keeping his capital in the business for the whole year. The table shows the amount invested by each partner.

Partner	Investment for the year (Rs.)
Rajat	30,000
Sameer	40,000
Tarun	50,000
Umesh	60,000
Vikas	20,000

If the annual profit was Rs. 60,000, what is Tarun's share

of the profit?

[Easy]

- (A) Rs. 6,000
(B) Rs. 9,000
(C) Rs. 12,000
- (D) Rs. 15,000
(E) Rs. 18,000

1246. The table gives the details of five fixed deposits opened on the same day at a bank, all of them earning compound interest compounded annually.

Depositor	Principal (Rs.)	Rate (% p.a.)	Time (years)
Alka	10,000	10	2
Bhaskar	20,000	5	2
Chetan	15,000	20	2
Divya	8,000	25	2
Faiz	12,000	10	2

How much compound interest does Alka

earn on her deposit?

[Easy]

- (A) Rs. 1,000
(B) Rs. 2,000
(C) Rs. 2,100
- (D) Rs. 2,200
(E) Rs. 2,310

1247. The table gives the cost price of one refrigerator and the profit percent earned on it at five dealerships.

Dealer	Cost price (Rs.)	Profit (%)
Ashok	6,000	25
Bimal	8,000	15
Chandra	9,500	20
Devi	7,500	12
Ganesh	5,600	30

By how much does Bimal's selling price exceed Ashok's

selling price?

[Moderate]

- (A) Rs. 1,200
(B) Rs. 1,500
(C) Rs. 1,700
- (D) Rs. 1,900
(E) Rs. 2,000

1248. Two banks offer the following terms on a deposit of Rs. 20,000 kept for 2 years.

Bank	Rate (% p.a.)	Type of interest
Bank X	10	Compound, compounded annually
Bank Y	12	Simple

Which bank gives the larger interest

over the two years, and by how much?

[Moderate]

- (A) Bank X, by Rs. 400
 (B) Bank X, by Rs. 600
 (C) Bank Y, by Rs. 400

- (D) Bank Y, by Rs. 600
 (E) Both give equal interest

1249. The table shows the number of days each clerk of a loan-processing cell needs, working alone, to clear one full stack of applications.

Clerk	Days taken alone
Kiran	12
Latika	18
Manoj	30
Neha	45
Omkar	20

Kiran and Latika begin a stack together, but Kiran is transferred after

4 days and Latika finishes the remaining work alone. For how many more days must Latika work?

[Moderate]

- (A) 6 days
 (B) 7 days
 (C) 8 days
 (D) 9 days
 (E) 10 days

1250. The table shows the downstream and upstream speeds of five motorboats plying on the Ganga.

Boat	Downstream speed (km/h)	Upstream speed (km/h)
P	18	12
Q	20	14
R	24	16
S	15	9
T	22	18

How long does boat P take to travel

60 km downstream and then return the same 60 km upstream?

[Moderate]

- (A) 7 hours 30 minutes
 (B) 8 hours
 (C) 8 hours 20 minutes
 (D) 8 hours 45 minutes
 (E) 9 hours

1251. Three partners started a courier franchise. The table shows the capital each brought in and the number of months for which that capital remained in the business during the year.

Partner	Capital (Rs.)	Months
Nitin	20,000	12
Pooja	30,000	8
Rakesh	40,000	9

If the annual profit was Rs. 56,000, what is Rakesh's share? [Mod-

erate]

- (A) Rs. 16,000
 (B) Rs. 18,000
 (C) Rs. 21,000
 (D) Rs. 24,000
 (E) Rs. 28,000

1252. A dairy cooperative records the contents of five vessels as follows.

Vessel	Total mixture (litres)	Milk : Water
A	60	7 : 3
B	80	5 : 3
C	45	4 : 5
D	90	2 : 1
E	50	3 : 2

If 15 litres of water is added to vessel A, what is the

new ratio of milk to water in vessel A?

[Moderate]

- (A) 7 : 5 (D) 11 : 14
 (B) 14 : 11 (E) 4 : 3
 (C) 3 : 2

1253. The table gives the length and the uniform speed of five suburban trains.

Train	Length (m)	Speed (km/h)
A	180	72
B	150	90
C	240	54
D	200	63
E	160	45

Train A crosses a railway platform completely in 20 seconds.

What is the length of that platform?

[Moderate]

- (A) 180 m (D) 240 m
 (B) 200 m (E) 260 m
 (C) 220 m

1254. Four traders of Ludhiana each borrowed money from a bank at compound interest, compounded annually, and immediately spent the whole loan on stock. Exactly two years later each sold the entire stock at the mark-up shown and repaid the bank in full on the same day.

Trader	Loan taken (Rs.)	Rate (% p.a.)	Stock sold above cost (%)
Harish	50,000	10	30
Ismail	40,000	5	20
Jaya	60,000	10	25
Kabir	80,000	20	35

By how much does Harish's

net gain exceed Jaya's net gain?

[Difficult]

- (A) Rs. 1,800 (D) Rs. 2,700
 (B) Rs. 2,100 (E) Rs. 3,000
 (C) Rs. 2,400

1255. The table shows the time each of three clerks would need, working alone, to reconcile a full month's branch ledger.

Clerk	Days taken alone
Anil	20
Bhavna	30
Chirag	60

All three begin the reconciliation together, but Anil is called away and

stops working exactly 5 days before the job is finished, while Bhavna and Chirag continue to the end. In how many days is the whole reconciliation completed?

[Difficult]

- (A) 10 days (C) $12\frac{1}{2}$ days
 (B) $11\frac{1}{4}$ days (D) 13 days
 (E) 15 days

1256. A survey team may hire any one of five motorboats. The table gives the speed of each boat in still water and the speed of the current in the stretch of river on which it plies.

Boat	Speed in still water (km/h)	Speed of current (km/h)
P	12	3
Q	15	5
R	10	2
S	18	6
T	20	10

Each boat has to go 90 km down-

stream and then return the same 90 km upstream. Which boat completes this round trip in the least time? [Difficult]

- (A) Boat P (D) Boat S
(B) Boat Q (E) Boat T
(C) Boat R

1257. During a clearance sale a showroom marks each article above its cost price and then allows two successive discounts on the marked price, as shown below.

Article	Mark-up above cost (%)	First discount (%)	Second discount (%)
Shirt	60	20	10
Bag	50	25	20
Watch	80	30	25
Shoes	40	10	5

By how many per-

centage points does the profit percent on Shoes exceed the profit percent on the Shirt? [Difficult]

- (A) 3.5 (D) 5.0
(B) 4.0 (E) 5.5
(C) 4.5

1258. A post office offers the five deposit schemes listed below, each paying simple interest.

Scheme	Rate (% p.a.)	Term (years)
P	10	3
Q	12	2
R	8	5
S	15	2
T	9	4

Mr. Iyer divides Rs. 12,000 between Scheme P and Scheme

Q, holding each deposit for its full term, and the two deposits together earn Rs. 3,360 as interest. What amount did he place in Scheme P? [Difficult]

- (A) Rs. 6,000 (D) Rs. 9,000
(B) Rs. 7,200 (E) Rs. 9,600
(C) Rs. 8,000

1259. Two trains run on parallel tracks in the same direction. The details are given below.

Train	Length (m)	Speed (km/h)
A	150	90
B	200	72

How long does the faster train take to overtake the slower train

completely, measured from the moment the engine of A reaches the rear of B until the rear of A clears the engine of B? [Difficult]

- (A) 50 seconds (D) 75 seconds
(B) 60 seconds (E) 80 seconds
(C) 70 seconds

1260. Anita and Baldev started a business together for one year. The table records the capital each of them began with and the change each of them made to that capital exactly at the end of 6 months.

Partner	Capital at the start (Rs.)	Change after 6 months
Anita	40,000	Brought in Rs. 20,000 more
Baldev	60,000	Withdrew Rs. 10,000

If the profit for the year was Rs. 1,05,000,

by how much does Baldev's share of the profit exceed Anita's share? [Difficult]

- (A) Rs. 2,500
- (B) Rs. 5,000
- (C) Rs. 7,500
- (D) Rs. 10,000
- (E) None of these

Section 1.12

1.12.1 Two-statement data sufficiency

[checked]

1261. What is Ravi's present age?

I. Ravi's present age is 3 times Sunita's present age.

II. Sunita's present age is 12 years.

[Easy]

- (A) The data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- (B) The data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- (C) The data in Statement I alone or in Statement II alone are sufficient to answer the question.
- (D) The data in both Statements I and II together are not sufficient to answer the question.
- (E) The data in both Statements I and II together are necessary to answer the question.

1262. What is the two-digit number?

I. The sum of the two digits of the number is 9.

II. The difference between the two digits of the number is 3.

[Easy]

- (A) The data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- (B) The data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- (C) The data in Statement I alone or in Statement II alone are sufficient to answer the question.
- (D) The data in both Statements I and II together are not sufficient to answer the question.
- (E) The data in both Statements I and II together are necessary to answer the question.

1263. What is the rate of simple interest per annum offered by a bank?

I. A sum deposited at this rate doubles itself in 8 years under simple interest.

II. The simple interest earned on a deposit in 2 years at this rate is Rs. 2,000.

[Easy]

- (A) The data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- (B) The data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- (C) The data in Statement I alone or in Statement II alone are sufficient to answer the question.
- (D) The data in both Statements I and II together are not sufficient to answer the question.
- (E) The data in both Statements I and II together are necessary to answer the question.

1264. In how many days can Mahesh alone complete a piece of work?

I. Mahesh and Naveen working together can complete the same work in 12 days.

II. Naveen alone can complete the same work in 20 days.

[Easy]

- (A) The data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- (B) The data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- (C) The data in Statement I alone or in Statement II alone are sufficient to answer the question.
- (D) The data in both Statements I and II together are not sufficient to answer the question.

(E) The data in both Statements I and II together are necessary to answer the question.

1265. What is the total number of students in a class?

I. The number of boys in the class is 24, which is 60% of the total strength of the class.

II. The ratio of the number of boys to the number of girls in the class is 3 : 2. [Easy]

- (A) The data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- (B) The data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- (C) The data in Statement I alone or in Statement II alone are sufficient to answer the question.
- (D) The data in both Statements I and II together are not sufficient to answer the question.
- (E) The data in both Statements I and II together are necessary to answer the question.

1266. What is the cost price of a wrist watch sold by a shopkeeper in Nashik?

I. The watch is marked at Rs. 900 and is sold after allowing a discount of 20% on the marked price.

II. The shopkeeper earns a profit of Rs. 120 on the watch, which is 20% of its cost price. [Easy]

- (A) The data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- (B) The data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- (C) The data in Statement I alone or in Statement II alone are sufficient to answer the question.
- (D) The data in both Statements I and II together are not sufficient to answer the question.
- (E) The data in both Statements I and II together are necessary to answer the question.

1267. What is the average age of the five members of the Deshmukh family?

I. The sum of the ages of all five members is 160 years.

II. The average age of the four elder members is 38 years and the youngest member is 8 years old. [Easy]

- (A) The data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- (B) The data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- (C) The data in Statement I alone or in Statement II alone are sufficient to answer the question.
- (D) The data in both Statements I and II together are not sufficient to answer the question.
- (E) The data in both Statements I and II together are necessary to answer the question.

1268. What is the two-digit number?

I. The number obtained by interchanging the two digits of the number is 27 more than the original number.

II. The sum of the two digits of the number is 11. [Moderate]

- (A) The data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- (B) The data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- (C) The data in Statement I alone or in Statement II alone are sufficient to answer the question.
- (D) The data in both Statements I and II together are not sufficient to answer the question.
- (E) The data in both Statements I and II together are necessary to answer the question.

1269. What is the rate of compound interest per annum, interest being compounded annually?

I. The compound interest on Rs. 8,000 for 2 years at this rate is Rs. 1,680.

II. The difference between the compound interest and the simple interest on Rs. 8,000 for 2 years at this rate is Rs. 80. [Moderate]

- (A) The data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- (B) The data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- (C) The data in Statement I alone or in Statement II alone are sufficient to answer the question.
- (D) The data in both Statements I and II together are not sufficient to answer the question.
- (E) The data in both Statements I and II together are necessary to answer the question.

1270. What is the speed of a boat in still water?

I. The boat covers 36 km downstream in 3 hours.

II. The speed of the boat downstream is 12 km/h. [Moderate]

- (A) The data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- (B) The data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- (C) The data in Statement I alone or in Statement II alone are sufficient to answer the question.
- (D) The data in both Statements I and II together are not sufficient to answer the question.
- (E) The data in both Statements I and II together are necessary to answer the question.

1271. Ajay, Bhaskar and Chetan started a business together. What is Bhaskar's share in the annual profit?

I. Their investments, which remained unchanged throughout the year, are in the ratio 4 : 5 : 6 and the total annual profit is Rs. 45,000.

II. Bhaskar invested Rs. 50,000 and Ajay invested Rs. 40,000, both for the whole year. [Moderate]

- (A) The data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- (B) The data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- (C) The data in Statement I alone or in Statement II alone are sufficient to answer the question.
- (D) The data in both Statements I and II together are not sufficient to answer the question.
- (E) The data in both Statements I and II together are necessary to answer the question.

1272. A grocer in Indore mixes a cheaper variety of rice with a dearer variety. What is the price per kg of the cheaper variety?

I. He mixes the cheaper and the dearer varieties in the ratio 3 : 2, the dearer variety costs Rs. 60 per kg, and the mixture costs him Rs. 48 per kg.

II. When equal quantities of the two varieties are mixed, the mixture costs Rs. 50 per kg, and the dearer variety costs Rs. 60 per kg. [Moderate]

- (A) The data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- (B) The data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- (C) The data in Statement I alone or in Statement II alone are sufficient to answer the question.
- (D) The data in both Statements I and II together are not sufficient to answer the question.
- (E) The data in both Statements I and II together are necessary to answer the question.

1273. What is the area of a rectangular plot of land?

I. The perimeter of the plot is 90 metres.

II. The length of the plot is twice its breadth and its diagonal measures $15\sqrt{5}$ metres. [Moderate]

- (A) The data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- (B) The data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- (C) The data in Statement I alone or in Statement II alone are sufficient to answer the question.
- (D) The data in both Statements I and II together are not sufficient to answer the question.
- (E) The data in both Statements I and II together are necessary to answer the question.

1274. How many girls are there in a coaching batch?

I. The number of boys in the batch is 40% more than the number of girls.

II. The ratio of the number of girls to the number of boys in the batch is 5 : 7. [Moderate]

- (A) The data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- (B) The data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- (C) The data in Statement I alone or in Statement II alone are sufficient to answer the question.
- (D) The data in both Statements I and II together are not sufficient to answer the question.
- (E) The data in both Statements I and II together are necessary to answer the question.

1275. A certain sum is invested at 10% per annum for 2 years. What is the sum?

I. The compound interest credited in the second year exceeds the compound interest credited in the first year by Rs. 250, interest being compounded annually.

II. The compound interest for the two years exceeds the simple interest for the same period at the same rate by Rs. 250. [Difficult]

- (A) The data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- (B) The data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- (C) The data in Statement I alone or in Statement II alone are sufficient to answer the question.
- (D) The data in both Statements I and II together are not sufficient to answer the question.
- (E) The data in both Statements I and II together are necessary to answer the question.

1276. What is Ramesh's present age?

I. The ratio of the present ages of Ramesh and his father is 2 : 5.

II. Five years from now, the ratio of the ages of Ramesh and his father will be 5 : 11. [Difficult]

- (A) The data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- (B) The data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- (C) The data in Statement I alone or in Statement II alone are sufficient to answer the question.
- (D) The data in both Statements I and II together are not sufficient to answer the question.
- (E) The data in both Statements I and II together are necessary to answer the question.

1277. What is the speed of a train running at a uniform speed?

I. The train crosses a stationary pole in 9 seconds.

II. The train crosses a platform 300 m long in 21 seconds and another platform 200 m long in 17 seconds. [Difficult]

- (A) The data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.

- (B) The data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- (C) The data in Statement I alone or in Statement II alone are sufficient to answer the question.
- (D) The data in both Statements I and II together are not sufficient to answer the question.
- (E) The data in both Statements I and II together are necessary to answer the question.

1278. What is the value of x ?

I. $x^2 - 5x + 6 = 0$

II. $x^3 - 5x^2 + 6x = 0$

[Difficult]

- (A) The data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- (B) The data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- (C) The data in Statement I alone or in Statement II alone are sufficient to answer the question.
- (D) The data in both Statements I and II together are not sufficient to answer the question.
- (E) The data in both Statements I and II together are necessary to answer the question.

1279. From a container completely full of pure milk, 8 litres are drawn out and replaced by water; the same operation is then performed once more on the resulting mixture. What is the capacity of the container?

I. In the final mixture the ratio of milk to water is 9 : 16.

II. The final mixture contains 7.2 litres of milk.

[Difficult]

- (A) The data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- (B) The data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- (C) The data in Statement I alone or in Statement II alone are sufficient to answer the question.
- (D) The data in both Statements I and II together are not sufficient to answer the question.
- (E) The data in both Statements I and II together are necessary to answer the question.

1280. In how many days can Anil, Bharat and Charu working together complete a piece of work?

I. Anil and Bharat together can complete the work in 8 days, and Bharat and Charu together can complete it in 12 days.

II. Anil and Charu together can complete the work in 8 days.

[Difficult]

- (A) The data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- (B) The data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.
- (C) The data in Statement I alone or in Statement II alone are sufficient to answer the question.
- (D) The data in both Statements I and II together are not sufficient to answer the question.
- (E) The data in both Statements I and II together are necessary to answer the question.

1281. What is the average monthly income of the four employees Amit, Bina, Chandan and Deepa?

I. The average monthly income of Amit and Bina is Rs. 32,000, and Chandan's monthly income is Rs. 28,000.

II. The average monthly income of Bina, Chandan and Deepa is Rs. 30,000.

[Difficult]

- (A) The data in Statement I alone are sufficient to answer the question, while the data in Statement II alone are not sufficient to answer the question.
- (B) The data in Statement II alone are sufficient to answer the question, while the data in Statement I alone are not sufficient to answer the question.

- (C) The data in Statement I alone or in Statement II alone are sufficient to answer the question.
- (D) The data in both Statements I and II together are not sufficient to answer the question.
- (E) The data in both Statements I and II together are necessary to answer the question.

1.12.2 Three-statement data sufficiency

[checked, 1 flagged]

1282. Directions: The question below is followed by three statements I, II and III. Decide which of the statements are necessary to answer the question.

What is the cost of painting the four walls of a rectangular hall?

I. The area of the floor of the hall is 300 sq m.

II. The height of the hall is 5 m and the cost of painting is Rs. 25 per sq m.

III. The perimeter of the floor of the hall is 70 m.

[Easy]

- (A) I and II only
- (B) II and III only
- (C) I and III only
- (D) All I, II and III are necessary
- (E) Even all I, II and III together are not sufficient

1283. Directions: The question below is followed by three statements I, II and III. Decide which of the statements are necessary to answer the question.

What is the two-digit number?

I. The number obtained by interchanging its two digits is 27 less than the original number.

II. The sum of the two digits of the number is 11.

III. The difference between the two digits of the number is 3.

[Easy]

- (A) I and II together are sufficient, while II and III together are not
- (B) II and III together are sufficient, while I and II together are not
- (C) Either I and II together, or II and III together, are sufficient
- (D) All I, II and III are necessary
- (E) Even all I, II and III together are not sufficient

1284. Directions: The question below is followed by three statements I, II and III. Decide which of the statements are necessary to answer the question.

What is Rohit's present age?

I. Rohit's present age is twice his son's present age.

II. Five years ago Rohit's age was three times his son's age at that time.

III. The sum of the present ages of Rohit and his son is 30 years.

[Easy]

- (A) I and II only
- (B) I and III only
- (C) II and III only
- (D) Any two of the three statements are sufficient
- (E) All I, II and III are necessary

1285. Directions: The question below is followed by three statements I, II and III. Decide which of the statements are necessary to answer the question.

What is Suresh's monthly income?

I. Suresh spends 25% of his monthly income on house rent.

II. Suresh pays Rs. 6,000 per month as house rent.

III. Suresh saves Rs. 9,000 every month.

[Easy]

- (A) I and II only
- (B) II and III only

- (C) I and III only
- (D) All I, II and III are necessary
- (E) Any two of the three statements are sufficient

1286. Directions: The question below is followed by three statements I, II and III. Decide which of the statements are necessary to answer the question.

What is Nisha's monthly salary?

- I. Nisha's monthly salary is Rs. 4,000 more than Priya's monthly salary.
- II. Priya's monthly salary is 80% of Ravi's monthly salary.
- III. Ravi's monthly salary is Rs. 25,000.

[Easy]

- (A) I and II only
- (B) II and III only
- (C) I and III only
- (D) All I, II and III are necessary
- (E) Even all I, II and III together are not sufficient

1287. Directions: The question below is followed by three statements I, II and III. Decide which of the statements are necessary to answer the question.

What is the average weight of the five members of the Deshmukh family?

- I. The total weight of the five members together is 250 kg.
- II. The heaviest member of the family weighs 70 kg.
- III. The lightest member of the family weighs 40 kg.

[Easy]

- (A) I alone is sufficient
- (B) I and II only
- (C) I and III only
- (D) All I, II and III are necessary
- (E) Even all I, II and III together are not sufficient

1288. Directions: The question below is followed by three statements I, II and III. Decide which of the statements are necessary to answer the question.

In a bank recruitment examination, what was the total number of candidates who appeared?

- I. 60% of the candidates who appeared were declared passed.
- II. 480 candidates failed the examination.
- III. 720 candidates passed the examination.

[Easy]

- (A) I and II only
- (B) II and III only
- (C) Any two of the three statements are sufficient
- (D) All I, II and III are necessary
- (E) Even all I, II and III together are not sufficient

1289. Directions: The question below is followed by three statements I, II and III. Decide which of the statements are necessary to answer the question.

What is the rate of interest per cent per annum?

- I. A sum of money doubles itself in 8 years at simple interest.
- II. The sum invested is Rs. 15,000.
- III. The simple interest earned on that sum in 4 years is Rs. 7,500.

[Moderate]

- (A) I alone is sufficient, while II and III together are not
- (B) II and III together are sufficient, while I alone is not
- (C) Either I alone, or II and III together, are sufficient
- (D) All I, II and III are necessary

(E) Even all I, II and III together are not sufficient

1290. Directions: The question below is followed by three statements I, II and III. Decide which of the statements are necessary to answer the question.

What is the cost price of the article sold by Mahesh?

I. Mahesh sold the article at a profit of 20%.

II. Had Mahesh sold the article for Rs. 60 more, his profit percentage would have been 5 percentage points higher.

III. The selling price of the article is Rs. 1,440.

[Moderate]

(A) II alone is sufficient

(B) I and II only

(C) II and III only

(D) All I, II and III are necessary

(E) Even all I, II and III together are not sufficient

1291. Directions: The question below is followed by three statements I, II and III. Decide which of the statements are necessary to answer the question.

In how many days can Anil and Bhaskar working together complete a piece of work?

I. Anil alone can complete the work in 15 days.

II. Bhaskar is 50% more efficient than Anil.

III. Anil and Chetan working together can complete the same work in 6 days.

[Moderate]

(A) II and III only

(B) I and II only

(C) I and III only

(D) All I, II and III are necessary

(E) Even all I, II and III together are not sufficient

1292. Directions: The question below is followed by three statements I, II and III. Decide which of the statements are necessary to answer the question.

What is the average marks obtained by the whole class in Mathematics?

I. The class has 40 students.

II. The average marks of the top 25 students is 76.

III. The average marks of the remaining students is 58.

[Moderate]

(A) I and II only

(B) II and III only

(C) I and III only

(D) Any two of the three statements are sufficient

(E) All I, II and III are necessary

1293. Directions: The question below is followed by three statements I, II and III. Decide which of the statements are necessary to answer the question.

What is Bhavesh's share in the annual profit of a partnership firm in which each partner's capital stayed invested for the whole year?

I. Amit, Bhavesh and Chirag invested their capitals in the ratio 4 : 5 : 6.

II. The total annual profit of the firm is Rs. 90,000.

III. Chirag invested Rs. 1,20,000.

[Moderate]

(A) II and III only

(B) I and III only

(C) I and II only

(D) All I, II and III are necessary

(E) Even all I, II and III together are not sufficient

1294. Directions: The question below is followed by three statements I, II and III. Decide which of the statements are necessary to answer the question.

What is the speed of the stream?

I. A motorboat covers 24 km downstream in 2 hours.

II. The motorboat takes 1 hour more to cover 24 km upstream than it takes to cover the same distance downstream.

III. The speed of the motorboat in still water is 5 times the speed of the stream. [Moderate]

(A) I and II only

(B) I and III only

(C) II and III only

(D) Any two of the three statements are sufficient

(E) All I, II and III are necessary

1295. Directions: The question below is followed by three statements I, II and III. Decide which of the statements are necessary to answer the question.

What is the total number of students in the college?

I. 45% of the students in the college are girls.

II. The ratio of the number of boys to the number of girls in the college is 11 : 9.

III. The number of girls in the college is more than 800. [Moderate]

(A) I and II only

(B) II and III only

(C) All I, II and III are necessary

(D) Even all I, II and III together are not sufficient

(E) I and III only

1296. Directions: The question below is followed by three statements I, II and III. Decide which of the statements are necessary to answer the question.

What is the sum of money invested by Ramesh?

I. The compound interest earned in the second year, interest being compounded annually, is Rs. 2,160.

II. The compound interest earned in the third year is Rs. 2,332.80.

III. The simple interest on the same sum at the same rate for 2 years is Rs. 4,000. [Difficult]

(A) I and II only

(B) II and III only

(C) I and III only

(D) Any two of the three statements are sufficient

(E) All I, II and III are necessary

1297. Directions: The question below is followed by three statements I, II and III. Decide which of the statements are necessary to answer the question.

What is the distance between town A and town B?

I. A car travelling at 60 km/h covers the distance in 20 minutes less than a bus travelling at 45 km/h.

II. A train covers the same distance in 45 minutes at an average speed of 80 km/h.

III. A cyclist covers the same distance in 4 hours. [Difficult]

(A) I alone is sufficient, while II alone is not

(B) II alone is sufficient, while I alone is not

(C) Either I alone or II alone is sufficient

(D) III alone is sufficient

(E) All I, II and III are necessary

1298. Directions: The question below is followed by three statements I, II and III. Decide which of the statements are necessary to answer the question.

How many litres of milk did the vessel contain initially?

I. The vessel contained milk and water in the ratio 5 : 3.

II. When 16 litres of the mixture was drawn off and replaced by an equal quantity of water, the ratio of milk to water became 5 : 7.

III. The maximum capacity of the vessel is 60 litres.

[Difficult]

(A) I and II only

(B) II and III only

(C) I and III only

(D) All I, II and III are necessary

(E) Even all I, II and III together are not sufficient

1299. Directions: The question below is followed by three statements I, II and III. Decide which of the statements are necessary to answer the question.

What is the total number of coins in the cash box?

I. The box contains coins of Re. 1, Rs. 2 and Rs. 5 only, and their numbers are in the ratio 5 : 3 : 2.

II. The total value of all the coins in the box is Rs. 2,100.

III. The number of Rs. 5 coins in the box is 200.

[Difficult]

(A) I and II together are sufficient, while I and III together are not

(B) I and III together are sufficient, while I and II together are not

(C) Either I and II together, or I and III together, are sufficient

(D) All I, II and III are necessary

(E) Even all I, II and III together are not sufficient

1300. Directions: The question below is followed by three statements I, II and III. Decide which of the statements are necessary to answer the question.

What is the present population of the town of Wardha?

I. The population of the town increased by 10% during the first year.

II. The population of the town increased by 20% during the second year.

III. The population of the town two years ago was 25,000.

[Difficult]

(A) I and II only

(B) II and III only

(C) I and III only

(D) All I, II and III are necessary

(E) Even all I, II and III together are not sufficient

1301. Directions: The question below is followed by three statements I, II and III. Decide which of the statements are necessary to answer the question.

What is the volume of the closed cylindrical water tank installed at the bank's premises?

I. The curved surface area of the tank is 440 sq m.

II. The total surface area of the tank is 748 sq m.

III. The steel sheet used to make the tank costs Rs. 50 per sq m.

[Difficult]

(A) I and III only

(B) I and II only

(C) II and III only

(D) All I, II and III are necessary

(E) Even all I, II and III together are not sufficient

1302. Directions: The question below is followed by three statements I, II and III. Decide which of

the statements are necessary to answer the question.

What is the cost price of the saree sold at Kamala Emporium?

- I. The saree was sold at a profit of 26%.
- II. The marked price of the saree is 40% above its cost price.
- III. A discount of 10% was allowed on the marked price.

[Difficult]

- (A) I and II only
- (B) II and III only
- (C) All I, II and III are necessary
- (D) Any two of the three statements are sufficient
- (E) Even all I, II and III together are not sufficient

1.12.3 Quantity I vs Quantity II comparison

[checked, 1 flagged]

1303. Directions: The question below consists of two quantities, Quantity I and Quantity II. Find the value of each and choose the option that states the *exact* relation between them. (The relations ' $\geq$ ' and ' $\leq$ ' are to be chosen only when the two quantities can be equal for some admissible values and unequal for others; if more than one relation is possible, no relation can be established.)

Quantity I: The simple interest earned by Mr. Deshmukh on a deposit of Rs. 12,000 at 8% per annum for 3 years.

Quantity II: The simple interest earned by Mrs. Nair on a deposit of Rs. 15,000 at 6% per annum for 2 years.

[Easy]

- (A) Quantity I < Quantity II
- (B) Quantity I > Quantity II
- (C) Quantity I = Quantity II
- (D) Quantity I $\geq$ Quantity II
- (E) No relation can be established between Quantity I and Quantity II

1304. Directions: The question below consists of two quantities, Quantity I and Quantity II. Find the value of each and choose the option that states the *exact* relation between them. (The relations ' $\geq$ ' and ' $\leq$ ' are to be chosen only when the two quantities can be equal for some admissible values and unequal for others; if more than one relation is possible, no relation can be established.)

Quantity I: The average of eight consecutive even numbers beginning with 12.

Quantity II: The average of the first nine multiples of 4.

[Easy]

- (A) Quantity I > Quantity II
- (B) Quantity I = Quantity II
- (C) Quantity I < Quantity II
- (D) Quantity I $\leq$ Quantity II
- (E) No relation can be established between Quantity I and Quantity II

1305. Directions: The question below consists of two quantities, Quantity I and Quantity II. Find the value of each and choose the option that states the *exact* relation between them. (The relations ' $\geq$ ' and ' $\leq$ ' are to be chosen only when the two quantities can be equal for some admissible values and unequal for others; if more than one relation is possible, no relation can be established.)

Quantity I: Anita's share when Rs. 4,500 is divided among Anita, Bina and Chetan in the ratio 4 : 5 : 6.

Quantity II: Bina's share when Rs. 3,600 is divided among Bina, Dinesh and Farhan in the ratio 4 : 3 : 5.

[Easy]

- (A) Quantity I > Quantity II
- (B) Quantity I < Quantity II
- (C) Quantity I $\geq$ Quantity II

- (D) Quantity I = Quantity II
(E) No relation can be established between Quantity I and Quantity II

1306. Directions: The question below consists of two quantities, Quantity I and Quantity II. Find the value of each and choose the option that states the *exact* relation between them. (The relations ' $\geq$ ' and ' $\leq$ ' are to be chosen only when the two quantities can be equal for some admissible values and unequal for others; if more than one relation is possible, no relation can be established.)

A branch of a bank sanctioned 720 home loans and 560 vehicle loans during a financial year.

Quantity I: 45% of the home loans sanctioned.

Quantity II: 60% of the vehicle loans sanctioned.

[Easy]

- (A) Quantity I < Quantity II
(B) Quantity I > Quantity II
(C) Quantity I = Quantity II
(D) Quantity I $\geq$ Quantity II
(E) No relation can be established between Quantity I and Quantity II

1307. Directions: The question below consists of two quantities, Quantity I and Quantity II. Find the value of each and choose the option that states the *exact* relation between them. (The relations ' $\geq$ ' and ' $\leq$ ' are to be chosen only when the two quantities can be equal for some admissible values and unequal for others; if more than one relation is possible, no relation can be established.)

Quantity I: The time taken by a train 180 m long, running at 54 km/h, to cross a signal pole.

Quantity II: The time taken by a train 200 m long, running at 72 km/h, to cross a signal pole. [Easy]

- (A) Quantity I = Quantity II
(B) Quantity I < Quantity II
(C) Quantity I $\geq$ Quantity II
(D) No relation can be established between Quantity I and Quantity II
(E) Quantity I > Quantity II

1308. Directions: The question below consists of two quantities, Quantity I and Quantity II. Find the value of each and choose the option that states the *exact* relation between them. (The relations ' $\geq$ ' and ' $\leq$ ' are to be chosen only when the two quantities can be equal for some admissible values and unequal for others; if more than one relation is possible, no relation can be established.)

Quantity I: The profit percent earned by a dealer who buys a mixer grinder for Rs. 450 and sells it for Rs. 540.

Quantity II: The profit percent earned by the same dealer on an induction cooktop bought for Rs. 800 and sold for Rs. 1,000. [Easy]

- (A) Quantity I > Quantity II
(B) Quantity I < Quantity II
(C) Quantity I = Quantity II
(D) Quantity I $\leq$ Quantity II
(E) No relation can be established between Quantity I and Quantity II

1309. Directions: The question below consists of two quantities, Quantity I and Quantity II. Find the value of each and choose the option that states the *exact* relation between them. (The relations ' $\geq$ ' and ' $\leq$ ' are to be chosen only when the two quantities can be equal for some admissible values and unequal for others; if more than one relation is possible, no relation can be established.)

Quantity I: The area, in sq cm, of a square plot whose perimeter is 48 cm.

Quantity II: The area, in sq cm, of a triangle whose base is 24 cm and corresponding height is 10 cm. [Easy]

- (A) Quantity I < Quantity II

- (B) Quantity I = Quantity II
- (C) Quantity I > Quantity II
- (D) Quantity I $\geq$ Quantity II
- (E) No relation can be established between Quantity I and Quantity II

1310. Directions: The question below consists of two quantities, Quantity I and Quantity II. Find the value of each and choose the option that states the *exact* relation between them. (The relations ' $\geq$ ' and ' $\leq$ ' are to be chosen only when the two quantities can be equal for some admissible values and unequal for others; if more than one relation is possible, no relation can be established.)

Quantity I: The larger root of the equation $x^2 - 13x + 42 = 0$.

Quantity II: The smaller root of the equation $y^2 - 15y + 56 = 0$.

[Moderate]

- (A) Quantity I > Quantity II
- (B) Quantity I < Quantity II
- (C) Quantity I = Quantity II
- (D) Quantity I $\leq$ Quantity II
- (E) No relation can be established between Quantity I and Quantity II

1311. Directions: The question below consists of two quantities, Quantity I and Quantity II. Find the value of each and choose the option that states the *exact* relation between them. (The relations ' $\geq$ ' and ' $\leq$ ' are to be chosen only when the two quantities can be equal for some admissible values and unequal for others; if more than one relation is possible, no relation can be established.)

A motorboat owned by Ravi covers 48 km downstream in 3 hours and the same 48 km upstream in 4 hours.

Quantity I: The speed of Ravi's boat in still water, in km/h.

Quantity II: The speed in still water of a second boat, which covers 65 km in 5 hours in still water.

[Moderate]

- (A) Quantity I > Quantity II
- (B) Quantity I < Quantity II
- (C) Quantity I = Quantity II
- (D) Quantity I $\geq$ Quantity II
- (E) No relation can be established between Quantity I and Quantity II

1312. Directions: The question below consists of two quantities, Quantity I and Quantity II. Find the value of each and choose the option that states the *exact* relation between them. (The relations ' $\geq$ ' and ' $\leq$ ' are to be chosen only when the two quantities can be equal for some admissible values and unequal for others; if more than one relation is possible, no relation can be established.)

Quantity I: The compound interest on Rs. 10,000 at 10% per annum for 2 years, compounded annually.

Quantity II: The simple interest on Rs. 13,000 at 8% per annum for 2 years.

[Moderate]

- (A) Quantity I < Quantity II
- (B) Quantity I = Quantity II
- (C) Quantity I $\geq$ Quantity II
- (D) Quantity I > Quantity II
- (E) No relation can be established between Quantity I and Quantity II

1313. Directions: The question below consists of two quantities, Quantity I and Quantity II. Find the value of each and choose the option that states the *exact* relation between them. (The relations ' $\geq$ ' and ' $\leq$ ' are to be chosen only when the two quantities can be equal for some admissible values and unequal for others; if more than one relation is possible, no relation can be established.)

Ajay alone can complete a piece of data-entry work in 12 days and Vijay alone can complete it in 18 days.

Quantity I: The number of days in which Ajay and Vijay working together complete the work.

Quantity II: The number of days in which Sanjay alone completes the work, given that Sanjay is thrice as efficient as Vijay. [Moderate]

- (A) Quantity I < Quantity II
- (B) Quantity I = Quantity II
- (C) No relation can be established between Quantity I and Quantity II
- (D) Quantity I $\leq$ Quantity II
- (E) Quantity I > Quantity II

1314. Directions: The question below consists of two quantities, Quantity I and Quantity II. Find the value of each and choose the option that states the *exact* relation between them. (The relations ' $\geq$ ' and ' $\leq$ ' are to be chosen only when the two quantities can be equal for some admissible values and unequal for others; if more than one relation is possible, no relation can be established.)

A vessel in a dairy contains 60 litres of a mixture of milk and water in the ratio 7 : 3.

Quantity I: The quantity of water, in litres, that must be added to the vessel so that the ratio of milk to water becomes 7 : 5.

Quantity II: The quantity of milk, in litres, that must be added to the original vessel so that the ratio of milk to water becomes 4 : 1. [Moderate]

- (A) Quantity I > Quantity II
- (B) Quantity I < Quantity II
- (C) Quantity I = Quantity II
- (D) Quantity I $\geq$ Quantity II
- (E) No relation can be established between Quantity I and Quantity II

1315. Directions: The question below consists of two quantities, Quantity I and Quantity II. Find the value of each and choose the option that states the *exact* relation between them. (The relations ' $\geq$ ' and ' $\leq$ ' are to be chosen only when the two quantities can be equal for some admissible values and unequal for others; if more than one relation is possible, no relation can be established.)

Rakesh started a business with Rs. 40,000 and remained in it for 12 months. Mahesh joined later with Rs. 75,000 and remained for 8 months. At the end of the year the profit was Rs. 54,000.

Quantity I: Rakesh's share of the profit.

Quantity II: Mahesh's share of the profit. [Moderate]

- (A) Quantity I > Quantity II
- (B) Quantity I = Quantity II
- (C) Quantity I $\leq$ Quantity II
- (D) Quantity I < Quantity II
- (E) No relation can be established between Quantity I and Quantity II

1316. Directions: The question below consists of two quantities, Quantity I and Quantity II. Find the value of each and choose the option that states the *exact* relation between them. (The relations ' $\geq$ ' and ' $\leq$ ' are to be chosen only when the two quantities can be equal for some admissible values and unequal for others; if more than one relation is possible, no relation can be established.)

A bag used in a school lottery contains 5 red, 4 green and 3 blue balls. Two balls are drawn at random together.

Quantity I: The probability that both the balls drawn are red.

Quantity II: The probability that one ball drawn is green and the other is blue. [Moderate]

- (A) Quantity I < Quantity II
- (B) Quantity I > Quantity II
- (C) Quantity I = Quantity II
- (D) Quantity I $\geq$ Quantity II
- (E) No relation can be established between Quantity I and Quantity II

1317. Directions: The question below consists of two quantities, Quantity I and Quantity II. Find the value of each and choose the option that states the *exact* relation between them. (The relations ' $\geq$ ' and ' $\leq$ ' are to be chosen only when the two quantities can be equal for some admissible values and unequal for others; if more than one relation is possible, no relation can be established.)

Quantity I: The profit percent of a trader who marks an article 40% above its cost price and then allows two successive discounts of 10% and 5%.

Quantity II: The profit percent of a trader who marks an identical article 25% above its cost price and then allows a single discount of 4%. [Difficult]

- (A) Quantity I > Quantity II
- (B) Quantity I = Quantity II
- (C) Quantity I < Quantity II
- (D) Quantity I $\geq$ Quantity II
- (E) No relation can be established between Quantity I and Quantity II

1318. Directions: The question below consists of two quantities, Quantity I and Quantity II. Find the value of each and choose the option that states the *exact* relation between them. (The relations ' $\geq$ ' and ' $\leq$ ' are to be chosen only when the two quantities can be equal for some admissible values and unequal for others; if more than one relation is possible, no relation can be established.)

The average age of the five members of the Iyer family is 28 years. When the youngest member, aged 6 years, is excluded, the average age of the remaining four members is 33.5 years.

Quantity I: The average age, in years, of the four elder members at the time the youngest member was born.

Quantity II: The average age, in years, of all five members two years ago. [Difficult]

- (A) Quantity I < Quantity II
- (B) Quantity I = Quantity II
- (C) Quantity I $\geq$ Quantity II
- (D) No relation can be established between Quantity I and Quantity II
- (E) Quantity I > Quantity II

1319. Directions: The question below consists of two quantities, Quantity I and Quantity II. Find the value of each and choose the option that states the *exact* relation between them. (The relations ' $\geq$ ' and ' $\leq$ ' are to be chosen only when the two quantities can be equal for some admissible values and unequal for others; if more than one relation is possible, no relation can be established.)

Two trains of lengths 180 m and 220 m run on parallel tracks at 72 km/h and 54 km/h respectively.

Quantity I: The time, in seconds, taken by the faster train to completely overtake the slower one when both run in the same direction.

Quantity II: The time, in seconds, taken by the faster train to cross a platform 420 m long. [Difficult]

- (A) Quantity I > Quantity II
- (B) Quantity I < Quantity II
- (C) Quantity I = Quantity II
- (D) Quantity I $\leq$ Quantity II
- (E) No relation can be established between Quantity I and Quantity II

1320. Directions: The question below consists of two quantities, Quantity I and Quantity II. Find the value of each and choose the option that states the *exact* relation between them. (The relations ' $\geq$ ' and ' $\leq$ ' are to be chosen only when the two quantities can be equal for some admissible values and unequal for others; if more than one relation is possible, no relation can be established.)

A water tank at a bank's staff quarters is served by two inlet pipes A and B, which alone can fill it in 20 minutes and 30 minutes respectively, and by a waste pipe C, which alone can empty the full tank in 15 minutes.

Quantity I: The time, in minutes, to fill the empty tank when A, B and C are all kept open throughout.

Quantity II: The time, in minutes, to fill the empty tank when A and B are kept open throughout but C is open only during the first 30 minutes. [Difficult]

- (A) Quantity I < Quantity II
- (B) Quantity I > Quantity II
- (C) Quantity I = Quantity II
- (D) Quantity I $\geq$ Quantity II
- (E) No relation can be established between Quantity I and Quantity II

1321. Directions: The question below consists of two quantities, Quantity I and Quantity II. Find the value of each and choose the option that states the *exact* relation between them. (The relations ' $\geq$ ' and ' $\leq$ ' are to be chosen only when the two quantities can be equal for some admissible values and unequal for others; if more than one relation is possible, no relation can be established.)

In a recruitment test taken by 6,000 candidates, 52% passed in English and 42% passed in Mathematics, while 17% passed in both the subjects.

Quantity I: The number of candidates who failed in both the subjects.

Quantity II: The number of candidates who passed in English but not in Mathematics. [Difficult]

- (A) Quantity I > Quantity II
- (B) Quantity I = Quantity II
- (C) Quantity I $\geq$ Quantity II
- (D) Quantity I < Quantity II
- (E) No relation can be established between Quantity I and Quantity II

1322. Directions: The question below consists of two quantities, Quantity I and Quantity II. Find the value of each and choose the option that states the *exact* relation between them. (The relations ' $\geq$ ' and ' $\leq$ ' are to be chosen only when the two quantities can be equal for some admissible values and unequal for others; if more than one relation is possible, no relation can be established.)

Quantity I: x , where $x^2 - 9x + 20 = 0$.

Quantity II: y , where $y^2 - 7y + 12 = 0$. [Difficult]

- (A) Quantity I > Quantity II
- (B) Quantity I < Quantity II
- (C) Quantity I = Quantity II
- (D) Quantity I $\geq$ Quantity II
- (E) No relation can be established between Quantity I and Quantity II

1323. Directions: The question below consists of two quantities, Quantity I and Quantity II. Find the value of each and choose the option that states the *exact* relation between them. (The relations ' $\geq$ ' and ' $\leq$ ' are to be chosen only when the two quantities can be equal for some admissible values and unequal for others; if more than one relation is possible, no relation can be established.)

Mr. Bhatia invests a total of Rs. 50,000 for one year, putting part of it in scheme A, which pays simple interest at 8% per annum, and the remainder in scheme B, which pays simple interest at 12% per annum. The amount invested in scheme A is more than Rs. 15,000 but less than Rs. 30,000.

Quantity I: The total interest, in rupees, earned by Mr. Bhatia in one year.

Quantity II: Rs. 5,200. [Difficult]

- (A) Quantity I > Quantity II
- (B) Quantity I < Quantity II
- (C) Quantity I = Quantity II
- (D) Quantity I $\geq$ Quantity II
- (E) No relation can be established between Quantity I and Quantity II

Answer Key

1 C	2 A	3 D	4 C	5 A	6 B	7 B	8 B	9 A	10 A
11 A	12 B	13 A	14 B	15 A	16 B	17 A	18 A	19 B	20 B
21 C	22 B	23 C	24 B	25 C	26 A	27 C	28 C	29 C	30 B
31 B	32 B	33 A	34 C	35 B	36 B	37 B	38 C	39 C	40 C
41 B	42 B	43 B	44 A	45 A	46 A	47 E	48 C	49 C	50 B
51 A	52 C	53 C	54 C	55 B	56 A	57 B	58 A	59 B	60 A
61 B	62 A	63 B	64 B	65 C	66 D	67 B	68 C	69 B	70 C
71 B	72 D	73 C	74 C	75 C	76 D	77 D	78 E	79 A	80 C
81 D	82 B	83 D	84 D	85 C	86 B	87 C	88 C	89 B	90 C
91 B	92 B	93 C	94 A	95 B	96 A	97 B	98 C	99 B	100 A
101 B	102 B	103 B	104 C	105 B	106 B	107 B	108 E	109 D	110 D
111 B	112 C	113 A	114 A	115 C	116 D	117 A	118 C	119 A	120 B
121 C	122 A	123 A	124 B	125 B	126 C	127 B	128 A	129 A	130 B
131 C	132 E	133 D	134 A	135 C	136 B	137 B	138 D	139 A	140 B
141 C	142 C	143 C	144 C	145 E	146 C	147 D	148 D	149 A	150 C
151 E	152 B	153 C	154 B	155 C	156 A	157 B	158 D	159 B	160 E
161 A	162 B	163 C	164 B	165 D	166 C	167 E	168 A	169 B	170 B
171 B	172 D	173 E	174 A	175 D	176 A	177 D	178 D	179 C	180 E
181 C	182 B	183 B	184 A	185 C	186 D	187 A	188 C	189 B	190 B
191 D	192 A	193 E	194 D	195 E	196 C	197 A	198 C	199 E	200 B
201 C	202 A	203 C	204 A	205 D	206 B	207 C	208 D	209 C	210 E
211 B	212 A	213 C	214 D	215 E	216 C	217 D	218 B	219 C	220 A
221 E	222 D	223 C	224 B	225 B	226 A	227 B	228 C	229 D	230 A
231 C	232 C	233 B	234 D	235 E	236 D	237 A	238 B	239 D	240 B
241 D	242 A	243 C	244 B	245 B	246 C	247 B	248 C	249 E	250 B
251 D	252 B	253 B	254 C	255 B	256 B	257 D	258 C	259 C	260 C
261 E	262 B	263 D	264 A	265 B	266 C	267 A	268 B	269 B	270 C
271 A	272 C	273 A	274 B	275 C	276 A	277 D	278 C	279 A	280 D
281	282	283	284	285	286	287	288	289	290

B	C	D	B	E	A	B	B	C	A
291	292	293	294	295	296	297	298	299	300
D	B	A	C	C	B	C	B	C	C
301	302	303	304	305	306	307	308	309	310
B	C	B	C	C	D	E	C	B	C
311	312	313	314	315	316	317	318	319	320
C	B	C	B	B	B	D	C	E	A
321	322	323	324	325	326	327	328	329	330
C	C	B	D	A	C	E	D	B	C
331	332	333	334	335	336	337	338	339	340
B	A	D	B	C	A	C	B	D	A
341	342	343	344	345	346	347	348	349	350
B	C	B	B	A	C	D	B	A	B
351	352	353	354	355	356	357	358	359	360
C	E	C	D	A	D	C	C	B	D
361	362	363	364	365	366	367	368	369	370
B	D	B	D	C	D	B	C	D	C
371	372	373	374	375	376	377	378	379	380
D	B	C	D	C	D	B	E	C	A
381	382	383	384	385	386	387	388	389	390
D	E	A	D	B	C	B	A	C	B
391	392	393	394	395	396	397	398	399	400
D	D	C	D	A	B	E	B	D	B
401	402	403	404	405	406	407	408	409	410
A	C	D	E	C	D	D	B	A	C
411	412	413	414	415	416	417	418	419	420
B	B	C	A	D	B	E	B	C	D
421	422	423	424	425	426	427	428	429	430
C	B	C	C	D	C	D	B	A	C
431	432	433	434	435	436	437	438	439	440
C	B	C	C	C	D	D	B	C	B
441	442	443	444	445	446	447	448	449	450
B	B	C	B	C	E	D	B	B	C
451	452	453	454	455	456	457	458	459	460
C	C	C	C	C	C	C	C	A	C
461	462	463	464	465	466	467	468	469	470
D	D	B	C	B	B	C	B	C	B
471	472	473	474	475	476	477	478	479	480
C	B	C	C	D	C	E	D	B	B
481	482	483	484	485	486	487	488	489	490
D	D	A	B	C	C	C	B	C	C
491	492	493	494	495	496	497	498	499	500
C	B	C	E	C	C	C	B	D	C
501	502	503	504	505	506	507	508	509	510
B	C	C	C	C	C	A	B	E	D
511	512	513	514	515	516	517	518	519	520
B	D	B	C	E	A	E	D	C	B
521	522	523	524	525	526	527	528	529	530
A	C	B	E	D	E	C	B	B	B
531	532	533	534	535	536	537	538	539	540
C	C	C	B	B	C	C	C	B	C
541	542	543	544	545	546	547	548	549	550
C	B	C	C	C	B	C	B	A	C
551	552	553	554	555	556	557	558	559	560
E	B	B	E	B	C	B	B	C	A
561	562	563	564	565	566	567	568	569	570
C	D	A	B	C	B	D	A	C	B
571	572	573	574	575	576	577	578	579	580
B	C	B	A	C	B	B	A	B	B
581	582	583	584	585	586	587	588	589	590

B	D	E	B	C	B	B	B	B	C
591	592	593	594	595	596	597	598	599	600
B	C	C	D	B	C	B	C	C	D
601	602	603	604	605	606	607	608	609	610
B	B	E	D	C	A	B	C	D	C
611	612	613	614	615	616	617	618	619	620
D	A	B	D	B	A	C	E	B	D
621	622	623	624	625	626	627	628	629	630
B	C	A	D	B	C	A	B	D	A
631	632	633	634	635	636	637	638	639	640
E	C	D	C	D	A	C	C	B	B
641	642	643	644	645	646	647	648	649	650
C	A	B	A	D	C	A	B	C	A
651	652	653	654	655	656	657	658	659	660
E	B	D	C	A	E	C	C	A	C
661	662	663	664	665	666	667	668	669	670
E	B	A	B	D	C	B	D	A	B
671	672	673	674	675	676	677	678	679	680
D	C	A	B	B	C	B	B	C	C
681	682	683	684	685	686	687	688	689	690
C	B	C	C	E	C	A	B	C	B
691	692	693	694	695	696	697	698	699	700
C	C	C	A	C	D	C	C	D	C
701	702	703	704	705	706	707	708	709	710
C	E	D	C	D	C	C	D	D	C
711	712	713	714	715	716	717	718	719	720
D	C	C	C	C	B	C	D	B	A
721	722	723	724	725	726	727	728	729	730
D	B	C	A	C	D	A	E	C	B
731	732	733	734	735	736	737	738	739	740
C	B	E	A	C	A	B	A	B	B
741	742	743	744	745	746	747	748	749	750
D	A	C	A	B	B	B	C	B	A
751	752	753	754	755	756	757	758	759	760
A	E	C	B	C	B	D	B	B	E
761	762	763	764	765	766	767	768	769	770
A	C	A	B	E	C	A	D	E	C
771	772	773	774	775	776	777	778	779	780
D	E	B	C	D	A	B	A	B	C
781	782	783	784	785	786	787	788	789	790
D	A	B	C	D	A	E	B	C	D
791	792	793	794	795	796	797	798	799	800
A	B	C	D	A	B	C	D	B	B
801	802	803	804	805	806	807	808	809	810
C	B	C	A	E	C	B	A	E	A
811	812	813	814	815	816	817	818	819	820
C	A	C	B	B	C	C	B	D	B
821	822	823	824	825	826	827	828	829	830
C	D	C	B	C	B	A	C	C	B
831	832	833	834	835	836	837	838	839	840
D	B	C	C	B	E	B	C	A	B
841	842	843	844	845	846	847	848	849	850
D	B	C	A	C	D	B	A	C	D
851	852	853	854	855	856	857	858	859	860
B	E	C	A	B	C	A	C	D	B
861	862	863	864	865	866	867	868	869	870
C	B	B	C	A	C	C	C	B	D
871	872	873	874	875	876	877	878	879	880
C	C	C	C	B	B	C	A	C	E
881	882	883	884	885	886	887	888	889	890

B	B	B	C	E	A	D	B	E	D
891	892	893	894	895	896	897	898	899	900
A	B	C	E	C	B	C	B	A	D
901	902	903	904	905	906	907	908	909	910
E	B	D	A	B	C	B	C	B	C
911	912	913	914	915	916	917	918	919	920
B	C	D	B	B	C	A	B	D	B
921	922	923	924	925	926	927	928	929	930
C	C	C	A	A	B	C	C	E	D
931	932	933	934	935	936	937	938	939	940
C	B	C	B	D	C	B	D	C	B
941	942	943	944	945	946	947	948	949	950
D	B	C	D	E	A	D	B	E	C
951	952	953	954	955	956	957	958	959	960
A	D	B	E	C	A	D	B	C	C
961	962	963	964	965	966	967	968	969	970
A	E	B	E	C	A	B	C	D	E
971	972	973	974	975	976	977	978	979	980
B	C	D	C	D	E	A	D	B	E
981	982	983	984	985	986	987	988	989	990
C	D	C	E	B	B	C	C	B	B
991	992	993	994	995	996	997	998	999	1000
D	B	B	C	C	C	C	B	B	C
1001	1002	1003	1004	1005	1006	1007	1008	1009	1010
C	C	B	C	C	D	C	C	B	A
1011	1012	1013	1014	1015	1016	1017	1018	1019	1020
C	D	A	E	C	C	D	B	C	A
1021	1022	1023	1024	1025	1026	1027	1028	1029	1030
D	C	A	C	C	D	B	B	B	D
1031	1032	1033	1034	1035	1036	1037	1038	1039	1040
E	D	E	E	D	D	D	D	D	E
1041	1042	1043	1044	1045	1046	1047	1048	1049	1050
D	D	C	D	D	C	D	E	D	B
1051	1052	1053	1054	1055	1056	1057	1058	1059	1060
C	A	B	D	E	C	D	C	B	E
1061	1062	1063	1064	1065	1066	1067	1068	1069	1070
C	A	D	C	A	B	C	B	D	C
1071	1072	1073	1074	1075	1076	1077	1078	1079	1080
A	E	A	C	D	A	B	B	D	B
1081	1082	1083	1084	1085	1086	1087	1088	1089	1090
A	D	E	C	B	A	D	C	B	A
1091	1092	1093	1094	1095	1096	1097	1098	1099	1100
D	C	B	C	B	B	D	B	B	D
1101	1102	1103	1104	1105	1106	1107	1108	1109	1110
B	B	C	E	B	C	A	B	B	B
1111	1112	1113	1114	1115	1116	1117	1118	1119	1120
B	C	B	B	A	D	C	D	E	C
1121	1122	1123	1124	1125	1126	1127	1128	1129	1130
C	B	D	B	A	D	B	A	C	B
1131	1132	1133	1134	1135	1136	1137	1138	1139	1140
D	B	C	D	A	C	B	D	A	D
1141	1142	1143	1144	1145	1146	1147	1148	1149	1150
C	B	E	C	D	B	D	A	C	B
1151	1152	1153	1154	1155	1156	1157	1158	1159	1160
A	B	E	D	B	B	C	B	B	C
1161	1162	1163	1164	1165	1166	1167	1168	1169	1170
C	E	C	C	B	B	C	A	B	D
1171	1172	1173	1174	1175	1176	1177	1178	1179	1180
B	D	E	C	C	C	C	A	B	D
1181	1182	1183	1184	1185	1186	1187	1188	1189	1190

C	E	D	B	A	C	D	B	E	C
1191 B	1192 A	1193 C	1194 D	1195 C	1196 B	1197 C	1198 C	1199 E	1200 B
1201 C	1202 B	1203 C	1204 C	1205 C	1206 C	1207 B	1208 C	1209 E	1210 A
1211 C	1212 B	1213 C	1214 C	1215 B	1216 A	1217 C	1218 B	1219 B	1220 C
1221 B	1222 C	1223 D	1224 D	1225 A	1226 C	1227 D	1228 C	1229 B	1230 E
1231 A	1232 B	1233 A	1234 B	1235 B	1236 E	1237 B	1238 C	1239 C	1240 C
1241 D	1242 C	1243 D	1244 E	1245 D	1246 C	1247 C	1248 D	1249 C	1250 C
1251 D	1252 B	1253 C	1254 B	1255 C	1256 D	1257 C	1258 C	1259 C	1260 B
1261 E	1262 D	1263 A	1264 E	1265 A	1266 B	1267 C	1268 E	1269 C	1270 D
1271 A	1272 C	1273 B	1274 D	1275 C	1276 E	1277 B	1278 D	1279 C	1280 E
1281 D	1282 B	1283 A	1284 D	1285 A	1286 D	1287 A	1288 C	1289 C	1290 A
1291 B	1292 E	1293 C	1294 D	1295 D	1296 D	1297 C	1298 A	1299 C	1300 D
1301 B	1302 E	1303 B	1304 C	1305 D	1306 A	1307 E	1308 B	1309 C	1310 C
1311 A	1312 D	1313 E	1314 B	1315 D	1316 A	1317 C	1318 E	1319 A	1320 B
1321 D	1322 D	1323 E							

Worked Solutions

Subtopic 1.1.1

1. Write the number in the Indian place-value chart: 5 (lakhs), 8 (ten thousands), 4 (thousands), 7 (hundreds), 6 (tens), 9 (units). The digit 8 occupies the ten-thousands place, so its place value is $8 \times 10,000 = 80,000$. (Its face value would be just 8, but the question asks for place value.) Hence option C.

2. In 3,17,542 the digits from the left are 3 (lakhs), 1 (ten thousands), 7 (thousands), 5 (hundreds), 4 (tens), 2 (units). So the digit 7 lies in the thousands place. Place value = $7 \times 1000 = 7,000$. Face value = 7. Required difference = $7,000 - 7 = 6,993$. Hence option A.

3. A composite number has at least one factor other than 1 and itself. To test a number n for primality it is enough to try the prime divisors p with $p^2 \leq n$. Every option here is less than $8^2 = 64$, so only 2, 3, 5, 7 need to be considered. 31, 37 and 41 are odd, have digit sums 4, 10 and 5 (not divisible by 3) and do not end in 0 or 5; moreover each is less than $7^2 = 49$, so 7 need not be tried and all three are prime. For 61 we have $49 < 61$, so 7 must also be tried: $61 = 7 \times 8 + 5$, not divisible, so 61 is prime too. For 51 the digit sum is $5 + 1 = 6$, which is divisible by 3, so $51 = 3 \times 17$. Therefore 51 is the only composite number. Hence option D.

4. A rational number can be written as $\frac{p}{q}$ with integers p, q and $q \neq 0$. Now $\sqrt{49} = 7$, a whole number, hence rational. $\frac{22}{7}$ is already a ratio of integers (note that it is only an approximation of π , it is not π), hence rational. $0.75 = \frac{3}{4}$ is a terminating decimal, hence rational. $-8 = \frac{-8}{1}$ is rational. But 30 is not a perfect square, so $\sqrt{30}$ is a non-terminating non-recurring decimal, i.e. irrational. Hence option C.

5. Place-value chart for 5,33,308: 5 (lakhs), 3 (ten thousands), 3 (thousands), 3 (hundreds), 0 (tens), 8 (units). The three 3s have place values 30,000, 3,000 and 300. Required sum = $30,000 + 3,000 + 300 = 33,300$. Hence option A.

6. List them: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29. Note that 1 is neither prime nor composite, so it is excluded, and $25 = 5^2$, $27 = 3^3$ are composite. Counting the list gives 10 primes. Hence option B.

7. To the right of the decimal point the places are tenths, hundredths, thousandths in order. In 63.472 the digit 4 is in the tenths place, 7 is in the hundredths place and 2 is in the thousandths place. Hence the place value of 7 is $7 \times \frac{1}{100} = \frac{7}{100} = 0.07$. Hence option B.

8. In 8,47,563 the digits are 8 (lakhs), 4 (ten thousands), 7 (thousands), 5 (hundreds), 6 (tens), 3 (units). So 4 sits in the ten-thousands place. Replacing it by 9 changes only that place, and the increase is $(9 - 4) \times 10,000 = 5 \times 10,000 = 50,000$. Check: $8,97,563 - 8,47,563 = 50,000$. Hence option B.

9. Place-value chart for 3,86,024: 3 (lakhs), 8 (ten thousands), 6 (thousands), 0 (hundreds), 2 (tens), 4 (units). So 6 is in the thousands place. Place value = $6 \times 1000 = 6,000$; face value = 6. Required sum = $6,000 + 6 = 6,006$. Hence option A.

10. Place-value chart for 6,72,738: 6 (lakhs), 7 (ten thousands), 2 (thousands), 7 (hundreds), 3 (tens), 8 (units). The first 7 has place value 70,000 and the second 7 has place value 700. Required difference = $70,000 - 700 = 69,300$. Hence option A.

11. Let the tens digit be x and the units digit be y , so the number is $10x + y$ and the reversed number is $10y + x$. Given $x + y = 11$ and $(10x + y) - (10y + x) = 27$, i.e. $9(x - y) = 27$, so $x - y = 3$. Adding the two equations: $2x = 14$, so $x = 7$ and $y = 4$. The number is 74. Check: $74 - 47 = 27$ and $7 + 4 = 11$. Hence option A.

12. Test each by trial division up to its square root. $91 = 7 \times 13$ (composite). 97: not divisible by 2, 3, 5, 7 and $\sqrt{97} < 10$, so prime. 111: digit sum 3, so $111 = 3 \times 37$ (composite). 113: not divisible by 2, 3, 5, 7 and $\sqrt{113} < 11$, so prime. $119 = 7 \times 17$ (composite). 127: not divisible by 2, 3, 5, 7, 11 and $\sqrt{127} < 12$, so prime. The primes are 97, 113, 127, i.e. 3 numbers. Hence option B.

13. In Rs. 3,45,600 the digits are 3 (lakhs), 4 (ten thousands), 5 (thousands), 6 (hundreds), 0 (tens), 0 (units). The thousands digit is 5; typing 9 there gives Rs. 3,49,600. Excess $= (9-5) \times 1000 = \text{Rs. } 4,000$. Check: $3,49,600 - 3,45,600 = 4,000$. Hence option A.

14. Evaluate each. $\sqrt{2} + \sqrt{8} = \sqrt{2} + 2\sqrt{2} = 3\sqrt{2}$, irrational. $(3 + \sqrt{5})(3 - \sqrt{5}) = 3^2 - (\sqrt{5})^2 = 9 - 5 = 4$, an integer and therefore rational. $\frac{\pi}{2}$ is irrational, since π is irrational and dividing an irrational by a non-zero rational keeps it irrational. $\sqrt{7} \times \sqrt{5} = \sqrt{35}$, and 35 is not a perfect square, so it is irrational. Only the second expression is rational. Hence option B.

15. In 6,54,321 the digit 6 is in the lakhs place, so its place value is 6,00,000 and its face value is 6; thus $X = 6,00,000 - 6 = 5,99,994$. In 3,45,678 the digits are 3 (lakhs), 4 (ten thousands), 5 (thousands), 6 (hundreds), 7 (tens), 8 (units), so 4 is in the ten-thousands place; its place value is 40,000 and face value 4, giving $Y = 40,000 - 4 = 39,996$. Therefore $X - Y = 5,99,994 - 39,996 = 5,59,998$. Hence option A.

16. Let the units digit be u . Then the hundreds digit is $2u$ and the tens digit is $u + 3$. For all three to be single digits we need $2u \leq 9$ and $u + 3 \leq 9$, so $u \in \{1, 2, 3, 4\}$ (with $u \neq 0$, since the hundreds digit $2u$ cannot be 0). The candidates are: $u = 1 \Rightarrow 241$; $u = 2 \Rightarrow 452$; $u = 3 \Rightarrow 663$; $u = 4 \Rightarrow 874$. A number is divisible by 4 when the number formed by its last two digits is divisible by 4: 41 is not, 52 $= 4 \times 13$ is, 63 is not, 74 is not. So the number is 452, and indeed $452 = 4 \times 113$. Hence option B.

17. Since p is a prime greater than 3, it is odd, so $p + 1$ is even, i.e. divisible by 2. Next consider the three consecutive integers $p, p + 1, p + 2$; exactly one of any three consecutive integers is divisible by 3. Neither p nor $p + 2$ can be that one, because both are primes greater than 3 and so have no factor 3. Hence 3 divides $p + 1$. As 2 and 3 are coprime, 6 divides $p + 1$. The other options fail: for $p = 5$ we get $p + 1 = 6$, which is divisible by neither 4, nor 12, nor 10. (Further check: $p = 11$ gives $p + 1 = 12$, $p = 17$ gives $p + 1 = 18$, $p = 29$ gives $p + 1 = 30$ – all multiples of 6.) Hence option A.

18. List the primes in the range. 41, 43, 47 are prime; $49 = 7^2$ is composite; $51 = 3 \times 17$, 53 is prime; $55 = 5 \times 11$, $57 = 3 \times 19$; 59 and 61 are prime; $63 = 7 \times 9$, $65 = 5 \times 13$; 67 is prime; $69 = 3 \times 23$. So the primes are 41, 43, 47, 53, 59, 61, 67. Adding: $41 + 43 = 84$; $84 + 47 = 131$; $131 + 53 = 184$; $184 + 59 = 243$; $243 + 61 = 304$; $304 + 67 = 371$. Hence option A.

19. Let the thousands digit be a and the tens digit be b . Their total contribution to the number is $1000a + 10b$. After interchanging, the contribution becomes $1000b + 10a$, and no other place is affected. Increase $= (1000b + 10a) - (1000a + 10b) = 990(b - a)$. Given $990(b - a) = 2970$, so $b - a = \frac{2970}{990} = 3$. Hence the required difference between the two digits is 3. (For example, in 24571 the thousands digit is 4 and the tens digit is 7; interchanging them gives 27541, and $27541 - 24571 = 2970$.) Hence option B.

20. Check each statement. (i) Any integer n can be written as $\frac{n}{1}$, a ratio of integers with non-zero denominator, so every integer is rational: TRUE. (ii) $\frac{3}{4}$ is rational but not an integer: FALSE. (iii) Prime and composite are defined only for natural numbers greater than 1; 0 is neither (and neither is 1): TRUE. (iv) $\sqrt{9} = 3$ is rational, so the statement fails for perfect squares: FALSE. Only (i) and (iii) are true. Hence option B.

21. Let the three-digit number be N , where $100 \leq N \leq 999$. Writing it twice in succession shifts the first copy three places to the left, so the six-digit number equals $1000N + N = 1001N$. Hence every such number is a multiple of 1001. Since $1001 = 7 \times 11 \times 13$, the number is in fact divisible by 7, 11 and 13 simultaneously, which makes options A and B false as stated. It need not be divisible by 101 (for instance $256256 = 1001 \times 256$, and 101 does not divide 1001 or 256). Hence option C.

Subtopic 1.1.2

22. Rule for 11: take the alternating sum of the digits (from the right, add, subtract, add, ...). The number is divisible by 11 only if this alternating sum is 0 or a multiple of 11.

For 45871: $1 - 7 + 8 - 5 + 4 = 1$, not a multiple of 11.

For 61809: $9 - 0 + 8 - 1 + 6 = 22$, and $22 = 11 \times 2$, so it is divisible by 11. (Check: $61809 = 11 \times 5619$.)

For 73952: $2 - 5 + 9 - 3 + 7 = 10$, not a multiple of 11.

For 58147: $7 - 4 + 1 - 8 + 5 = 1$, not a multiple of 11.

Only one number qualifies, so the answer is 61809.

23. A number is divisible by 9 when its digit sum is divisible by 9.

Digit sum of 34258 is $3 + 4 + 2 + 5 + 8 = 22$.

The multiples of 9 near 22 are 18 and 27. Since we must ADD, we move up to 27.

Required addition = $27 - 22 = 5$.

Check: $34258 + 5 = 34263$, digit sum $3 + 4 + 2 + 6 + 3 = 18$, which is divisible by 9. Hence the least number to be added is 5.

24. For any two numbers, (First number) $\times$ (Second number) = HCF $\times$ LCM.

So $40 \times x = 10 \times 120 = 1200$, giving $x = \frac{1200}{40} = 30$.

Verification: $40 = 2^3 \times 5$ and $30 = 2 \times 3 \times 5$. HCF = $2 \times 5 = 10$ and LCM = $2^3 \times 3 \times 5 = 120$. Both conditions hold, so the other number is 30.

25. First write 180 in prime factor form: $180 = 2 \times 90 = 2 \times 2 \times 45 = 2^2 \times 3^2 \times 5^1$.

If $N = p^a \times q^b \times r^c$, the total number of factors is $(a+1)(b+1)(c+1)$, because each prime's exponent may independently be chosen from 0 up to its maximum.

Here the exponents are 2, 2 and 1, so the number of factors = $(2+1)(2+1)(1+1) = 3 \times 3 \times 2 = 18$.

26. A number is divisible by 6 only if it is divisible by BOTH 2 (last digit even) and 3 (digit sum a multiple of 3).

23412: last digit 2 is even; digit sum = $2 + 3 + 4 + 1 + 2 = 12$, a multiple of 3. So it is divisible by 6. (Check: $23412 = 6 \times 3902$.)

51236: even, but digit sum = $5 + 1 + 2 + 3 + 6 = 17$, not a multiple of 3.

74318: even, but digit sum = $7 + 4 + 3 + 1 + 8 = 23$, not a multiple of 3.

41102: even, but digit sum = $4 + 1 + 1 + 0 + 2 = 8$, not a multiple of 3.

Hence only 23412 works.

27. The least number divisible by all of them is their LCM.

Prime factorisation: $12 = 2^2 \times 3$, $16 = 2^4$, $18 = 2 \times 3^2$, $24 = 2^3 \times 3$.

For the LCM take the highest power of each prime: highest power of 2 is 2^4 (from 16), highest power of 3 is 3^2 (from 18).

LCM = $2^4 \times 3^2 = 16 \times 9 = 144$.

Check: $144 \div 12 = 12$, $144 \div 16 = 9$, $144 \div 18 = 8$, $144 \div 24 = 6$; all exact. Note 72 fails because $72 \div 16$ is not a whole number.

28. The first multiple of 13 greater than 100 is $13 \times 8 = 104$.

The last multiple of 13 less than 400 is $13 \times 30 = 390$ (since $13 \times 31 = 403 > 400$).

So the multiples run from 13×8 to 13×30 , that is the multipliers are 8, 9, 10, ..., 30.

Count = $30 - 8 + 1 = 23$.

29. $45 = 9 \times 5$, and 9 and 5 are co-prime, so the number must be divisible by both 9 and 5.

Divisibility by 5 forces $y = 0$ or $y = 5$.

Case 1, $y = 0$: digit sum = $7 + x + 3 + 0 = 10 + x$. For divisibility by 9 we need $10 + x = 18$, so $x = 8$.

The code is 7830, and $7830 \div 45 = 174$. Here $x + y = 8 + 0 = 8$.

Case 2, $y = 5$: digit sum = $7 + x + 3 + 5 = 15 + x$. We need $15 + x = 18$, so $x = 3$. The code is 7335, and $7335 \div 45 = 163$. Here $x + y = 3 + 5 = 8$.

In both admissible cases $x + y = 8$, so the value is uniquely 8.

30. A number leaving remainder 3 on division by 5, 6, 7 and 8 has the form $N = 840k + 3$, where $840 = \text{LCM}(5, 6, 7, 8) = 2^3 \times 3 \times 5 \times 7$ and k is a whole number.

We also need 9 to divide N . Note $840 = 9 \times 93 + 3$, so 840 leaves remainder 3 on division by 9.

Therefore $N = 840k + 3$ leaves remainder $3k + 3$ modulo 9. We need $3k + 3$ to be a multiple of 9, i.e. $k + 1$ to be a multiple of 3, so the least such k is $k = 2$.

Hence $N = 840 \times 2 + 3 = 1683$.

Check: $1683 \div 5 = 336 \text{ r } 3$; $1683 \div 6 = 280 \text{ r } 3$; $1683 \div 7 = 240 \text{ r } 3$; $1683 \div 8 = 210 \text{ r } 3$; and $1683 \div 9 = 187$ exactly.

31. The largest equal packet value that divides each bundle exactly is the HCF of the three amounts.

Work in thousands: $108 = 2^2 \times 3^3$, $144 = 2^4 \times 3^2$, $180 = 2^2 \times 3^2 \times 5$.

Common primes with least powers: $2^2 \times 3^2 = 36$. So HCF = Rs. 36,000 per packet.

Number of packets $= \frac{108000}{36000} + \frac{144000}{36000} + \frac{180000}{36000} = 3 + 4 + 5 = 12$.

32. Prime factorise: $1080 = 8 \times 135 = 2^3 \times 3^3 \times 5^1$.

A factor is a perfect square exactly when every prime in it appears to an EVEN power.

Power of 2 may be 0 or 2 (it cannot be 4, since only 2^3 is available): 2 choices.

Power of 3 may be 0 or 2: 2 choices.

Power of 5 may only be 0 (since 5^2 is not available): 1 choice.

Total $= 2 \times 2 \times 1 = 4$.

These four factors are 1, 4, 9 and 36.

33. If a number d leaves the same remainder with 43, 91 and 183, then d divides each of their differences exactly (the equal remainders cancel out on subtraction).

Differences: $91 - 43 = 48$, $183 - 91 = 92$, $183 - 43 = 140$.

Required number $= \text{HCF}(48, 92, 140)$. Here $48 = 2^4 \times 3$, $92 = 2^2 \times 23$, $140 = 2^2 \times 5 \times 7$, so the HCF is $2^2 = 4$.

Check: $43 = 4 \times 10 + 3$, $91 = 4 \times 22 + 3$, $183 = 4 \times 45 + 3$; the remainder is 3 in every case. Hence the greatest such number is 4.

34. Use the standard counting method: add the quotients obtained on repeatedly dividing 30 by 3, ignoring remainders.

$\left\lceil \frac{30}{3} \right\rceil = 10$ (the multiples of 3 up to 30 each contribute at least one 3).

$\left\lceil \frac{30}{9} \right\rceil = 3$ (the multiples of 9, namely 9, 18, 27, each contribute one extra 3).

$\left\lceil \frac{30}{27} \right\rceil = 1$ (the number 27 contributes yet one more 3).

$\left\lceil \frac{30}{81} \right\rceil = 0$, so we stop.

Total power $= 10 + 3 + 1 = 14$.

35. Count multiples of 4 up to 200: $\left\lceil \frac{200}{4} \right\rceil = 50$.

Count multiples of 6 up to 200: $\left\lceil \frac{200}{6} \right\rceil = 33$ (since $6 \times 33 = 198$).

Numbers divisible by both 4 and 6 are the multiples of $\text{LCM}(4, 6) = 12$: $\left\lceil \frac{200}{12} \right\rceil = 16$ (since $12 \times 16 = 192$).

By the addition rule for overlapping sets, required count $= 50 + 33 - 16 = 67$.

36. Numbers leaving remainder 5 with each of 8, 12 and 18 are of the form $N = Lk + 5$, where $L = \text{LCM}(8, 12, 18)$.

$8 = 2^3$, $12 = 2^2 \times 3$, $18 = 2 \times 3^2$, so $L = 2^3 \times 3^2 = 72$.

We need the least k with $72k + 5 \geq 1000$, i.e. $72k \geq 995$, i.e. $k \geq 13.8\dots$, so $k = 14$.

$N = 72 \times 14 + 5 = 1008 + 5 = 1013$.

Check: $1013 = 8 \times 126 + 5 = 12 \times 84 + 5 = 18 \times 56 + 5$. Also $72 \times 13 + 5 = 941$ is only a three-digit number, confirming 1013 is the smallest four-digit one.

37. Prime factorise: $1800 = 18 \times 100 = (2 \times 3^2) \times (2^2 \times 5^2) = 2^3 \times 3^2 \times 5^2$.

For $N = p^a q^b r^c$, the sum of all factors is $(1 + p + \cdots + p^a)(1 + q + \cdots + q^b)(1 + r + \cdots + r^c)$, since expanding the product generates every factor exactly once.

$$(1 + 2 + 4 + 8) = 15.$$

$$(1 + 3 + 9) = 13.$$

$$(1 + 5 + 25) = 31.$$

$$\text{Sum of factors} = 15 \times 13 \times 31 = 195 \times 31 = 6045.$$

38. If d divides 1657 leaving remainder 6, then d divides $1657 - 6 = 1651$ exactly.

If d divides 2037 leaving remainder 5, then d divides $2037 - 5 = 2032$ exactly.

So the largest such d is $\text{HCF}(1651, 2032)$. Apply the division algorithm:

$$2032 = 1 \times 1651 + 381.$$

$$1651 = 4 \times 381 + 127.$$

$$381 = 3 \times 127 + 0.$$

Hence $\text{HCF} = 127$.

Check: $1657 = 127 \times 13 + 6$ and $2037 = 127 \times 16 + 5$, exactly as required. (The divisor must also exceed both remainders, and $127 > 6$, so it is valid.)

39. Step 1. Three-digit multiples of 7: the smallest is $7 \times 15 = 105$ and the largest is $7 \times 142 = 994$. So the count is $142 - 15 + 1 = 128$.

Step 2. Among these, the ones also divisible by 3 are the multiples of $\text{LCM}(7, 3) = 21$. The smallest three-digit multiple of 21 is $21 \times 5 = 105$ and the largest is $21 \times 47 = 987$. So the count is $47 - 5 + 1 = 43$.

Step 3. Required count $= 128 - 43 = 85$.

40. Since the HCF is 13, write the numbers as $13a$ and $13b$, where a and b are co-prime.

Their product: $13a \times 13b = 169ab = 2028$, so $ab = \frac{2028}{169} = 12$.

Co-prime pairs (a, b) with $ab = 12$: $(1, 12)$ and $(3, 4)$. (The pair $(2, 6)$ is rejected as 2 and 6 share the factor 2.)

For $(1, 12)$ the numbers would be 13 and 156, but 156 is not a two-digit number, so this pair is rejected.

For $(3, 4)$ the numbers are 39 and 52, both two-digit. Check: $39 \times 52 = 2028$ and $\text{HCF}(39, 52) = 13$.

Required sum $= 39 + 52 = 91$.

41. Write a general factor as $2^p \times 3^q \times 5^r$ with $0 \leq p \leq 4$, $0 \leq q \leq 3$, $0 \leq r \leq 2$.

Divisible by $12 = 2^2 \times 3$ means $p \geq 2$ and $q \geq 1$. Then $p \in \{2, 3, 4\}$ gives 3 choices, $q \in \{1, 2, 3\}$ gives 3 choices, and $r \in \{0, 1, 2\}$ gives 3 choices, so $3 \times 3 \times 3 = 27$ such factors.

Divisible by $36 = 2^2 \times 3^2$ means $p \geq 2$ and $q \geq 2$: that is 3 choices for p , $q \in \{2, 3\}$ giving 2 choices, and 3 choices for r , so $3 \times 2 \times 3 = 18$ factors. Every one of these 18 is already counted in the 27, since $q \geq 2$ implies $q \geq 1$.

Required count $= 27 - 18 = 9$.

42. Step 1. Two-digit multiples of 3 run from 12 to 99. Their count is $\frac{99 - 12}{3} + 1 = 30$, and being an arithmetic progression their sum is $\frac{30}{2}(12 + 99) = 15 \times 111 = 1665$.

Step 2. Those also divisible by 5 are the multiples of $\text{LCM}(3, 5) = 15$, running from 15 to 90. Their count is $\frac{90 - 15}{15} + 1 = 6$, and their sum is $\frac{6}{2}(15 + 90) = 3 \times 105 = 315$.

Step 3. Required sum $= 1665 - 315 = 1350$.

Subtopic 1.1.3

43. Factorise both numbers. $36 = 2^2 \times 3^2$ and $84 = 2^2 \times 3 \times 7$. The HCF is the product of the common prime factors taken with the lowest power: common primes are 2 (lowest power 2^2) and 3 (lowest power 3^1). So $\text{HCF} = 2^2 \times 3 = 4 \times 3 = 12$. Check: $36 \div 12 = 3$ and $84 \div 12 = 7$, both exact, and 3 and 7 share no further factor, confirming 12 is the highest. Hence option B.

44. Write prime factorisations: $12 = 2^2 \times 3$, $15 = 3 \times 5$, $20 = 2^2 \times 5$. The LCM takes every prime that occurs, each to its highest power: 2^2 , 3^1 , 5^1 . So $\text{LCM} = 4 \times 3 \times 5 = 60$. Verify: $60 \div 12 = 5$, $60 \div 15 = 4$, $60 \div 20 = 3$, all exact. No smaller positive number works, since any common multiple must contain 2^2 , 3 and 5. Hence option A.

45. For fractions in lowest terms the rule is $\text{HCF} = \frac{\text{HCF of numerators}}{\text{LCM of denominators}}$. Numerators: HCF of 2, 8, 16 is 2. Denominators: $3 = 3$, $9 = 3^2$, $81 = 3^4$, so $\text{LCM} = 3^4 = 81$. Therefore $\text{HCF} = \frac{2}{81}$. Check that each fraction divided by $\frac{2}{81}$ gives a whole number: $\frac{2}{3} \div \frac{2}{81} = 27$, $\frac{8}{9} \div \frac{2}{81} = 36$, $\frac{16}{81} \div \frac{2}{81} = 8$. All integers, so option A is correct.

46. The rule is $\text{LCM} = \frac{\text{LCM of numerators}}{\text{HCF of denominators}}$. Numerators 3, 6, 9: $\text{LCM} = 18$. Denominators 4, 7, 8: their HCF is 1, since 7 is coprime to 4 and 8. Therefore $\text{LCM} = \frac{18}{1} = 18$. Check: $18 \div \frac{3}{4} = 24$, $18 \div \frac{6}{7} = 21$, $18 \div \frac{9}{8} = 16$, all whole numbers, so 18 is a common multiple, and it is the least such. Hence option A.

47. For any two numbers, $\text{HCF} \times \text{LCM} = \text{product of the numbers}$. So $\text{LCM} = \frac{2028}{13} = 156$. (Indeed the numbers are $13 \times 1 = 13$ and $13 \times 12 = 156$, whose product is 2028 and whose HCF is 13.) The value 156 does not appear among options A to D, so the correct choice is None of these, option E.

48. First make the number of decimal places equal: 0.63, 1.05, 2.10. Ignoring the decimal point, work with 63, 105, 210. Factorise: $63 = 3^2 \times 7$, $105 = 3 \times 5 \times 7$, $210 = 2 \times 3 \times 5 \times 7$. Common factors: 3 and 7, so $\text{HCF} = 21$. Restore two decimal places: $\text{HCF} = 0.21$. Check: $0.63 \div 0.21 = 3$, $1.05 \div 0.21 = 5$, $2.1 \div 0.21 = 10$, all whole numbers. Hence option C.

49. The required number is the LCM of 8, 12 and 18. Prime factorisations: $8 = 2^3$, $12 = 2^2 \times 3$, $18 = 2 \times 3^2$. Take each prime to its highest power: $2^3 \times 3^2 = 8 \times 9 = 72$. Verify: $72 \div 8 = 9$, $72 \div 12 = 6$, $72 \div 18 = 4$, all exact. The smaller options fail: $36 \div 8$ is not a whole number, and $48 \div 18$ is not a whole number. Hence option C.

50. Since the HCF is 16, write the numbers as $16a$ and $16b$ where a and b are coprime. For such a pair, $\text{LCM} = 16ab$, so $16ab = 240$ and therefore $ab = 15$. Now list the factorisations of 15 into two coprime factors: $15 = 1 \times 15$ and $15 = 3 \times 5$ (the pair $a = b$ is impossible, as coprimality would force $a = b = 1$, giving $ab = 1$). Both listed pairs are coprime, so both are valid, giving the numbers (16, 240) and (48, 80). Verify: $\text{HCF}(16, 240) = 16$ and $\text{LCM}(16, 240) = 240$; $\text{HCF}(48, 80) = 16$ and $\text{LCM}(48, 80) = 240$. Hence exactly 2 pairs exist, option B.

51. If a divisor d leaves the same remainder with all three numbers, then d divides each of their differences exactly. Differences: $91 - 43 = 48$, $183 - 91 = 92$, $183 - 43 = 140$. Now take the HCF: $48 = 2^4 \times 3$, $92 = 2^2 \times 23$, $140 = 2^2 \times 5 \times 7$. The only common factor is $2^2 = 4$. So $d = 4$. Check: $43 = 4 \times 10 + 3$, $91 = 4 \times 22 + 3$, $183 = 4 \times 45 + 3$; the common remainder is 3. Hence option A.

52. They ring together again after a number of minutes equal to the LCM of 9, 12 and 15. Factorise: $9 = 3^2$, $12 = 2^2 \times 3$, $15 = 3 \times 5$. Highest powers: $2^2 \times 3^2 \times 5 = 4 \times 9 \times 5 = 180$ minutes. Now 180 minutes = 3 hours. Adding 3 hours to 8:00 a.m. gives 11:00 a.m. Check: in 180 minutes the bells ring 20, 15 and 12 times respectively, all whole numbers. Hence option C.

53. Since the ratio in lowest terms is $3 : 4$ and the HCF is 4, write the numbers as $3 \times 4 = 12$ and $4 \times 4 = 16$. (This is valid because 3 and 4 are coprime, so the HCF of 12 and 16 is exactly 4.) Now $\text{LCM} = \frac{\text{product}}{\text{HCF}} = \frac{12 \times 16}{4} = \frac{192}{4} = 48$. Alternatively, for numbers ha and hb with a, b coprime, $\text{LCM} = h \times a \times b = 4 \times 3 \times 4 = 48$. Hence option C.

54. If the divisor leaves remainder 9 in 2011, it divides $2011 - 9 = 2002$ exactly. Similarly it divides $2623 - 5 = 2618$ exactly. So the greatest such divisor is the HCF of 2002 and 2618. Factorise:

$2002 = 2 \times 7 \times 11 \times 13$ and $2618 = 2 \times 7 \times 11 \times 17$. Common part $= 2 \times 7 \times 11 = 154$. Check: $2002 \div 154 = 13$ and $2618 \div 154 = 17$, both exact, and $154 > 9$, so the stated remainders are genuine. Options A and B divide the numbers too, but they are smaller; 308 does not divide 2002. Hence option C.

55. Use $\text{HCF} \times \text{LCM} = \text{product of the two numbers}$. So the other number $= \frac{12 \times 336}{84} = \frac{4032}{84} = 48$. Verify directly: $84 = 2^2 \times 3 \times 7$ and $48 = 2^4 \times 3$. Their $\text{HCF} = 2^2 \times 3 = 12$ and their $\text{LCM} = 2^4 \times 3 \times 7 = 336$, matching the given data. Hence option B.

56. The required length is the HCF of the three fractions, given by $\frac{\text{HCF of numerators}}{\text{LCM of denominators}}$. Numerators 7, 5, 4 have HCF 1 (no common factor). Denominators 2, 4, 5 have LCM 20. So the rod is $\frac{1}{20}$ m long. Check: $\frac{7}{2} \div \frac{1}{20} = 70$, $\frac{5}{4} \div \frac{1}{20} = 25$, $\frac{4}{5} \div \frac{1}{20} = 16$, all whole numbers. A longer rod such as $\frac{1}{10}$ m fails, since $\frac{5}{4} \div \frac{1}{10} = 12.5$. Hence option A.

57. A number leaving remainder 3 on division by 5, 6, 7 and 8 has the form $N = 840k + 3$, since LCM of 5, 6, 7, 8 is $2^3 \times 3 \times 5 \times 7 = 840$. We also need $9 \mid N$. Note $840 = 9 \times 93 + 3$, so $840 \equiv 3 \pmod{9}$ and $N \equiv 3k + 3 \pmod{9}$. For $9 \mid 3k + 3$ we need $3 \mid k + 1$, so the least positive k is 2. Then $N = 840 \times 2 + 3 = 1683$. Check: $1683 \div 9 = 187$ exactly, and $1683 - 3 = 1680 = 840 \times 2$ is divisible by 5, 6, 7, 8. Option A, 1677, is not of the form $840k + 3$. Hence option B.

58. Let the numbers be x and y . Then $xy = \text{HCF} \times \text{LCM} = 5 \times 495 = 2475$, and $x + y = 100$. Now $(x - y)^2 = (x + y)^2 - 4xy = 100^2 - 4 \times 2475 = 10000 - 9900 = 100$, so $x - y = 10$ (taking the positive difference). Indeed the numbers are 55 and 45: their sum is 100, HCF is 5 and $\text{LCM} = \frac{55 \times 45}{5} = 495$, matching all conditions. Hence option A.

59. In each case the remainder is exactly 1 less than the divisor ($6 - 5 = 1$, $7 - 6 = 1$, $8 - 7 = 1$). So $N + 1$ is divisible by 6, 7 and 8, i.e. $N + 1$ is a multiple of their LCM. LCM of 6, 7, 8 $= 2^3 \times 3 \times 7 = 168$. Thus $N = 168k - 1$, giving 167, 335, 503, 671, 839, 1007, ... The first value exceeding 1000 is $k = 6$: $N = 1008 - 1 = 1007$. Check: $1007 = 6 \times 167 + 5 = 7 \times 143 + 6 = 8 \times 125 + 7$. Hence option B.

60. For fractions, just as for integers, $\text{HCF} \times \text{LCM} = \text{product of the two fractions}$. So the product is $\frac{1}{12} \times \frac{35}{2} = \frac{35}{24}$. Dividing by the known fraction, the other fraction $= \frac{35}{24} \div \frac{5}{6} = \frac{35}{24} \times \frac{6}{5} = \frac{210}{120} = \frac{7}{4}$. Verify with the standard rules on $\frac{5}{6}$ and $\frac{7}{4}$: $\text{HCF} = \frac{\text{HCF}(5, 7)}{\text{LCM}(6, 4)} = \frac{1}{12}$, and $\text{LCM} = \frac{\text{LCM}(5, 7)}{\text{HCF}(6, 4)} = \frac{35}{2}$. Both match the given data. Hence option A.

61. Let the HCF be h . Then the LCM is $84h$, and $h + 84h = 680$, so $85h = 680$ and $h = 8$. Hence $\text{LCM} = 84 \times 8 = 672$. Using $\text{HCF} \times \text{LCM} = \text{product of the numbers}$, the other number $= \frac{8 \times 672}{56} = \frac{5376}{56} = 96$. Verify: $56 = 2^3 \times 7$ and $96 = 2^5 \times 3$, so $\text{HCF} = 2^3 = 8$ and $\text{LCM} = 2^5 \times 3 \times 7 = 672$; their sum is 680 and $672 = 84 \times 8$. Hence option B.

62. Compare each divisor with its remainder: $20 - 14 = 6$, $25 - 19 = 6$, $35 - 29 = 6$, $40 - 34 = 6$. The shortfall is a constant 6, so $N + 6$ must be divisible by all four divisors. LCM of 20, 25, 35, 40 $= 2^2 \times 5 \times 5^2 \times 7 = 2^2 \times 5^3 \times 7 = 8 \times 25 \times 7 = 1400$. So the least value is $N = 1400 - 6 = 1394$. Check: $1394 = 20 \times 69 + 14 = 25 \times 55 + 19 = 35 \times 39 + 29 = 40 \times 34 + 34$. Hence option A.

63. Equalise the decimal places: 0.60, 9.60, 0.36. Remove the decimal point and work with 60, 960, 36 (all in hundredths). Factorise: $60 = 2^2 \times 3 \times 5$, $960 = 2^6 \times 3 \times 5$, $36 = 2^2 \times 3^2$. $\text{HCF} = 2^2 \times 3 = 12$, so $H = 0.12$. $\text{LCM} = 2^6 \times 3^2 \times 5 = 64 \times 45 = 2880$, so $L = 28.80$. Therefore $\frac{L}{H} = \frac{28.8}{0.12} = \frac{2880}{12} = 240$. (Note the same ratio equals $\frac{2880}{12}$ whether or not the decimal point is restored, since both are scaled alike.) Hence option B.

Subtopic 1.1.4

64. Convert each fraction to a decimal so that a single common scale can be used. $\frac{3}{5} = 0.600$, $\frac{2}{3} = 0.6667$, $\frac{5}{8} = 0.625$, $\frac{7}{12} = 0.5833$ and $\frac{11}{20} = 0.550$. Comparing the decimals: $0.550 < 0.5833 < 0.600 < 0.625 < 0.6667$. Hence the greatest value is 0.6667, which corresponds to $\frac{2}{3}$.

65. There are three digits after the decimal point, so write $0.375 = \frac{375}{1000}$. Now cancel common factors: $\frac{375}{1000} = \frac{375 \div 25}{1000 \div 25} = \frac{15}{40} = \frac{15 \div 5}{40 \div 5} = \frac{3}{8}$. As a check, $3 \div 8 = 0.375$. Hence the required fraction is $\frac{3}{8}$.

66. Align the decimal places by writing every number with three decimal digits: $2.500 + 0.750 - 1.125$. First add: $2.500 + 0.750 = 3.250$. Then subtract: $3.250 - 1.125 = 2.125$. Hence the value is 2.125.

67. Rent = $\frac{2}{5} \times 32000$. Divide first: $32000 \div 5 = 6400$. Then multiply: $6400 \times 2 = 12800$. So Rahul pays Rs. 12,800 as rent each month.

68. Write each number with four decimal places so that the digits line up: 0.7000, 0.0770, 0.0700, 0.7070, 0.0707. Compare the tenths digit first: 0.7000 and 0.7070 have 7 there, while the other three have 0, so those three are the smaller group. Among 0.0770, 0.0700 and 0.0707 the hundredths digit is 7 in each case, so compare the thousandths digit: 0.0770 has 7, whereas 0.0700 and 0.0707 have 0; hence 0.0770 is the largest of the three. Finally compare 0.0700 and 0.0707 at the ten-thousandths place: $0 < 7$, so $0.0700 < 0.0707$. The smallest value is therefore 0.07.

69. Divide 7 by 8. Since 8 does not divide 7, write 7 as 7.000. Now $70 \div 8 = 8$ remainder 6, giving the first decimal digit 8; $60 \div 8 = 7$ remainder 4, giving the second digit 7; $40 \div 8 = 5$ remainder 0, giving the third digit 5. Hence $\frac{7}{8} = 0.875$. A quick check: $\frac{7}{8} = \frac{7 \times 125}{8 \times 125} = \frac{875}{1000} = 0.875$.

70. Let $x = 0.\bar{6} = 0.6666\dots$. One digit repeats, so multiply by 10: $10x = 6.6666\dots$. Subtracting, $10x - x = 6.6666\dots - 0.6666\dots$, which gives $9x = 6$, so $x = \frac{6}{9} = \frac{2}{3}$. Note that $\frac{3}{5} = \frac{6}{10} = 0.6$ exactly, which is a terminating decimal and therefore not equal to $0.\bar{6}$.

71. Compare by cross multiplication: for $\frac{13}{17}$ and $\frac{15}{19}$, compute $13 \times 19 = 247$ and $15 \times 17 = 255$. Since $255 > 247$, we get $\frac{15}{19} > \frac{13}{17}$. The common denominator is $17 \times 19 = 323$, so $\frac{15}{19} = \frac{255}{323}$ and $\frac{13}{17} = \frac{247}{323}$. The difference is $\frac{255 - 247}{323} = \frac{8}{323}$.

72. Use the identity $\frac{1}{n(n+1)} = \frac{1}{n} - \frac{1}{n+1}$. The sum becomes $\left(\frac{1}{1} - \frac{1}{2}\right) + \left(\frac{1}{2} - \frac{1}{3}\right) + \left(\frac{1}{3} - \frac{1}{4}\right) + \left(\frac{1}{4} - \frac{1}{5}\right)$. All intermediate terms cancel in pairs, leaving $1 - \frac{1}{5} = \frac{4}{5}$.

73. Let the number be x . The condition gives $0.05x = 0.02x + 45$, so $0.05x - 0.02x = 45$, that is $0.03x = 45$. Therefore $x = \frac{45}{0.03} = \frac{4500}{3} = 1500$. Check: $0.05 \times 1500 = 75$ and $0.02 \times 1500 = 30$, and $75 - 30 = 45$.

74. The numerator is of the form $a^2 - b^2$ with $a = 0.35$ and $b = 0.15$, so it factorises as $(a+b)(a-b)$. The expression becomes $\frac{(0.35+0.15)(0.35-0.15)}{0.35+0.15} = 0.35 - 0.15 = 0.20$. (Direct arithmetic confirms this: numerator = $0.1225 - 0.0225 = 0.10$ and denominator = 0.50 , and $0.10 \div 0.50 = 0.2$.)

75. Convert every entry to a decimal: 0.85 ; $\frac{7}{9} = 0.7778$; $\frac{5}{6} = 0.8333$; 0.8 ; $\frac{13}{16} = 0.8125$. Arranging in descending order: $0.85 > 0.8333 > 0.8125 > 0.80 > 0.7778$, that is $0.85 > \frac{5}{6} > \frac{13}{16} > 0.8 > \frac{7}{9}$. The largest is 0.85, so the second largest is $\frac{5}{6}$.

76. Let $x = 2.363636\dots$. Two digits repeat, so multiply by 100: $100x = 236.363636\dots$. Subtract the first equation from the second: $100x - x = 236.3636\dots - 2.3636\dots$, giving $99x = 234$, so $x = \frac{234}{99}$. Divide numerator and denominator by their HCF 9: $x = \frac{26}{11}$. Check: $26 \div 11 = 2.3636\dots$. Note $\frac{236}{99} = 2.3838\dots$, which is not the given number.

77. Let the income be x . Rent $= \frac{x}{3}$, so the amount remaining after rent is $x - \frac{x}{3} = \frac{2x}{3}$. Food $= \frac{2}{5} \times \frac{2x}{3} = \frac{4x}{15}$. The amount left is $\frac{2x}{3} - \frac{4x}{15} = \frac{10x - 4x}{15} = \frac{6x}{15} = \frac{2x}{5}$. Given $\frac{2x}{5} = 7200$, we get $x = \frac{7200 \times 5}{2} = 18000$. Hence her monthly income is Rs. 18,000.

78. All the fractions are close to $\frac{3}{4} = 0.75$, so compare each with 0.75 by cross multiplication against $\frac{3}{4}$. For $\frac{17}{23}$: $17 \times 4 = 68$ and $3 \times 23 = 69$, so $\frac{17}{23} < \frac{3}{4}$. For $\frac{25}{34}$: $25 \times 4 = 100$ and $3 \times 34 = 102$, so it is also less than $\frac{3}{4}$. For $\frac{39}{52}$: $39 \times 4 = 156 = 3 \times 52$, so it equals $\frac{3}{4}$ exactly. For $\frac{31}{41}$: $31 \times 4 = 124$ and $3 \times 41 = 123$, so it exceeds $\frac{3}{4}$. For $\frac{22}{29}$: $22 \times 4 = 88$ and $3 \times 29 = 87$, so it also exceeds $\frac{3}{4}$. Only the last two remain; compare them directly: $31 \times 29 = 899$ and $22 \times 41 = 902$, and since $902 > 899$, $\frac{22}{29} > \frac{31}{41}$. Hence $\frac{22}{29}$ is greatest.

79. Simplify from the innermost level outwards. First, $3 + \frac{1}{4} = \frac{13}{4}$. Next, $\frac{1}{\left(\frac{13}{4}\right)} = \frac{4}{13}$. Then $2 + \frac{4}{13} = \frac{26 + 4}{13} = \frac{30}{13}$. Finally the whole expression is $\frac{1}{\left(\frac{30}{13}\right)} = \frac{13}{30}$.

80. For a single repeating digit d , $0.\bar{d} = \frac{d}{9}$. So $0.\bar{6} = \frac{6}{9}$, $0.\bar{7} = \frac{7}{9}$ and $0.\bar{8} = \frac{8}{9}$. Their sum is $\frac{6 + 7 + 8}{9} = \frac{21}{9} = \frac{7}{3}$. Converting back, $7 \div 3 = 2.3333\dots = 2.\bar{3}$. Note that 2.1 and $2.\bar{1}$ are both smaller than $\frac{7}{3} = 2.333\dots$

81. Take $a = 0.75$ and $b = 0.25$, so that $a + b = 1$. The identity $(a + b)^3 = a^3 + b^3 + 3ab(a + b)$ gives $a^3 + b^3 + 3ab(a + b) = 1^3 = 1$. Since $a + b = 1$, the term $3ab(a + b)$ is simply $3ab = 3 \times 0.75 \times 0.25$, which is exactly the third term of the given expression. Hence the expression equals 1.

82. Let the numerator be n ; then the denominator is $3n - 2$. After increasing both by 2, the fraction is $\frac{n + 2}{3n - 2 + 2} = \frac{n + 2}{3n}$. This equals $\frac{1}{2}$, so cross multiplying gives $2(n + 2) = 3n$, that is $2n + 4 = 3n$, so $n = 4$. The denominator is $3 \times 4 - 2 = 10$, so the original fraction is $\frac{4}{10}$. Check: $\frac{4 + 2}{10 + 2} = \frac{6}{12} = \frac{1}{2}$. The required sum is $4 + 10 = 14$.

83. Since $\frac{a}{b} = \frac{3}{5}$, write $a = 3k$ and $b = 5k$ for some non-zero k . Then the numerator is $3(3k) + 2(5k) = 9k + 10k = 19k$ and the denominator is $5(3k) - 2(5k) = 15k - 10k = 5k$. Hence $\frac{3a + 2b}{5a - 2b} = \frac{19k}{5k} = \frac{19}{5}$.

84. Remove the decimals by writing each factor as a whole number times a power of ten. Numerator $= 203 \times 292 \times 10^{-6}$. Denominator $= 73 \times 145 \times 7 \times 10^{-6}$ (since $0.0073 = 73 \times 10^{-4}$, $14.5 = 145 \times 10^{-1}$ and $0.7 = 7 \times 10^{-1}$). The powers of ten cancel, leaving $\frac{203 \times 292}{73 \times 145 \times 7}$. Now $203 = 7 \times 29$, $292 = 4 \times 73$ and $145 = 5 \times 29$. Substituting: $\frac{7 \times 29 \times 4 \times 73}{73 \times 5 \times 29 \times 7} = \frac{4}{5} = 0.8$.

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85. Evaluate each surd separately. $\sqrt{144} = 12$, $\sqrt{81} = 9$ and $\sqrt{36} = 6$. Substituting, the expression becomes $\frac{12 \times 9}{6} = \frac{108}{6} = 18$. Hence the required value is 18.

86. Using the law $a^m \times a^n = a^{m+n}$, the numerator is $2^{5+3} = 2^8$. Then using $\frac{a^m}{a^n} = a^{m-n}$, we get $2^{8-6} = 2^2 = 4$.

87. Write the base as a power of 3: $81 = 3^4$. Then $(81)^{3/4} = (3^4)^{3/4} = 3^{4 \times \frac{3}{4}} = 3^3 = 27$, using $(a^m)^n = a^{mn}$.

88. Express 625 as a power of 5: $5^1 = 5$, $5^2 = 25$, $5^3 = 125$, $5^4 = 625$. So $5^x = 5^4$. Since the bases are equal and greater than 1, the exponents must be equal, giving $x = 4$.

89. Write $0.0064 = \frac{64}{10000}$. Then $\sqrt{0.0064} = \frac{\sqrt{64}}{\sqrt{10000}} = \frac{8}{100} = 0.08$. As a check, $0.08 \times 0.08 = 0.0064$, which confirms the answer.

90. Any non-zero number raised to the power zero is 1, so $7^0 = 1$. Also $4^{-1} = \frac{1}{4}$. Therefore the bracket equals $1 + \frac{1}{4} = \frac{5}{4}$, and $\frac{5}{4} \times 8 = 10$.

91. Multiply numerator and denominator by the conjugate $\sqrt{5} + 2$. The denominator becomes $(\sqrt{5} - 2)(\sqrt{5} + 2) = (\sqrt{5})^2 - 2^2 = 5 - 4 = 1$. So the expression equals $\frac{\sqrt{5} + 2}{1} = \sqrt{5} + 2$.

92. Bring both sides to base 2. Since $8 = 2^3$, the right side is $(2^3)^{x-1} = 2^{3x-3}$. Equating exponents of the same base, $x + 3 = 3x - 3$, so $6 = 2x$ and $x = 3$. Check: $2^6 = 64$ and $8^2 = 64$.

93. Reduce each surd to its simplest form: $\sqrt{50} = 5\sqrt{2}$, $\sqrt{18} = 3\sqrt{2}$ and $\sqrt{8} = 2\sqrt{2}$. The expression becomes $\frac{5\sqrt{2} + 3\sqrt{2}}{2\sqrt{2}} = \frac{8\sqrt{2}}{2\sqrt{2}} = 4$.

94. Rationalise using the conjugate $3 - 2\sqrt{2}$. The denominator becomes $(3 + 2\sqrt{2})(3 - 2\sqrt{2}) = 9 - 8 = 1$, so the expression equals $3 - 2\sqrt{2}$. Now $2\sqrt{2} = 2 \times 1.414 = 2.828$, hence the value is $3 - 2.828 = 0.172$.

95. Make the orders of the radicals equal. The LCM of 3, 2, 6, 4 is 12, so raise each number to the twelfth power and compare. $(4^{1/3})^{12} = 4^4 = 256$; $(3^{1/2})^{12} = 3^6 = 729$; $(20^{1/6})^{12} = 20^2 = 400$; $(8^{1/4})^{12} = 8^3 = 512$. The largest twelfth power is 729, so $\sqrt{3}$ is the greatest.

96. Rationalise: $x = \frac{1}{2 - \sqrt{3}} \times \frac{2 + \sqrt{3}}{2 + \sqrt{3}} = \frac{2 + \sqrt{3}}{4 - 3} = 2 + \sqrt{3}$. Then $x^2 = (2 + \sqrt{3})^2 = 4 + 4\sqrt{3} + 3 = 7 + 4\sqrt{3}$ and $4x = 8 + 4\sqrt{3}$. So $x^2 - 4x + 1 = (7 + 4\sqrt{3}) - (8 + 4\sqrt{3}) + 1 = 0$.

97. A negative exponent inverts the fraction: $\left(\frac{9}{16}\right)^{-3/2} = \left(\frac{16}{9}\right)^{3/2}$. Now $\left(\frac{16}{9}\right)^{1/2} = \frac{4}{3}$, and cubing gives $\left(\frac{4}{3}\right)^3 = \frac{64}{27}$.

98. Write both bases as powers of 2: $64 = 2^6$ and $32 = 2^5$. Then $(64)^{5/6} = (2^6)^{5/6} = 2^5 = 32$ and $(32)^{2/5} = (2^5)^{2/5} = 2^2 = 4$. Their product is $32 \times 4 = 128$, so the deposit is Rs. 128 lakh.

99. Notice that $3 + 2\sqrt{2} = 2 + 2\sqrt{2} + 1 = (\sqrt{2})^2 + 2\sqrt{2} + 1^2 = (\sqrt{2} + 1)^2$. Hence $\sqrt{x} = \sqrt{2} + 1$. Also $\frac{1}{\sqrt{x}} = \frac{1}{\sqrt{2} + 1} = \sqrt{2} - 1$ after rationalising. Therefore $\sqrt{x} - \frac{1}{\sqrt{x}} = (\sqrt{2} + 1) - (\sqrt{2} - 1) = 2$.

100. Let $2^a = 3^b = 6^{-c} = k$. Taking logarithms, $a \log 2 = \log k$, so $\frac{1}{a} = \frac{\log 2}{\log k}$. Similarly $\frac{1}{b} = \frac{\log 3}{\log k}$ and $-c \log 6 = \log k$ gives $\frac{1}{c} = -\frac{\log 6}{\log k}$. Adding, the sum is $\frac{\log 2 + \log 3 - \log 6}{\log k} = \frac{\log 6 - \log 6}{\log k} = 0$.

101. Substitute $y = 2x$ into $x^y = y^x$ to get $x^{2x} = (2x)^x$. The left side can be written as $(x^2)^x$, so $(x^2)^x = (2x)^x$. Since the exponent x is positive and common to both sides, the bases must be equal: $x^2 = 2x$, giving $x = 2$ (as $x \neq 0$). Then $y = 4$, and indeed $2^4 = 4^2 = 16$.

102. Each term $\frac{1}{\sqrt{n} + \sqrt{n+1}}$, on rationalising with the conjugate $\sqrt{n+1} - \sqrt{n}$, becomes $\frac{\sqrt{n+1} - \sqrt{n}}{(n+1) - n} = \sqrt{n+1} - \sqrt{n}$. So the sum is $(\sqrt{2} - \sqrt{1}) + (\sqrt{3} - \sqrt{2}) + \cdots + (\sqrt{81} - \sqrt{80})$. All intermediate terms cancel, leaving $\sqrt{81} - \sqrt{1} = 9 - 1 = 8$.

103. Square the given relation: $\left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)^2 = x + 2 + \frac{1}{x} = 6$, so $x + \frac{1}{x} = 4$. Square again: $\left(x + \frac{1}{x}\right)^2 = x^2 + 2 + \frac{1}{x^2} = 16$, hence $x^2 + \frac{1}{x^2} = 16 - 2 = 14$.

104. Here $P = 25,000$ and the maturity amount is 2,00,000, so $25,000 \times 2^{t/5} = 2,00,000$. Dividing, $2^{t/5} = \frac{2,00,000}{25,000} = 8 = 2^3$. Equating exponents of base 2, $\frac{t}{5} = 3$, giving $t = 15$ years.

105. Using $\frac{a^m}{a^n} = a^{m-n}$, the first factor is $a^{(m-n)(m+n)} = a^{m^2-n^2}$. Similarly the second is $a^{n^2-p^2}$ and the third is $a^{p^2-m^2}$. Multiplying, the exponents add: $(m^2 - n^2) + (n^2 - p^2) + (p^2 - m^2) = 0$. Hence the product is $a^0 = 1$.

Subtopic 1.1.6

106. Resolve 5184 into prime factors: $5184 = 2^6 \times 3^4$. Then $\sqrt{5184} = 2^3 \times 3^2 = 8 \times 9 = 72$. Check directly: $72 \times 72 = 5184$. Hence the answer is 72.

107. The last digit of 6859 is 9, and the only digit whose cube ends in 9 is 9, so the unit digit of the cube root is 9. Striking off the last three digits leaves 6, which lies between $1^3 = 1$ and $2^3 = 8$, so the tens digit is 1. Therefore the cube root is 19. Verify: $19^3 = 19 \times 19 \times 19 = 361 \times 19 = 6859$.

108. $1764 = 2^2 \times 3^2 \times 7^2$, so $\sqrt{1764} = 2 \times 3 \times 7 = 42$. Also $2025 = 45 \times 45$, so $\sqrt{2025} = 45$. Adding, $42 + 45 = 87$. Since 87 does not appear among the four listed choices, the correct response is 'None of these'.

109. For a square, area = side², so side = $\sqrt{3136}$. Since $3136 = 2^6 \times 7^2$, we get side = $2^3 \times 7 = 56$ m. Perimeter = $4 \times \text{side} = 4 \times 56 = 224$ m.

110. Factorise: $1080 = 2^3 \times 3^3 \times 5^1$. In a perfect cube every prime must occur to a power that is a multiple of 3. Here 2 and 3 already appear to the power 3, but 5 appears only once, so it needs two more factors of 5, i.e. multiply by $5^2 = 25$. Then $1080 \times 25 = 27000 = 30^3$, a perfect cube.

111. Write the number as a fraction: $0.000216 = \frac{216}{1000000}$. Now $\sqrt[3]{216} = 6$ and $\sqrt[3]{1000000} = 100$. So $\sqrt[3]{0.000216} = \frac{6}{100} = 0.06$. Check by cubing: $0.06 \times 0.06 \times 0.06 = 0.000216$.

112. Squares near this range are $45^2 = 2025$, $46^2 = 2116$ and $47^2 = 2209$. Comparing the options, 2028 and 2058 lie strictly between 2025 and 2116, and 2180 lies strictly between 2116 and 2209, so none of them can be a perfect square. Only $2116 = 46 \times 46$ is a perfect square.

113. First, $0.0169 = \frac{169}{10000}$, so $\sqrt{0.0169} = \frac{13}{100} = 0.13$. Next, $6.25 = \frac{625}{100}$, so $\sqrt{6.25} = \frac{25}{10} = 2.5$. Multiplying, $0.13 \times 2.5 = 0.325$.

114. Locate 7500 between consecutive squares. Since $86^2 = 7396$ and $87^2 = 7569$, we have $7396 < 7500 < 7569$. The largest perfect square not exceeding 7500 is therefore 7396. The number to be subtracted is $7500 - 7396 = 104$. (Subtracting less would leave a number above 7396 but below 7569, which cannot be a perfect square.)

115. Let the numbers be x , $2x$ and $3x$. Then the sum of their cubes is $x^3 + (2x)^3 + (3x)^3 = x^3 + 8x^3 + 27x^3 = 36x^3$. Setting $36x^3 = 4500$ gives $x^3 = \frac{4500}{36} = 125$, so $x = \sqrt[3]{125} = 5$. The three numbers are 5, 10 and 15, and the largest is 15. Check: $125 + 1000 + 3375 = 4500$.

116. Evaluate each root separately. $9261 = 21^3$, so $\sqrt[3]{9261} = 21$. Next, $2916 = 2^2 \times 3^6$, so $\sqrt{2916} = 2 \times 27 = 54$. Finally $4096 = 2^{12}$, so $\sqrt[3]{4096} = 2^4 = 16$. Therefore the expression equals $21 + 54 - 16 = 59$.

117. Find the cubes on either side of 4931. We have $17^3 = 4913$ and $18^3 = 5832$. Since 4931 already exceeds 4913, the next perfect cube above it is 5832. The required number is $5832 - 4931 = 901$.

118. For the first term, $\sqrt{3136} = 56$ and $\sqrt{196} = 14$, so the quotient is $\frac{56}{14} = 4$. For the second term, $2744 = 14^3$ and $343 = 7^3$, so $\sqrt[3]{\frac{2744}{343}} = \frac{14}{7} = 2$. Adding, $4 + 2 = 6$.

119. Let the number of members be n . Each member gets Rs. n , so the total distributed is $n \times n = n^2 = 15876$. Hence $n = \sqrt{15876}$. Factorising, $15876 = 2^2 \times 3^4 \times 7^2$, so $n = 2 \times 9 \times 7 = 126$. Verify: $126 \times 126 = 15876$.

120. Expand each square. $x^2 = (\sqrt{5} + \sqrt{3})^2 = 5 + 3 + 2\sqrt{15} = 8 + 2\sqrt{15}$. Similarly $y^2 = (\sqrt{5} - \sqrt{3})^2 = 5 + 3 - 2\sqrt{15} = 8 - 2\sqrt{15}$. Adding, the irrational parts cancel: $x^2 + y^2 = 8 + 8 = 16$.

121. A number that is simultaneously a perfect square and a perfect cube must be a perfect sixth power. The sixth powers are $1^6 = 1$, $2^6 = 64$, $3^6 = 729$ and $4^6 = 4096$. The first of these with four digits is 4096, which equals 64^2 and also 16^3 . Checking the other options: $1024 = 32^2$ is a square but not a cube; $1728 = 12^3$ is a cube but not a square; $5832 = 18^3$ is a cube but lies between $76^2 = 5776$ and $77^2 = 5929$, so it is not a square.

122. Square both sides: $1 + \frac{x}{144} = \frac{169}{144}$. Subtract 1 from both sides, writing $1 = \frac{144}{144}$: $\frac{x}{144} = \frac{169 - 144}{144} = \frac{25}{144}$. Therefore $x = 25$. Check: $\sqrt{1 + \frac{25}{144}} = \sqrt{\frac{169}{144}} = \frac{13}{12}$.

123. Greatest four-digit perfect square: since $99^2 = 9801$ and $100^2 = 10000$ has five digits, it is 9801. Least four-digit perfect cube: since $9^3 = 729$ has three digits and $10^3 = 1000$ has four, it is 1000. The required difference is $9801 - 1000 = 8801$.

124. First find the LCM: $8 = 2^3$, $12 = 2^2 \times 3$, $15 = 3 \times 5$, $20 = 2^2 \times 5$, so $\text{LCM} = 2^3 \times 3 \times 5 = 120$. Any common multiple is a multiple of 120. For a multiple of $2^3 \times 3 \times 5$ to be a perfect square, every prime power must be even, so we need at least $2^4 \times 3^2 \times 5^2 = 3600$. Thus the least such perfect square is $3600 = 60^2$, and indeed $3600 \div 8 = 450$, $3600 \div 12 = 300$, $3600 \div 15 = 240$, $3600 \div 20 = 180$. Among the other options, 900 and 4900 are not divisible by 8, and 1600 is not divisible by 3.

125. Volume of a cube = side³, so side = $\sqrt[3]{13824}$. Since $13824 = 2^9 \times 27 = 2^9 \times 3^3$, the cube root is $2^3 \times 3 = 24$ cm. Total surface area = $6 \times \text{side}^2 = 6 \times 24^2 = 6 \times 576 = 3456$ square cm. Cost = $3456 \times 15 = \text{Rs. } 51,840$.

126. Let the numbers be a and b , with $a^2 + b^2 = 185$ and $ab = 52$. Then $(a - b)^2 = a^2 + b^2 - 2ab = 185 - 2 \times 52 = 185 - 104 = 81$, so $a - b = \sqrt{81} = 9$ (taking the positive difference). As a check, $(a + b)^2 = 185 + 104 = 289$, giving $a + b = 17$; solving with $a - b = 9$ gives $a = 13$ and $b = 4$, and indeed $169 + 16 = 185$ and $13 \times 4 = 52$.

Subtopic 1.1.7

127. The unit digits of powers of 7 repeat in a cycle of length 4: $7^1 = 7$, $7^2 = 49$ (digit 9), $7^3 = 343$ (digit 3), $7^4 = 2401$ (digit 1), and then the pattern 7, 9, 3, 1 repeats. Divide the exponent by 4: $35 = 4 \times 8 + 3$, so the remainder is 3. The third entry of the cycle 7, 9, 3, 1 is 3. Hence the unit digit of 7^{35} is 3.

128. By the divisibility (remainder) rule for 9, the remainder on dividing a number by 9 equals the remainder obtained when its digit sum is divided by 9. Digit sum $= 4 + 5 + 7 + 8 + 9 + 3 = 36$. Now $36 = 9 \times 4 + 0$, so the remainder is 0. Therefore Rs. 4,57,893 is exactly divisible by 9 and the remainder is 0.

129. Unit digits of powers of 2 cycle as 2, 4, 8, 6 with period 4. Since $34 = 4 \times 8 + 2$, the remainder is 2, so 2^{34} ends in the second entry, 4. Unit digits of powers of 3 cycle as 3, 9, 7, 1 with period 4. Since $17 = 4 \times 4 + 1$, the remainder is 1, so 3^{17} ends in 3. Multiply the two unit digits: $4 \times 3 = 12$, whose unit digit is 2. Hence the required unit digit is 2.

130. Write the base in terms of the divisor: $6 = 5 + 1$, so $6 \equiv 1 \pmod{5}$. When the base leaves remainder 1, every power also leaves remainder 1, because $6^{50} \equiv 1^{50} = 1 \pmod{5}$. (Equivalently, $6^{50} = (5 + 1)^{50}$, and on binomial expansion every term except the last contains a factor of 5; the last term is 1.) Hence the remainder is 1.

131. Only the unit digit of the base matters. For $(37)^{12}$ the base ends in 7; powers of 7 cycle 7, 9, 3, 1 with period 4. Since 12 is exactly divisible by 4 (remainder 0), we take the last entry of the cycle, which is 1. For $(43)^{15}$ the base ends in 3; powers of 3 cycle 3, 9, 7, 1. Since $15 = 4 \times 3 + 3$, the remainder is 3 and the third entry is 7. Adding the unit digits: $1 + 7 = 8$. Hence the unit digit of the sum is 8.

132. Let the number of bundles be N . Given $N = 15k + 7$ for some whole number k . Since $15k$ is a multiple of 5, it contributes remainder 0 on division by 5. So the remainder depends only on 7: $7 = 5 \times 1 + 2$, giving remainder 2. Hence N leaves remainder 2 when divided by 5. As 2 is not listed among options A to D, the correct choice is None of these.

133. Observe that $76 \times 76 = 5776$, whose last two digits are again 76. So 76^2 ends in 76; multiplying by 76 once more, 76^3 also ends in 76, and so on. By this self-reproducing property, every positive power of a number ending in 76 ends in 76. Hence the last two digits of $(76)^{25}$ are 76.

134. Look for a small power of 2 that leaves remainder 1 on division by 7. Here $2^3 = 8 = 7 + 1$, so $2^3 \equiv 1 \pmod{7}$. Now express the exponent as a multiple of 3: $51 = 3 \times 17$. Therefore $2^{51} = (2^3)^{17} \equiv 1^{17} = 1 \pmod{7}$. Hence the remainder is 1.

135. Unit digit of 7^{95} : powers of 7 cycle 7, 9, 3, 1 with period 4; $95 = 4 \times 23 + 3$, so the third entry applies and the unit digit is 3. Unit digit of 3^{58} : powers of 3 cycle 3, 9, 7, 1; $58 = 4 \times 14 + 2$, so the second entry applies and the unit digit is 9. Now subtract: since $3 < 9$, borrow 10 from the tens place, giving $13 - 9 = 4$. (Note 7^{95} is far larger than 3^{58} , so the difference is positive and this borrowing is valid.) Hence the unit digit is 4.

136. Let the number be $N = 361k + 47$. Note that $361 = 19^2 = 19 \times 19$, so $361k$ is a multiple of 19 and leaves remainder 0 on division by 19. Hence the remainder of N by 19 is just the remainder of 47 by 19. Now $47 = 19 \times 2 + 9$, so the remainder is 9.

137. From $4!$ onwards every factorial is a multiple of 8: $4! = 24 = 8 \times 3$, and each later factorial contains $4!$ as a factor, so all of $4!, 5!, \dots, 100!$ leave remainder 0 on division by 8. Only the first three terms matter: $1! + 2! + 3! = 1 + 2 + 6 = 9$. Finally $9 = 8 \times 1 + 1$, so the required remainder is 1.

138. Compute a convenient power of 7 modulo 100: $7^2 = 49$ and $7^4 = 49^2 = 2401$, whose last two digits are 01. So $7^4 \equiv 1 \pmod{100}$. Split the exponent: $54 = 4 \times 13 + 2$. Therefore $7^{54} = (7^4)^{13} \times 7^2 \equiv 1^{13} \times 49 = 49 \pmod{100}$. Hence the last two digits are 49.

139. The remainder on division by 10 is simply the unit digit. For 53^{53} , the base ends in 3 and powers of 3 cycle 3, 9, 7, 1 with period 4; $53 = 4 \times 13 + 1$, so the unit digit is the first entry, 3. For 33^{33} , the base again ends in 3; $33 = 4 \times 8 + 1$, so its unit digit is also 3. The difference therefore ends in $3 - 3 = 0$, and since $53^{53} > 33^{33}$ the difference is positive. Hence the remainder is 0.

140. Let the number be N . From the second condition, $N = 9k + 4$, so the possible values are 4, 13, 22, 31, 40, $\dots$. Test each against the first condition $N \equiv 3 \pmod{7}$: 4 leaves 4; 13 leaves 6; 22

leaves 1; 31 leaves $31 - 28 = 3$, which works. Check: $31 = 7 \times 4 + 3$ and $31 = 9 \times 3 + 4$, so both conditions hold. Hence the least number of passbooks is 31.

141. First reduce the base: $32 = 7 \times 4 + 4$, so $32 \equiv 4 \pmod{7}$. The required remainder is that of $4^{32^{32}}$ modulo 7. Next find the cycle of 4 modulo 7: $4^1 \equiv 4$, $4^2 = 16 \equiv 2$, $4^3 = 64 \equiv 1 \pmod{7}$. So the cycle length is 3, and we need the exponent 32^{32} modulo 3. Since $32 = 3 \times 10 + 2$, we have $32 \equiv 2 \equiv -1 \pmod{3}$, so $32^{32} \equiv (-1)^{32} = 1 \pmod{3}$. Thus the exponent is of the form $3m + 1$, giving $4^{3m+1} = (4^3)^m \times 4 \equiv 1^m \times 4 = 4 \pmod{7}$. Hence the remainder is 4.

142. Only the last two digits of the base matter, so work with 17^{2019} modulo 100. Build up powers: $17^2 = 289 \equiv 89$; $17^4 \equiv 89^2 = 7921 \equiv 21$; $17^8 \equiv 21^2 = 441 \equiv 41$; $17^{16} \equiv 41^2 = 1681 \equiv 81 \pmod{100}$. Now find the cycle length: $17^{20} = 17^{16} \times 17^4 \equiv 81 \times 21 = 1701 \equiv 01 \pmod{100}$, so the cycle length is 20. Since $2019 = 20 \times 100 + 19$, we need $17^{19} = 17^{16} \times 17^2 \times 17 \equiv 81 \times 89 \times 17$. Now $81 \times 89 = 7209 \equiv 09$, and $09 \times 17 = 153 \equiv 53 \pmod{100}$. Hence the last two digits are 53. (Check: $53 \times 17 = 901 \equiv 01$, consistent with $17^{20} \equiv 01$.)

143. Use the standard formula $\frac{n(n+1)(2n+1)}{6}$ with $n = 100$. This gives $\frac{100 \times 101 \times 201}{6}$. Compute step by step: $100 \times 101 = 10100$, then $10100 \times 201 = 20,30,100$, and dividing by 6 gives 3,38,350. Now divide by 7: $7 \times 48,335 = 3,38,345$, and $3,38,350 - 3,38,345 = 5$. Hence the remainder is 5.

144. Find each term's unit digit. 1^1 ends in 1. $2^2 = 4$. $3^3 = 27$ ends in 7. 4^4 : powers of 4 alternate 4, 6; even exponent gives 6. 5^5 ends in 5. 6^6 ends in 6 (all powers of 6 do). 7^7 : cycle 7, 9, 3, 1 and $7 = 4 \times 1 + 3$, so the third entry, 3. 8^8 : cycle 8, 4, 2, 6 and 8 is a multiple of 4, so the last entry, 6. 9^9 : powers of 9 alternate 9, 1; odd exponent gives 9. Adding the unit digits: $1 + 4 + 7 + 6 + 5 + 6 + 3 + 6 + 9 = 47$, whose unit digit is 7.

145. Reduce each base modulo 5. For the first term, $444 = 5 \times 88 + 4$, so $444 \equiv 4 \equiv -1 \pmod{5}$; since the exponent 444 is even, $(444)^{444} \equiv (-1)^{444} = 1 \pmod{5}$. For the second term, $333 = 5 \times 66 + 3$, so $333 \equiv 3 \pmod{5}$; powers of 3 modulo 5 cycle 3, 4, 2, 1 with period 4, and $333 = 4 \times 83 + 1$, so $(333)^{333} \equiv 3 \pmod{5}$. Adding, $1 + 3 = 4$, and 4 is already less than 5, so the remainder is 4. Since 4 is not among options A to D, the answer is None of these.

146. Note that $7^2 = 49 = 50 - 1 \equiv -1 \pmod{25}$, which is the key simplification. Write $103 = 2 \times 51 + 1$, so $7^{103} = (7^2)^{51} \times 7 \equiv (-1)^{51} \times 7 = -7 \pmod{25}$. A negative residue is converted by adding the divisor: $-7 + 25 = 18$. Hence the remainder is 18.

147. Write $8^{25} = (2^3)^{25} = 2^{75}$ and work modulo 100 using the Chinese-remainder idea, splitting $100 = 4 \times 25$. Modulo 4: 2^{75} is divisible by 4, so the remainder is 0. Modulo 25: $2^{10} = 1024 = 25 \times 41 - 1 \equiv -1 \pmod{25}$, so $2^{75} = (2^{10})^7 \times 2^5 \equiv (-1)^7 \times 32 = -32 \equiv -32 + 50 = 18 \pmod{25}$. Now find the number below 100 that is $\equiv 0 \pmod{4}$ and $\equiv 18 \pmod{25}$: the candidates are 18, 43, 68, 93, of which only 68 is a multiple of 4. Hence the last two digits of 8^{25} are 68.

Subtopic 1.2.1

148. By BODMAS, division and multiplication are carried out before addition and subtraction. Division: $48 \div 6 = 8$. Multiplication: $3 \times 5 = 15$. The expression becomes $8 + 15 - 7$. Working left to right: $8 + 15 = 23$ and $23 - 7 = 16$. A common error is to add $6 + 3$ first, which would give $48 \div 9 \times 5 - 7$ and a wrong value. Hence the answer is 16.

149. Brackets first: $12 - 8 = 4$, so the expression is $15 + 5 \times 4 \div 2$. Multiplication and division rank equally and are done left to right: $5 \times 4 = 20$, then $20 \div 2 = 10$. Finally the addition: $15 + 10 = 25$. Note that doing $4 \div 2$ first also gives $5 \times 2 = 10$ here, but the left-to-right rule is the safe habit. Hence the answer is 25.

150. Work from the innermost bracket outward. Inner bracket: $7 - 5 = 2$. Inside the square bracket the multiplication comes before the addition: $2 \times 2 = 4$, then $4 + 4 = 8$. So the expression reduces to $36 \div 8 = 4.5$. If a student wrongly computes $4 + 2 = 6$ first and then $6 \times 2 = 12$, the answer would come to 3, which is not correct. Hence the answer is 4.5.

151. In BODMAS, roots and powers are evaluated at the 'order' stage, before division. $\sqrt{169} = 13$ and $12^2 = 144$. The expression becomes $13 + 144 \div 6$. Division next: $144 \div 6 = 24$. Finally $13 + 24 = 37$. Since 37 does not appear among the first four options, the correct choice is 'None of these'.

152. A percentage phrase such as '25% of 480' is a single product and must be evaluated before the addition. $25\% \text{ of } 480 = \frac{25}{100} \times 480 = 120$. Next, $15\% \text{ of } 200 = \frac{15}{100} \times 200 = 30$. Only now do we add: $120 + 30 = 150$. Hence the answer is 150.

153. Multiplication and division are settled first: $7 \times 8 = 56$ and $36 \div 9 = 4$. The expression becomes $56 - 4 + 5$. Addition and subtraction now proceed left to right: $56 - 4 = 52$, then $52 + 5 = 57$. Evaluating $4 + 5 = 9$ first and subtracting would wrongly give 47; subtraction and addition have equal rank, so left to right must be respected. Hence the answer is 57.

154. Bracket first: $18 + 12 = 30$. The expression is now $30 \div 6 \times 4 - 5$. Division and multiplication have equal priority, so move left to right: $30 \div 6 = 5$, then $5 \times 4 = 20$. Finally $20 - 5 = 15$. Doing $6 \times 4 = 24$ first would give $30 \div 24 - 5$, a negative value, which is the standard trap here. Hence the answer is 15.

155. Each 'of' term is a product and is evaluated before the addition and subtraction. $\frac{5}{8} \times 720 = 5 \times 90 = 450$. Next, $\frac{3}{7} \times 490 = 3 \times 70 = 210$. Next, $15\% \text{ of } 400 = \frac{15}{100} \times 400 = 60$. The expression becomes $450 + 210 - 60$. Left to right: $450 + 210 = 660$, then $660 - 60 = 600$. Hence the answer is 600.

156. Clear the round brackets first: $36 \div 4 = 9$ and $48 \div 6 = 8$. The square bracket becomes $9 \times 5 - 8 \times 3$. Inside it, both multiplications precede the subtraction: $9 \times 5 = 45$ and $8 \times 3 = 24$, giving $45 - 24 = 21$. The whole expression is now $21 \div 7 = 3$. Hence the answer is 3.

157. First the 'order' stage: $8^2 = 64$. The expression is $12 \times 15 - 144 \div 12 + 64 \div 4$. Now all multiplications and divisions: $12 \times 15 = 180$, $144 \div 12 = 12$, $64 \div 4 = 16$. This leaves $180 - 12 + 16$. Left to right: $180 - 12 = 168$, then $168 + 16 = 184$. Hence the answer is 184.

158. Start with the innermost round bracket: $25 - 9 = 16$. The square bracket gives $16 \div 4 = 4$. Inside the curly bracket we now have $4 + 6 \times 3$; multiplication first, so $6 \times 3 = 18$ and $4 + 18 = 22$. Finally, multiply by 2: $22 \times 2 = 44$. A student who adds $4 + 6 = 10$ before multiplying gets $30 \times 2 = 60$, which is wrong. Hence the answer is 44.

159. Roots are handled at the 'order' stage: $\sqrt{576} = 24$ because $24 \times 24 = 576$, and $\sqrt[3]{729} = 9$ because $9 \times 9 \times 9 = 729$. The expression becomes $24 \div 4 + 9 \times 2 - 5$. Division and multiplication next: $24 \div 4 = 6$ and $9 \times 2 = 18$, giving $6 + 18 - 5$. Left to right: $6 + 18 = 24$, then $24 - 5 = 19$. Hence the answer is 19.

160. The fraction bar acts as a bracket, so numerator and denominator are simplified separately before dividing. Numerator: multiplications first, $0.6 \times 0.6 = 0.36$ and $0.4 \times 0.4 = 0.16$, so the numerator is $0.36 + 0.16 = 0.52$. Denominator: the bracket is evaluated before the power, $0.6 + 0.4 = 1$, and $1^2 = 1$. Therefore the value is $0.52 \div 1 = 0.52$. The trap is to assume the numerator equals the denominator, i.e. that $a^2 + b^2 = (a + b)^2$, which is false. Since 0.52 is not listed, the answer is 'None of these'.

161. Simplify the known part of the left side first. By BODMAS, $240 \div 8 = 30$ must be computed before the subtraction. Let the missing value be x . Then $18x - 30 = 150$. Adding 30 to both sides gives $18x = 180$, so $x = 180 \div 18 = 10$. Checking: $18 \times 10 - 240 \div 8 = 180 - 30 = 150$, which matches. Hence the answer is 10.

162. Simplify each bracket independently. First bracket: $\frac{3}{5} \times 1250 = 3 \times 250 = 750$ and $\frac{7}{9} \times 810 = 7 \times 90 = 630$; the 'of' products come before the subtraction, giving $750 - 630 = 120$. Second bracket: $15\% \text{ of } 120 = \frac{15}{100} \times 120 = 18$, and this product precedes the subtraction, so $18 - 6 = 12$. The expression is now $120 \div 12 = 10$. Hence the answer is 10.

163. Powers are evaluated first: $(0.8)^3 = 0.512$ and $(0.2)^3 = 0.008$. Then the chain of multiplications, left to right: $3 \times 0.8 = 2.4$ and $2.4 \times 0.2 = 0.48$. Only now do the additions run: $0.512 + 0.008 = 0.52$

and $0.52 + 0.48 = 1$. There is a shortcut, but it must be stated carefully. The general identity is $a^3 + b^3 + 3ab(a + b) = (a + b)^3$. The expression here is $a^3 + b^3 + 3ab$, which is not the same thing in general; the two agree only when $a + b = 1$, since then the factor $(a + b)$ is 1 and $3ab(a + b)$ collapses to $3ab$. With $a = 0.8$ and $b = 0.2$ we do have $a + b = 1$, so in this special case the expression equals $(0.8 + 0.2)^3 = 1^3 = 1$. Do not carry the shortcut over to a problem where $a + b \neq 1$. Hence the answer is 1.

164. Each square bracket is simplified in full before the outer division, and inside each bracket multiplication and division outrank addition and subtraction. First bracket: the product comes first, $\frac{2}{3} \times \frac{9}{4} = \frac{18}{12} = \frac{3}{2}$, so the bracket is $\frac{5}{6} + \frac{3}{2} = \frac{5}{6} + \frac{9}{6} = \frac{14}{6} = \frac{7}{3}$. Second bracket: the division comes first, $\frac{5}{8} \div \frac{1}{2} = \frac{5}{8} \times \frac{2}{1} = \frac{10}{8} = \frac{5}{4}$, so the bracket is $\frac{7}{4} - \frac{1}{4} = \frac{6}{4} = \frac{3}{2}$. Now the outer division: $\frac{7}{3} \div \frac{3}{2} = \frac{7}{3} \times \frac{2}{3} = \frac{14}{9}$. This division ranks above the final subtraction, which is therefore done last: $\frac{14}{9} - \frac{1}{3} = \frac{14}{9} - \frac{3}{9} = \frac{11}{9}$. A student who subtracts $\frac{1}{3}$ from $\frac{3}{2}$ before dividing would get $\frac{7}{3} \div \frac{7}{6} = 2$, which is the standard trap. Hence the answer is $\frac{11}{9}$.

165. The whole expression under the root sign acts as a bracket. Inside it, division precedes addition: $84 \div 4 = 21$, so $21 + 15 = 36$; then $36 \times 4 = 144$. Therefore $\sqrt{144} = 12$. For the second term, the power is taken first: $12^2 = 144$, then $144 \div 24 = 6$. Adding the two results, $12 + 6 = 18$. Hence the answer is 18.

166. Let the sum be x . The phrase 'three-fourths of two-fifths of x ' means the two fractions multiply before anything else: $\frac{3}{4} \times \frac{2}{5} \times x = \frac{6}{20}x = \frac{3}{10}x$. Similarly 'one-sixth of three-fifths of x ' is $\frac{1}{6} \times \frac{3}{5} \times x = \frac{3}{30}x = \frac{1}{10}x$. The condition gives $\frac{3}{10}x - \frac{1}{10}x = 45$, that is $\frac{2}{10}x = 45$, so $\frac{x}{5} = 45$ and $x = 225$. Check: $\frac{3}{10} \times 225 = 67.5$ and $\frac{1}{10} \times 225 = 22.5$, and $67.5 - 22.5 = 45$. Hence the sum is Rs. 225.

167. Evaluate the bracketed percentages first. 45% of $1200 = \frac{45}{100} \times 1200 = 540$, and 30% of $40 = \frac{30}{100} \times 40 = 12$. The remaining 'of' term is 20% of $150 = \frac{20}{100} \times 150 = 30$; this product also ranks above the addition. The expression is now $540 \div 12 + 30$. Division before addition: $540 \div 12 = 45$, then $45 + 30 = 75$. Since 75 is not among the first four options, the answer is 'None of these'.

168. Each fraction bar groups its numerator and denominator, so simplify the two fractions before multiplying them. First fraction: the numerator is a difference of squares, $\frac{(3.5)^2 - (1.5)^2}{3.5 - 1.5} = \frac{(3.5 + 1.5)(3.5 - 1.5)}{3.5 - 1.5} = 3.5 + 1.5 = 5$. Second fraction: the numerator is a perfect square, $\frac{(2.4)^2 + 2 \times 2.4 \times 0.6 + (0.6)^2}{(2.4 + 0.6)^2} = \frac{3^2}{3^2} = 1$, so the fraction is $9 \div 3 = 3$. Only now multiply the two simplified results: $5 \times 3 = 15$. Hence the answer is 15.

Subtopic 1.2.2

169. Apply the BODMAS order. Division and multiplication are settled before addition and subtraction. First, $48 \div 6 = 8$. Next, $12 \times 3 = 36$. The expression now reads $8 + 36 - 15$. Working left to right, $8 + 36 = 44$ and $44 - 15 = 29$. Hence the required value is 29, which is option B.

170. Take each part separately. For the first part, $\frac{3}{5} \times 450 = 3 \times 90 = 270$, since $450 \div 5 = 90$. For the second part, $259 \div 7 = 37$, so $\frac{2}{7} \times 259 = 2 \times 37 = 74$. Adding the two results, $270 + 74 = 344$. Hence the answer is 344, option B.

171. Evaluate each square root using standard perfect squares. Since $32 \times 32 = 1024$, we get $\sqrt{1024} = 32$. Since $27 \times 27 = 729$, we get $\sqrt{729} = 27$. Since $21 \times 21 = 441$, we get $\sqrt{441} = 21$. Substituting, the

expression becomes $32 + 27 - 21$. Now $32 + 27 = 59$ and $59 - 21 = 38$. Hence the value is 38, option B.

172. Compute the squares first: $(18)^2 = 324$ and $(13)^2 = 169$. So the expression is $324 - 169 + 45$. Then $324 - 169 = 155$, and $155 + 45 = 200$. Alternatively, use the identity $a^2 - b^2 = (a + b)(a - b) = (18 + 13)(18 - 13) = 31 \times 5 = 155$, then add 45 to get 200. Hence the answer is 200, option D.

173. Convert the percentages to easy fractions. Here $37.5\% = \frac{3}{8}$, so $\frac{3}{8} \times 800 = 3 \times 100 = 300$. Also $12.5\% = \frac{1}{8}$, so $\frac{1}{8} \times 640 = 80$. Adding, $300 + 80 = 380$. The value 380 does not appear among options A to D, so the correct choice is None of these, option E.

174. Take the LCM of the denominators 4 and 6, which is 12. The left side becomes $\frac{3x}{12} + \frac{2x}{12} = \frac{5x}{12}$. So $\frac{5x}{12} = 25$. Cross-multiplying gives $5x = 25 \times 12 = 300$, hence $x = 60$. Check: $\frac{60}{4} + \frac{60}{6} = 15 + 10 = 25$, which matches. Hence $x = 60$, option A.

175. Simplify the fraction before multiplying. Since $144 \div 48 = 3$, the fraction $\frac{144 \times 16}{48}$ reduces to $3 \times 16 = 48$. The expression is now $48 - 25 = 23$. Hence the required value is 23, option D.

176. Work through the two blocks separately. First, $\frac{3}{4} \times 1200 = 900$, and $900 \div 15 = 60$. Second, 42% of 350 means $\frac{42}{100} \times 350 = \frac{42 \times 7}{2} = \frac{294}{2} = 147$. Adding the two results, $60 + 147 = 207$. Hence the answer is 207, option A.

177. Simplify the right hand side first. Here $\frac{2}{5} \times 700 = 2 \times 140 = 280$, and $280 - 195 = 85$. So the equation becomes $\sqrt{?} + 15 = 85$, giving $\sqrt{?} = 85 - 15 = 70$. Squaring both sides, $? = 70^2 = 4900$. Hence the answer is 4900, option D.

178. The chain of fractions can be multiplied together first: $\frac{2}{3} \times \frac{5}{8} \times \frac{4}{7} = \frac{2 \times 5 \times 4}{3 \times 8 \times 7} = \frac{40}{168} = \frac{5}{21}$. Now multiply by 4410: since $4410 \div 21 = 210$, we get $\frac{5}{21} \times 4410 = 5 \times 210 = 1050$. Hence the value is 1050, option D.

179. Household expenses are 35% of Rs. 48,000, which is $\frac{35}{100} \times 48000 = \text{Rs. } 16,800$. The amount remaining is $48000 - 16800 = \text{Rs. } 31,200$. Transport takes $\frac{1}{6}$ of this remainder, that is $31200 \div 6 = \text{Rs. } 5,200$. The deposit is therefore $31200 - 5200 = \text{Rs. } 26,000$. Note that the transport fraction applies to the remainder, not to the original salary, which is the common trap here. Hence the answer is Rs. 26,000, option C.

180. Take the terms one at a time. First, $(24)^2 = 576$ and $576 \div 16 = 36$. Second, $(13)^2 = 169$. Third, since $45 \times 45 = 2025$, we have $\sqrt{2025} = 45$. Substituting gives $36 + 169 - 45$. Then $36 + 169 = 205$ and $205 - 45 = 160$. The value 160 is not listed in options A to D, so the correct choice is None of these, option E.

181. Recall the identity $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$. Here $a = 0.8$ and $b = 0.2$, and the denominator is exactly $a^2 - ab + b^2$. So the fraction reduces to $\frac{(a + b)(a^2 - ab + b^2)}{a^2 - ab + b^2} = a + b = 0.8 + 0.2 = 1$. As a check by direct computation, the numerator is $0.512 + 0.008 = 0.520$ and the denominator is $0.64 - 0.16 + 0.04 = 0.52$, and $0.520 \div 0.52 = 1$. Hence the answer is 1, option C.

182. Convert the mixed numbers to decimals: $12\frac{1}{2} = 12.5$, $8\frac{3}{4} = 8.75$ and $6\frac{5}{8} = 6.625$. The bracket is evaluated first: $6.625 \times 2 = 13.25$. Now $12.5 + 8.75 = 21.25$, and $21.25 - 13.25 = 8$. Hence the value is 8, option B.

183. Build the fraction first. The numerator is $(18)^2 + \sqrt{1296} = 324 + 36 = 360$, since $36 \times 36 = 1296$.

The denominator is $\sqrt{225} \times 2 = 15 \times 2 = 30$. So the fraction equals $360 \div 30 = 12$. Next, $37.5\% = \frac{3}{8}$, so $\frac{3}{8} \times 96 = 3 \times 12 = 36$. Adding, $12 + 36 = 48$. Hence the answer is 48, option B.

184. Let $a = 4.5$ and $b = 2.5$. The expression is $\frac{a^2 - b^2}{a^3 + b^3} \times (a^2 - ab + b^2)$. Using $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$ and $a^2 - b^2 = (a + b)(a - b)$, the expression becomes $\frac{(a + b)(a - b)}{(a + b)(a^2 - ab + b^2)} \times (a^2 - ab + b^2)$. The factor $(a + b)$ cancels, and then $(a^2 - ab + b^2)$ cancels as well, leaving simply $a - b$. Therefore the value is $4.5 - 2.5 = 2$. Hence the answer is 2, option A.

185. Rent is $\frac{2}{9} \times 63000 = 2 \times 7000 = \text{Rs. } 14,000$, leaving $63000 - 14000 = \text{Rs. } 49,000$. Food takes 25% of this remainder, that is $\frac{1}{4} \times 49000 = \text{Rs. } 12,250$, leaving $49000 - 12250 = \text{Rs. } 36,750$. Education takes $\frac{3}{7}$ of that, that is $\frac{3}{7} \times 36750 = 3 \times 5250 = \text{Rs. } 15,750$. The miscellaneous balance is $36750 - 15750 = \text{Rs. } 21,000$. Hence the answer is Rs. 21,000, option C.

186. Handle the brackets first. Division by a fraction means multiplication by its reciprocal, so $\frac{7}{9} \div \frac{14}{27} = \frac{7}{9} \times \frac{27}{14} = \frac{7 \times 27}{9 \times 14} = \frac{3}{2}$. For the second bracket, $\frac{5}{8} + \frac{3}{4} = \frac{5}{8} + \frac{6}{8} = \frac{11}{8}$. Multiplying, $\frac{3}{2} \times \frac{11}{8} = \frac{33}{16}$. Finally, dividing by $\frac{11}{16}$ gives $\frac{33}{16} \times \frac{16}{11} = \frac{33}{11} = 3$. Hence the value is 3, option D.

187. Evaluate the right hand side. Here $(35)^2 = 1225$ and $(12)^2 = 144$, so the right side is $1225 - 144 + 24 = 1081 + 24 = 1105$. On the left, $(23)^2 = 529$. Therefore $(?)^2 = 1105 - 529 = 576$. Since $24 \times 24 = 576$, the question mark stands for 24. Hence the answer is 24, option A.

188. Cancel factor by factor rather than multiplying everything out. Note $\frac{0.48}{0.12} = 4$ and $\frac{2.50}{0.5} = 5$. That leaves $\frac{3.6}{0.09} \times 4 \times 5$. Now $\frac{3.6}{0.09} = \frac{360}{9} = 40$. So the value is $40 \times 4 \times 5 = 800$. As a check, the numerator is $3.6 \times 0.48 \times 2.5 = 4.32$ and the denominator is $0.12 \times 0.09 \times 0.5 = 0.0054$, and $4.32 \div 0.0054 = 800$. Hence the answer is 800, option C.

189. Each denominator is a product of two consecutive integers: $2 = 1 \times 2$, $6 = 2 \times 3$, $12 = 3 \times 4$, $20 = 4 \times 5$, $30 = 5 \times 6$ and $42 = 6 \times 7$. Use the splitting rule $\frac{1}{n(n+1)} = \frac{1}{n} - \frac{1}{n+1}$. The sum becomes $\left(\frac{1}{1} - \frac{1}{2}\right) + \left(\frac{1}{2} - \frac{1}{3}\right) + \left(\frac{1}{3} - \frac{1}{4}\right) + \left(\frac{1}{4} - \frac{1}{5}\right) + \left(\frac{1}{5} - \frac{1}{6}\right) + \left(\frac{1}{6} - \frac{1}{7}\right)$. All the middle terms cancel in pairs, leaving $1 - \frac{1}{7} = \frac{6}{7}$. Hence the answer is $\frac{6}{7}$, option B.

Subtopic 1.2.3

190. Round each quantity to the nearest convenient value. $624.98 \approx 625$, and $\sqrt{625} = 25$. Also $15.02 \approx 15$. Hence the expression is about $25 \times 15 = 375$. The rounding error is tiny: $\sqrt{624.98} \approx 24.9996$ and $24.9996 \times 15.02 \approx 375.5$, so 375 is the closest listed value.

191. Round 19.97% to 20% and 4501 to 4500. Now 20% of 4500 = $\frac{1}{5} \times 4500 = 900$. Checking the drift: the percentage is low by 0.03 points (about 1.35) while the base is high by 1 (worth about 0.2), so the true value is roughly 898.8. The nearest option is 900.

192. Round to 24 and 16 and use $a^2 - b^2 = (a + b)(a - b)$. Then $(24)^2 - (16)^2 = (24 + 16)(24 - 16) = 40 \times 8 = 320$. Exact working gives $575.04 - 255.68 = 319.36$, which rounds to 320.

193. Round the numerator to 1250 and the divisor to 25, both chosen because 1250 is an exact multiple of 25. Then $1250 \div 25 = 50$. Since the numerator was rounded up by about 0.13 and the divisor up by 0.02, the true quotient is about 50.03, so 50 is correct.

194. Round the quantity to 20 kg and the rate to Rs. 48 per kg, since 20×48 is easy. Cost $\approx 20 \times 48 =$ Rs. 960. Both roundings were upward but by very little: the exact product is $19.87 \times 47.95 =$ Rs. 952.8, which is nearest to Rs. 960 among the options.

195. Recognise the nearby perfect powers. $4096 = 16^3$, so $\sqrt[3]{4095.99} \approx 16$. Also $1024 = 32^2$, so $\sqrt{1024.02} \approx 32$. Adding, $16 + 32 = 48$. The corrections are of the order of 0.0001, so 48 stands.

196. To round to the nearest thousand, look at the digits after the thousands place, namely 567. Since $567 > 500$, the thousands digit is increased by one and everything after it becomes zero: 2,34,567 $\rightarrow$ 2,35,000. Rs. 2,34,000 would be rounding down (wrong, since $567 > 500$), Rs. 2,34,500 is rounding to the nearest five hundred, and Rs. 2,35,600 is rounding to the nearest hundred of a different number. Hence Rs. 2,35,000 is correct and 'None of these' does not apply.

197. Treat the two fractions separately. First, $\frac{4999.99}{24.99} \approx \frac{5000}{25} = 200$. Second, $\frac{3600.11}{5.98} \approx \frac{3600}{6} = 600$. Adding the two rounded results gives $200 + 600 = 800$. A quick error check: the second divisor was rounded up from 5.98 to 6, which makes the estimate slightly low (true value about 602), so the sum is near 802 and 800 is the intended answer.

198. Round each factor to a value with an exact result: $15.02 \approx 15$ so $(15.02)^2 \approx 225$; $195.99 \approx 196$ and $\sqrt{196} = 14$; $3.99 \approx 4$. Now apply the operations left to right in the usual order (multiplication and division rank equally): $225 \times 14 = 3150$, then $3150 \div 4 = 787.5$. The nearest option is 790.

199. Round the disbursement to Rs. 25,00,000 and the rate to 15%. Then the NPA amount $\approx \frac{15}{100} \times 25,00,000$. Compute in two easy pieces: 10% of 25,00,000 = 2,50,000 and 5% is half of that, i.e. 1,25,000. Their sum is 3,75,000. Both roundings were upward by a whisker, so the exact figure is about Rs. 3,74,314, nearest to Rs. 3,75,000.

200. Round each number to a multiple of the denominator so the fraction divides exactly. Take $1399.94 \approx 1400$, which is divisible by 7: $\frac{3}{7} \times 1400 = 3 \times 200 = 600$. Take $899.87 \approx 900$, which is divisible by 9: $\frac{5}{9} \times 900 = 5 \times 100 = 500$. Adding, $600 + 500 = 1100$.

201. Round 19.98% to 20% and 10.01% to 10%; successive percentage changes must be applied one after the other, never added. After the rise: $1250 \times \frac{120}{100} = 1500$. After the fall on this new price: $1500 \times \frac{90}{100} = 1350$. (Adding +20% and -10% to get a flat +10% would wrongly give Rs. 1375, which is why that distractor is present.)

202. Each radicand sits next to a perfect square: $1295.99 \approx 1296$ with $\sqrt{1296} = 36$; $255.98 \approx 256$ with $\sqrt{256} = 16$; $80.98 \approx 81$ with $\sqrt{81} = 9$. Substituting, the expression becomes $36 \times 16 \div 9$. Cancel first to keep the arithmetic light: $\frac{36}{9} = 4$, so the value is $4 \times 16 = 64$.

203. Round each figure to the nearest fifty thousand before adding: $12,50,000 + 8,00,000 + 15,50,000 + 10,00,000 + 14,00,000$. Adding in pairs, $12,50,000 + 15,50,000 = 28,00,000$ and $8,00,000 + 10,00,000 + 14,00,000 = 32,00,000$, giving a total of 60,00,000. The average is $\frac{60,00,000}{5} = 12,00,000$. Since Rs. 12,00,000 is listed, 'None of these' is not the answer.

204. Round each base to the nearest integer and use the standard cubes. $(7.98)^3 \approx 8^3 = 512$, $(4.02)^3 \approx 4^3 = 64$ and $(5.99)^3 \approx 6^3 = 216$. Substituting, $512 + 64 - 216 = 576 - 216 = 360$. The small errors partly cancel. Using $\Delta(x^3) \approx 3x^2 \Delta x$: replacing 7.98 by 8 over-states that cube by $3(64)(0.02) \approx 3.84$, so the correction is -3.84; replacing 4.02 by 4 under-states that cube by $3(16)(0.02) \approx 0.96$, so the correction is +0.96; replacing 5.99 by 6 over-states the cube being subtracted by $3(36)(0.01) \approx 1.08$, and because it carries a minus sign the correction is again +1.08. The corrections total $-3.84 + 0.96 + 1.08 = -1.80$, so the true value is about $360 - 1.8 = 358.2$ (exactly 358.21). Among the options the nearest is 360.

205. Identify the nearby exact powers one by one. $5832 = 18^3$, so $\sqrt[3]{5831.98} \approx 18$. Next, $441 = 21^2$, so $\sqrt{440.99} \approx 21$. Finally $(2.99)^2 \approx 3^2 = 9$. The expression becomes $18 \times 21 \div 9$. Cancelling 18 against 9 first gives $2 \times 21 = 42$.

206. Round the principal to Rs. 16,000 and the rate to 10%. For compound interest, amount $= P \left(1 + \frac{r}{100}\right)^n = 16000 \times (1.1)^2$. Since $(1.1)^2 = 1.21$, the amount $= 16000 \times 1.21$. Split the multiplication: $16000 + 10\%$ of $16000 = 17600$ after year one, then $17600 + 10\%$ of $17600 = 19360$ after year two. So the amount is about Rs. 19,360. (Simple interest would have given only $16000 + 3200 =$ Rs. 19,200, so the compounding step matters.)

207. Round the salary to Rs. 40,000, the first rate to 25% and the second to 20%; the deductions act one after another on a shrinking balance. Rent takes $\frac{1}{4}$ of 40,000 $= 10,000$, leaving 30,000. Food takes $\frac{1}{5}$ of 30,000 $= 6,000$, leaving 24,000. Transport takes $\frac{1}{8}$ of 24,000 $= 3,000$, leaving $24,000 - 3,000 = 21,000$. So he is left with about Rs. 21,000.

208. Evaluate the two bracketed quantities first. Rounding 2499.87 to 2500, $\frac{4}{5} \times 2500 = 4 \times 500 = 2000$. Rounding 639.94 to 640, $\frac{3}{8} \times 640 = 3 \times 80 = 240$. The expression is now $2000 \div 240 \times 5.98$. Take $5.98 \approx 6$ and simplify before dividing: $\frac{2000 \times 6}{240} = \frac{12000}{240} = 50$.

209. Round every percentage and every base, then handle the three terms separately. First term: 35% of 800 $= 0.35 \times 800 = 280$. Second term: 45% of 1200 $= 0.45 \times 1200 = 540$. Third term: 25% of 400 $= \frac{1}{4} \times 400 = 100$, and it is subtracted. Combining, $280 + 540 - 100 = 820 - 100 = 720$.

210. Round every factor: the numerator becomes $12 \times 15 \times 8$ and the denominator 6×3 . Cancel before multiplying: $\frac{12}{6} = 2$ and $\frac{15}{3} = 5$, so the expression reduces to $2 \times 5 \times 8 = 80$. Since 80 is not among the four numerical choices, and the rounding errors are far too small to pull the value down to 75 (the exact value is about 80.2), the correct response is 'None of these'.

Subtopic 1.2.4

211. Instead of multiplying by 12.5 and dividing by 100, recall the fraction equivalent $12.5\% = \frac{1}{8}$. So the deposit is $\frac{1}{8} \times 48000$. Since $48 \div 8 = 6$, the answer is $6 \times 1000 = 6000$. Hence she deposits Rs. 6,000.

212. For any number ending in 5, written as $(10a + 5)$, the square is $a(a + 1)$ followed by 25. Here $a = 4$, so compute $a(a + 1) = 4 \times 5 = 20$ and append 25, giving 2025. Check by expansion: $45^2 = (40 + 5)^2 = 1600 + 2 \times 40 \times 5 + 25 = 1600 + 400 + 25 = 2025$.

213. This is a direct table fact, 17×14 . If the table of 17 is not memorised, split the multiplier: $17 \times 14 = 17 \times (10 + 4) = 170 + 68 = 238$. Alternatively use $17 \times 14 = (17 \times 7) \times 2 = 119 \times 2 = 238$. So the cashier receives 238 notes.

214. Use the fraction equivalent $62.5\% = \frac{5}{8}$. Then $\frac{5}{8} \times 3200 = 5 \times 400 = 2000$. The trap options come from using $\frac{1}{2}$ (giving 1600) or 60% (giving 1920); the correct equivalent is $\frac{5}{8}$, so the answer is Rs. 2,000.

215. The standard equivalent is $16\frac{2}{3}\% = \frac{1}{6}$. So the discount is $\frac{1}{6} \times 5400 = 900$. Note that a candidate who wrongly reads the rate as 16% gets 864, and one who uses 15% gets 810; both are planted distractors. The correct discount is Rs. 900.

216. Take base 100. The surplus is $108 - 100 = 8$. Add the surplus to the number to get the left part, $108 + 8 = 116$, and square the surplus for the right part, $8^2 = 64$, written in two digits. Joining

them gives $116 \mid 64 = 11664$. Verifying by expansion, $(100 + 8)^2 = 10000 + 2 \times 100 \times 8 + 64 = 10000 + 1600 + 64 = 11664$. The distractor 11,608 comes from writing the surplus 8 instead of its square in the right part.

217. Convert each fraction to a percentage. $\frac{2}{5} = 40\%$; $\frac{5}{16} = 31.25\%$; $\frac{1}{3} = 33\frac{1}{3}\%$; $\frac{3}{8} = 3 \times 12.5\% = 37.5\%$; $\frac{3}{7} = 42\frac{6}{7}\%$. Only $\frac{3}{8}$ matches, since $\frac{1}{8} = 12.5\%$ and tripling it gives 37.5%.

218. The area is 96^2 . Rather than long multiplication, use the base-100 deficiency method: the deficiency is $100 - 96 = 4$. Then $96^2 = (96 - 4) \mid 4^2 = 92 \mid 16 = 9216$. Verifying by expansion, $(100 - 4)^2 = 10000 - 800 + 16 = 9216$. So the area is 9,216 square metres.

219. Replace both rates by fractions. $33\frac{1}{3}\% = \frac{1}{3}$, so the fuel spend is $\frac{1}{3} \times 4200 = 1400$. Next, $12.5\% = \frac{1}{8}$, so the dairy spend is $\frac{1}{8} \times 3200 = 400$. Adding, $1400 + 400 = 1800$. The total is Rs. 1,800.

220. Do not square the numbers separately. Use $a^2 - b^2 = (a - b)(a + b)$ with $a = 87$ and $b = 13$. Then $a - b = 74$ and $a + b = 100$, so the value is $74 \times 100 = 7400$. (As a check, $87^2 = 7569$ and $13^2 = 169$, and $7569 - 169 = 7400$.)

221. Multiplying by 125 is fastest as multiplying by $\frac{1000}{8}$, since $125 = \frac{1000}{8}$. So $384 \times 125 = \frac{384 \times 1000}{8} = 48 \times 1000 = 48000$. The total bill is Rs. 48,000, which does not appear among the first four options, so the correct choice is 'None of these'.

222. Note that $18.75\% = \frac{3}{16}$, because $6.25\% = \frac{1}{16}$ and $18.75 = 3 \times 6.25$. Therefore the count is $\frac{3}{16} \times 6400 = 3 \times 400 = 1200$. The distractor 1280 comes from using 20% instead of 18.75%. So 1,200 education loans were sanctioned.

223. Percentage excess is measured against the second quantity. The excess is $\frac{5}{8} - \frac{1}{2} = \frac{5-4}{8} = \frac{1}{8}$. Dividing by the base $\frac{1}{2}$ gives $\frac{1/8}{1/2} = \frac{1}{8} \times 2 = \frac{1}{4} = 25\%$. The trap answer 12.5% arises from comparing the difference with 1 instead of with $\frac{1}{2}$.

224. For consecutive numbers n and $n - 1$, the difference of squares is $n^2 - (n - 1)^2 = (n - (n - 1))(n + (n - 1)) = 2n - 1$, that is, simply the sum of the two numbers. So $2n - 1 = 141$, giving $2n = 142$ and $n = 71$. Checking, $71^2 = 5041$ and $70^2 = 4900$, and $5041 - 4900 = 141$. The larger number is 71.

225. Convert both rates. $37.5\% = \frac{3}{8}$, so the pension fund takes $\frac{3}{8} \times 76800 = 28800$, leaving $76800 - 28800 = 48000$. Next, $16\frac{2}{3}\% = \frac{1}{6}$, so keeping the rest means retaining $\frac{5}{6}$ of the remainder: $\frac{5}{6} \times 48000 = 40000$. He is left with Rs. 40,000. As a check, the two steps together retain $\frac{5}{8} \times \frac{5}{6} = \frac{25}{48}$ of the lump sum, and $\frac{25}{48} \times 76800 = 25 \times 1600 = 40000$.

226. Recognise the numerator as the expansion of $(a+b)^2$ with $a = 113$ and $b = 87$, since $a^2 + b^2 + 2ab = (a + b)^2$. Here $a + b = 200$, so the numerator is $200^2 = 40000$. Dividing, $\frac{40000}{40} = 1000$. Spotting the identity avoids squaring three-digit numbers entirely.

227. Use fraction equivalents. An increase of $12.5\% = \frac{1}{8}$ multiplies the price by $\frac{9}{8}$, giving $7200 \times \frac{9}{8} = 8100$. A decrease of $11\frac{1}{9}\% = \frac{1}{9}$ multiplies by $\frac{8}{9}$, giving $8100 \times \frac{8}{9} = 7200$. Since $\frac{9}{8} \times \frac{8}{9} = 1$, the two changes cancel exactly and the final price is Rs. 7,200, the original amount.

228. Factor each numerator using $a^2 - b^2 = (a - b)(a + b)$. For the first term, $76 - 24 = 52$ and $76 + 24 = 100$, so the numerator is 52×100 and the term equals $\frac{52 \times 100}{52} = 100$. For the second, $63 - 37 = 26$ and $63 + 37 = 100$, so that term equals $\frac{26 \times 100}{26} = 100$. Adding, $100 + 100 = 200$.

229. Evaluate the right side first: $6.25\% = \frac{1}{16}$, so it equals $\frac{1}{16} \times 2400 = 150$. On the left, $8\frac{1}{3}\% = \frac{1}{12}$. So $\frac{1}{12} \times x = 150$, which gives $x = 150 \times 12 = 1800$. The required number is 1,800.

230. First take the square root by the digit method. Since 7396 ends in 6, its root ends in 4 or 6. The leading group is 73, which lies between $8^2 = 64$ and $9^2 = 81$, so the tens digit is 8 and the root is 84 or 86. As 73 is nearer the upper end (above $8 \times 9 = 72$), take the larger: 86. Indeed $86^2 = 7396$, so the side is 86 m and the perimeter is $4 \times 86 = 344$ m. The cost is $344 \times 250 = 344 \times \frac{1000}{4} = 86000$, that is Rs. 86,000.

231. Note $43.75\% = \frac{7}{16}$, since $6.25\% = \frac{1}{16}$ and $43.75 = 7 \times 6.25$. So net-banking users number $\frac{7}{16} \times 12800 = 7 \times 800 = 5600$, leaving $12800 - 5600 = 7200$ non-users. Of these, $33\frac{1}{3}\% = \frac{1}{3}$ use only the mobile app, that is $\frac{1}{3} \times 7200 = 2400$. Hence those using neither number $7200 - 2400 = 4800$. The distractor 5,600 is the net-banking count itself.

Subtopic 1.3.1

232. The required fraction of counters is $\frac{7}{20}$. To convert a fraction into a percentage, multiply it by 100: $\frac{7}{20} \times 100 = 7 \times 5 = 35$. Hence 35% of the counters are reserved.

233. 45% of 640 = $\frac{45}{100} \times 640 = 45 \times 6.4 = 288$. (Alternatively, 10% of 640 = 64, so $40\% = 256$ and $5\% = 32$; $256 + 32 = 288$.)

234. A percentage is converted to a fraction by dividing by 100: $37.5\% = \frac{37.5}{100} = \frac{375}{1000}$. Dividing numerator and denominator by 125 gives $\frac{3}{8}$. Check: $\frac{3}{8} \times 100 = 37.5$, confirming the answer.

235. Let the number be x . Then $\frac{25}{100}x = 90$, i.e. $\frac{x}{4} = 90$, so $x = 360$. Since 360 does not appear among the first four options, the correct choice is None of these.

236. Required percentage = $\frac{45}{250} \times 100$. Now $\frac{45}{250} = \frac{9}{50}$, and $\frac{9}{50} \times 100 = 9 \times 2 = 18$. Hence 45 is 18% of 250.

237. $\frac{3}{16} \times 100 = \frac{300}{16} = 18.75$. (A quick check: $\frac{1}{16} = 6.25\%$, so $\frac{3}{16} = 3 \times 6.25\% = 18.75\%$.)

238. First write the mixed percentage as an improper fraction: $16\frac{2}{3}\% = \frac{50}{3}\%$. Dividing by 100 converts it to a fraction: $\frac{50}{3} \times \frac{1}{100} = \frac{50}{300} = \frac{1}{6}$. Check: $\frac{1}{6} \times 100 = \frac{100}{6} = 16\frac{2}{3}$, confirming the answer. (For contrast, $\frac{1}{5} = 20\%$, $\frac{2}{15} = 13\frac{1}{3}\%$ and $\frac{3}{20} = 15\%$.)

239. Traders' share = 30% of Rs. 2,500 = $\frac{30}{100} \times 2500 = \text{Rs. } 750$. Kapoor & Sons receive 40% of this = $\frac{40}{100} \times 750 = \text{Rs. } 300$. (Shortcut: 40% of $30\% = 12\%$, and 12% of 2500 = 300.)

240. Fraction of women = $1 - \frac{5}{8} = \frac{3}{8}$, i.e. 37.5% of the staff. So $\frac{3}{8} \times \text{Total} = 96$, giving Total = $96 \times \frac{8}{3} = 256$. Number of men = $\frac{5}{8} \times 256 = 160$.

241. Difference = $\frac{5}{6} - \frac{3}{4} = \frac{10-9}{12} = \frac{1}{12}$. The comparison is made with respect to $\frac{3}{4}$, so the required percentage = $\frac{1/12}{3/4} \times 100 = \frac{1}{12} \times \frac{4}{3} \times 100 = \frac{100}{9} = 11\frac{1}{9}\%$. Two traps are worth noting: option A, $8\frac{1}{3}\%$, is the raw difference $\frac{1}{12}$ quoted as a percentage without dividing by any base, while option B, 10% , is what one gets by wrongly dividing by $\frac{5}{6}$ instead of $\frac{3}{4}$.

242. Let the maximum marks be M . Deepak's marks = 35% of M , and these are 35 less than the pass mark 210. So $\frac{35}{100}M = 210 - 35 = 175$, hence $M = \frac{175 \times 100}{35} = 500$.

243. Given $\frac{15}{100}A = \frac{20}{100}B$, i.e. $15A = 20B$. Therefore $\frac{A}{B} = \frac{20}{15} = \frac{4}{3}$, so $A : B = 4 : 3$. Check: if $A = 4$ and $B = 3$, then 15% of $4 = 0.6$ and 20% of $3 = 0.6$. Note that option A, $3 : 4$, reverses the relationship: the smaller percentage must belong to the larger quantity.

244. Convert each percentage to its fractional equivalent. $33\frac{1}{3}\% = \frac{1}{3}$, so $\frac{1}{3} \times 720 = 240$. Also $12.5\% = \frac{1}{8}$, so $\frac{1}{8} \times 1024 = 128$. The required sum = $240 + 128 = 368$.

245. Priya's marks = $240 + 30\%$ of $240 = 240 + 72 = 312$. Her percentage of the total = $\frac{312}{400} \times 100 = \frac{312}{4} = 78$. So Priya scored 78% . (Anil himself scored 60% ; note that 30% more marks does not mean 30 percentage points more.)

246. From the first relation, $\frac{2}{5}a = \frac{2}{3}b$, so $a = \frac{2}{3} \times \frac{5}{2}b = \frac{5}{3}b$. From the second relation, $b = \frac{3}{5}c$. Substituting, $a = \frac{5}{3} \times \frac{3}{5}c = c$. Hence a is $\frac{a}{c} \times 100 = 100\%$ of c .

247. Take the total number of students as 100. Then girls = 60 and boys = 40. Boys opting for music = 40% of $40 = 16$. Girls opting for music = 25% of $60 = 15$. Total opting for music = $16 + 15 = 31$. Therefore students not opting = $100 - 31 = 69$, i.e. 69% of the total.

248. Let the original fraction be $\frac{n}{d}$. After the changes it becomes $\frac{1.20n}{0.75d} = \frac{120}{75} \cdot \frac{n}{d} = \frac{8}{5} \cdot \frac{n}{d}$. So $\frac{8}{5} \cdot \frac{n}{d} = \frac{16}{15}$, giving $\frac{n}{d} = \frac{16}{15} \times \frac{5}{8} = \frac{2}{3}$. Verification: $\frac{2 \times 1.2}{3 \times 0.75} = \frac{2.4}{2.25} = \frac{16}{15}$.

249. Let Chetan's share be $100k$. Bhavna gets 20% less, so her share = $80k$. Amit gets 25% more than Bhavna, so his share = $80k \times \frac{125}{100} = 100k$. Total = $100k + 80k + 100k = 280k = 14000$, so $k = 50$. Chetan's share = $100 \times 50 = \text{Rs. } 5,000$, which is not listed among the first four options; hence None of these.

250. Let the third number be 100. First number = $100 - 25 = 75$; second number = $100 - 40 = 60$. Required percentage = $\frac{75}{60} \times 100 = \frac{5}{4} \times 100 = 125$. So the first number is 125% of the second.

251. Take the original income as 100. Since $62.5\% = \frac{5}{8}$, expenditure = 62.5 and savings = 37.5 . New income = 120; new expenditure = $62.5 \times 1.15 = 71.875$. New savings = $120 - 71.875 = 48.125$. Increase = $48.125 - 37.5 = 10.625$. Percentage increase = $\frac{10.625}{37.5} \times 100 = \frac{85}{3} = 28\frac{1}{3}\%$.

252. Invalid votes = 20% of $7500 = 1500$, so valid votes = $7500 - 1500 = 6000$. The winner got 55% of the valid votes, so the loser got the remaining $45\% = \frac{45}{100} \times 6000 = 2700$ votes. (The common error is to take 45% of $7500 = 3375$, ignoring the invalid votes.)

Subtopic 1.3.2

253. Increase = 15% of Rs. 24,000 = $\frac{15}{100} \times 24000 = \text{Rs. } 3,600$. New salary = $24000 + 3600 = \text{Rs. } 27,600$. (Equivalently $24000 \times 1.15 = 27600$.)

254. Actual decrease = $850 - 731 = \text{Rs. } 119$. Percentage decrease is always taken on the original price, so it is $\frac{119}{850} \times 100$. Since $\frac{119}{850} = \frac{7}{50}$, the decrease = $\frac{7}{50} \times 100 = 14\%$.

255. The second discount is applied on the price left after the first discount, not on the marked price. After 20% off: $2500 \times \frac{80}{100} = \text{Rs. } 2,000$. After a further 10% off: $2000 \times \frac{90}{100} = \text{Rs. } 1,800$. (Note that Rs. 1,750, obtained by adding the discounts to 30%, is wrong.)

256. Take the original output as 100 units. After a 25% rise it becomes $100 \times 1.25 = 125$. The fall of 25% acts on 125, not on 100, and equals $\frac{25}{100} \times 125 = 31.25$. Final output = $125 - 31.25 = 93.75$. Net change = $100 - 93.75 = 6.25$ units on a base of 100, i.e. a decrease of 6.25%.

257. After the first year: $40000 \times \frac{110}{100} = 44,000$. The second year's growth is on 44,000: $44000 \times \frac{110}{100} = 48,400$. In one step, $40000 \times (1.1)^2 = 40000 \times 1.21 = 48,400$.

258. Let the original side be 10 m, so the area is $10 \times 10 = 100$ sq m. The new side = $10 \times 1.2 = 12$ m and the new area = $12 \times 12 = 144$ sq m. Increase = $144 - 100 = 44$ on a base of 100, i.e. 44%.

259. Let the original price be Rs. 100. After the 20% cut it is Rs. 80. To return to Rs. 100 the rise needed is Rs. 20, but this rise is calculated on the new price of Rs. 80: $\frac{20}{80} \times 100 = 25\%$. The answer is not 20% because the base has changed.

260. Let the original salary be Rs. x . After the rise it is $1.2x$ and after the fall it is $1.2x \times 0.8 = 0.96x$. So $0.96x = 28800$, giving $x = \frac{28800}{0.96} = \text{Rs. } 30,000$. (Check: $30000 \times 1.2 = 36000$ and $36000 \times 0.8 = 28800$.)

261. Expenditure = price $\times$ consumption. Take price = 100 and consumption = 100, so the original expenditure = 10,000. New price = 125, new consumption = 90, so the new expenditure = $125 \times 90 = 11,250$. Change = $\frac{11250 - 10000}{10000} \times 100 = 12.5\%$ increase. Since an increase of 12.5% is not listed, the correct choice is None of these.

262. Let Chetan's income be Rs. 100. Bharat = $100 \times 1.20 = \text{Rs. } 120$. Arun = $120 \times 1.25 = \text{Rs. } 150$. Arun exceeds Chetan by Rs. 50 on Chetan's base of Rs. 100, so Arun's income is 50% more. (Simply adding $25 + 20 = 45$ is wrong because the two percentages are on different bases.)

263. If the purchase price is Rs. x , then after 3 years the value is $x \times (0.9)^3 = 0.729x$. So $0.729x = 43740$, giving $x = \frac{43740}{0.729} = \text{Rs. } 60,000$. Check: $60000 \rightarrow 54000 \rightarrow 48600 \rightarrow 43740$.

264. Let the annual rise be r (as a decimal) and the initial number be 100. After two years the number is $100(1+r)^2$, and this equals 121. So $(1+r)^2 = 1.21$, giving $1+r = 1.1$ and $r = 0.1$, i.e. 10% per year. (Halving 21% to get 10.5% ignores the compounding of the first year's rise.)

265. Only the second step is needed for the final count, but note the structure. Original strength = $\frac{1725}{1.15} = 1,500$, which rose to 1,725. Of these, 8% left, so 92% remain: $1725 \times \frac{92}{100} = 1,587$.

266. Present expenditure = 75% of 40000 = Rs. 30,000, so present savings = $40000 - 30000 = \text{Rs. } 10,000$. New income = $40000 \times 1.25 = \text{Rs. } 50,000$. New expenditure = $30000 \times 1.20 = \text{Rs. } 36,000$. New savings = $50000 - 36000 = \text{Rs. } 14,000$. Increase in savings = $\frac{14000 - 10000}{10000} \times 100 = 40\%$.

267. Take the list price as Rs. 100. Price left after all three cuts = $100 \times \frac{80}{100} \times \frac{85}{100} \times \frac{90}{100}$. Step by step: $100 \rightarrow 80 \rightarrow 68 \rightarrow 61.2$. So the customer pays Rs. 61.20 in place of Rs. 100, a total reduction of

Rs. 38.80, i.e. a single equivalent discount of 38.8%. (Adding $20 + 15 + 10 = 45$ overstates it, as each later discount acts on a smaller amount.)

268. Let the original price be Rs. p per kg. Since $12.5\% = \frac{1}{8}$, the new price is $p - \frac{p}{8} = \frac{7p}{8}$. Quantity bought for Rs. 224 rises from $\frac{224}{p}$ to $\frac{224 \times 8}{7p} = \frac{256}{p}$. The extra quantity is $\frac{256}{p} - \frac{224}{p} = \frac{32}{p}$, and this equals 4 kg. Hence $p = \frac{32}{4} = \text{Rs. } 8$ per kg. Check: at Rs. 8 one gets 28 kg, at Rs. 7 one gets 32 kg, a gain of 4 kg.

269. Let the original length and breadth be L and B , so the area is LB . The new length is $1.25L$ and let the new breadth be kB . Then $1.25L \times kB = 1.05LB$, so $1.25k = 1.05$ and $k = \frac{1.05}{1.25} = 0.84$. The breadth becomes 84% of its original value, i.e. it must be decreased by 16%.

270. Let the initial deposits be Rs. x lakh. Applying the three changes in order gives $x \times 1.20 \times 0.90 \times 1.25$. Now $1.20 \times 0.90 = 1.08$ and $1.08 \times 1.25 = 1.35$, so the final deposits are $1.35x$. The rise is $1.35x - x = 0.35x$, and this equals 28 lakh. Hence $x = \frac{28}{0.35} = 80$, i.e. Rs. 80 lakh.

271. Let the number of males be m ; then the number of females is $25000 - m$. Total increase = $27600 - 25000 = 2,600$. So $0.08m + 0.12(25000 - m) = 2600$, i.e. $0.08m + 3000 - 0.12m = 2600$, giving $0.04m = 400$ and $m = 10,000$. Check: males $10000 \rightarrow 10800$, females $15000 \rightarrow 16800$, total 27,600.

272. Take the starting value as Rs. 100. After the first week: $100 \times 1.20 = \text{Rs. } 120$. After the second week the fall of 25% acts on 120, so the value is $120 \times \frac{75}{100} = \text{Rs. } 90$. The third week must carry Rs. 90 back to Rs. 100, a rise of Rs. 10 on the new base of Rs. 90: $x = \frac{10}{90} \times 100 = \frac{100}{9} = 11\frac{1}{9}\%$. (The trap answer 5% comes from adding $+20 - 25 = -5$ and assuming a 5% rise restores the value; that is wrong because each change is on a different base.)

273. Let Sanjay's salary be Rs. 100; then Rohit's is $100 - 20 = \text{Rs. } 80$. After the revision, Sanjay gets $100 \times 1.10 = \text{Rs. } 110$ and Rohit gets $80 \times 1.25 = \text{Rs. } 100$. The shortfall is Rs. 10, and it must be expressed as a percentage of Sanjay's new salary: $\frac{10}{110} \times 100 = \frac{100}{11} = 9\frac{1}{11}\%$. (Taking the base as Rohit's Rs. 100 would wrongly give 10%.)

Subtopic 1.3.3

274. Use the net-change formula $x + y + \frac{xy}{100}$ with $x = +20$ and $y = -20$. Net change = $20 - 20 + \frac{(20)(-20)}{100} = -4$. Verify with numbers: take the salary as Rs. 100. After a 20% rise it becomes $100 \times \frac{120}{100} = \text{Rs. } 120$. After a 20% fall it becomes $120 \times \frac{80}{100} = \text{Rs. } 96$. The drop is Rs. 4 on Rs. 100, i.e. a 4% decrease. Note that a rise followed by an equal percentage fall always gives a net decrease, so option A is impossible.

275. Let the marked price be Rs. 100. After the first discount the price is $100 \times \frac{75}{100} = \text{Rs. } 75$. After the second discount it is $75 \times \frac{80}{100} = \text{Rs. } 60$. So the customer pays Rs. 60 instead of Rs. 100, a total reduction of Rs. 40, i.e. a single equivalent discount of 40%. Using the formula directly: equivalent discount = $25 + 20 - \frac{25 \times 20}{100} = 45 - 5 = 40\%$. Adding the discounts to get 45% is the standard trap.

276. Expenditure = price $\times$ consumption. If the price becomes $\frac{125}{100} = \frac{5}{4}$ times the original, the consumption must become $\frac{4}{5}$ times the original to keep the product constant. Reduction = $1 - \frac{4}{5} = \frac{1}{5} = 20\%$. By formula, required reduction = $\frac{R}{100 + R} \times 100 = \frac{25}{125} \times 100 = 20\%$. The reduction is taken on the new (higher) base, which is why the answer is 20% and not 25%.

277. Area of a square = side $\times$ side, so the same 10% increase acts twice and the net change formula applies with $x = y = +10$. Net change = $10 + 10 + \frac{10 \times 10}{100} = 21\%$. Check: side 10 m gives area 100 sq m; new side 11 m gives area 121 sq m; increase = 21 sq m on 100 sq m = 21%.

278. Take the list price as Rs. 1000. After the first discount: $1000 \times 0.9 = \text{Rs. } 900$. After the second: $900 \times 0.9 = \text{Rs. } 810$. After the third: $810 \times 0.9 = \text{Rs. } 729$. The customer pays Rs. 729 instead of Rs. 1000, so the reduction is Rs. 271, i.e. 27.1%. Equivalently the multiplying factor is $(0.9)^3 = 0.729$, giving a discount of $1 - 0.729 = 0.271$.

279. Selling price = $4800 \times \frac{80}{100} \times \frac{90}{100}$. First step: $4800 \times 0.80 = \text{Rs. } 3840$. Second step: $3840 \times 0.90 = \text{Rs. } 3456$. Alternatively, the equivalent single discount is $20 + 10 - \frac{20 \times 10}{100} = 28\%$, so the customer pays 72% of Rs. 4800 = Rs. 3456. Option B is what you get if you wrongly subtract a single 30% discount.

280. Apply the net change formula with $x = -10$ and $y = +20$: net change = $-10 + 20 + \frac{(-10)(20)}{100} = 10 - 2 = +8$. Verification: take the value as Rs. 1000. After a 10% fall it is Rs. 900; a 20% rise on Rs. 900 gives $900 + 180 = \text{Rs. } 1080$. That is Rs. 80 more than Rs. 1000, an increase of 8%.

281. Combine the first two: equivalent discount = $20 + 15 - \frac{20 \times 15}{100} = 35 - 3 = 32\%$. Now combine 32% with 10%: $32 + 10 - \frac{32 \times 10}{100} = 42 - 3.2 = 38.8\%$. Cross-check with factors: $0.80 \times 0.85 \times 0.90 = 0.612$, so the customer pays 61.2% of the marked price and the discount is $100 - 61.2 = 38.8\%$.

282. Let the cost price be Rs. x . Marked price = $1.40x$. Selling price = $1.40x \times \frac{75}{100} = 1.05x$. So the net effect of marking up 40% and discounting 25% is $40 - 25 - \frac{40 \times 25}{100} = 15 - 10 = 5\%$ profit. Profit = $1.05x - x = 0.05x = 120$, hence $x = \frac{120}{0.05} = \text{Rs. } 2400$.

283. Store P: equivalent discount = $25 + 5 - \frac{25 \times 5}{100} = 30 - 1.25 = 28.75\%$, so the price paid is $8000 \times 0.7125 = \text{Rs. } 5700$. Store Q: price paid = $8000 \times 0.70 = \text{Rs. } 5600$. Store Q is cheaper, and the saving is $5700 - 5600 = \text{Rs. } 100$. (In percentage terms Q is better by 1.25% of Rs. 8000, which is again Rs. 100.)

284. Net change = $20 - 25 + \frac{(20)(-25)}{100} = -5 - 5 = -10\%$, so the present income is 90% of the original. If the original income is Rs. x , then $0.90x = 43200$, giving $x = \frac{43200}{0.9} = \text{Rs. } 48,000$. Check: $48000 \times 1.20 = 57600$ and $57600 \times 0.75 = 43200$.

285. Area = length $\times$ breadth, so the two percentage changes combine by the net change formula with $x = +20$ and $y = -10$: net change = $20 - 10 + \frac{(20)(-10)}{100} = 10 - 2 = +8$. The area increases by 8%. Numerically, a 10×10 hoarding of area 100 becomes $12 \times 9 = 108$. Since 8% increase is not listed among options A to D, the correct choice is None of these.

286. Let the original price be Rs. p per kg; the reduced price is $0.8p$. Quantity bought earlier = $\frac{400}{p}$ and now = $\frac{400}{0.8p} = \frac{500}{p}$. The extra quantity is $\frac{500}{p} - \frac{400}{p} = \frac{100}{p} = 5$, so $p = 20$. Hence the reduced price is $0.8 \times 20 = \text{Rs. } 16$ per kg. (Consistency check: Rs. 400 buys 20 kg at Rs. 20 and 25 kg at Rs. 16, which is 5 kg more.)

287. Under 'buy 4 get 1 free' a customer takes 5 mugs but pays for 4. If each mug is marked at Rs. 100, the marked value of 5 mugs is Rs. 500 while the customer pays Rs. 400, i.e. a discount of $\frac{100}{500} \times 100 = 20\%$. The extra 15% is then allowed on Rs. 400, so the final payment is $400 \times 0.85 =$

Rs. 340. Against a marked value of Rs. 500, the customer saves Rs. 160, so the equivalent single discount is $\frac{160}{500} \times 100 = 32\%$. By formula: $20 + 15 - \frac{20 \times 15}{100} = 35 - 3 = 32\%$. Adding the two rates to get 35% is the standard trap.

288. Let the cost price be Rs. x . Marked price = $1.60x$. The two discounts give a multiplying factor $0.80 \times 0.90 = 0.72$, so selling price = $1.60x \times 0.72 = 1.152x$, i.e. a profit of 15.2%. Then $0.152x = 912$, so $x = \frac{912}{0.152} = \text{Rs. } 6000$. Marked price = $1.60 \times 6000 = \text{Rs. } 9,600$. (Check: $9600 \times 0.72 = 6912$ and $6912 - 6000 = 912$.)

289. A discount of 42.4% means the customer pays 57.6% of the marked price, so the overall multiplying factor is 0.576. Therefore $0.90 \times 0.80 \times \left(1 - \frac{x}{100}\right) = 0.576$. Now $0.90 \times 0.80 = 0.72$, so $1 - \frac{x}{100} = \frac{0.576}{0.72} = 0.80$, giving $\frac{x}{100} = 0.20$ and $x = 20$.

290. Let the initial population be P . Then $P \times 1.10 \times 0.80 \times 1.25 = 66000$. Simplify the factors step by step: $1.10 \times 0.80 = 0.88$ and $0.88 \times 1.25 = 1.10$. So $1.10P = 66000$ and $P = \frac{66000}{1.1} = 60000$. In other words the three changes together amount to a net increase of only 10%.

291. Take the original salary as Rs. 100. After the first cut: $100 \times 0.80 = \text{Rs. } 80$. After the second cut: $80 \times 0.75 = \text{Rs. } 60$. So the two cuts together are a net reduction of 40%. To go from Rs. 60 back to Rs. 100 the required rise is $\frac{100 - 60}{60} \times 100 = \frac{40}{60} \times 100 = 66\frac{2}{3}\%$. The increase must be measured on the reduced salary, not on the original, which is why 40% is wrong.

292. Let the cost price be Rs. 100 and the marked price be Rs. M . Selling at 20% discount gives $0.80M$, and this equals a 20% gain, i.e. Rs. 120. So $0.80M = 120$ and $M = 150$. With a 30% discount the selling price becomes $150 \times 0.70 = \text{Rs. } 105$. Profit = $105 - 100 = \text{Rs. } 5$ on a cost of Rs. 100, i.e. 5%. (Note the shortcut: raising the discount from 20% to 30% costs 10% of $M = \text{Rs. } 15$, and $120 - 15 = 105$.)

293. Let each discount be $d\%$, so the multiplying factor for one discount is $\left(1 - \frac{d}{100}\right)$. Two such discounts leave the customer paying $100 - 36 = 64\%$ of the marked price, hence $\left(1 - \frac{d}{100}\right)^2 = 0.64$.

Taking the positive root, $1 - \frac{d}{100} = 0.80$, so $d = 20$. For three successive discounts of 20% the factor is $(0.80)^3 = 0.512$, i.e. the customer pays 51.2% of the marked price. The equivalent single discount is therefore $100 - 51.2 = 48.8\%$. Note that 51.2% is the amount paid, not the discount, and 60% is the trap of adding $20 + 20 + 20$.

294. Take the income as Rs. 100. Then expenditure = Rs. 75 and savings = $100 - 75 = \text{Rs. } 25$. New income = $100 \times 1.20 = \text{Rs. } 120$. New expenditure = $75 \times 1.15 = \text{Rs. } 86.25$. New savings = $120 - 86.25 = \text{Rs. } 33.75$. Increase in savings = $33.75 - 25 = \text{Rs. } 8.75$, so the percentage increase = $\frac{8.75}{25} \times 100 = 35\%$. Savings rise faster than income because expenditure grew more slowly than income.

Subtopic 1.3.4

295. Growth at a fixed rate per annum acts on the fresh population each year, so multiply by $\left(1 + \frac{4}{100}\right) = 1.04$ once per year.

After year 1: $25000 \times 1.04 = 26000$.

After year 2: $26000 \times 1.04 = 26000 + 1040 = 27040$.

(Note that simply adding $4\% + 4\% = 8\%$ of 25000 = 27000 is wrong, because the second year's growth acts on 26000, not on 25000.)

296. Depreciation on reducing balance means each year the machine retains $(100 - 10)\% = 90\%$ of its value at the start of that year.

$$\text{Value after year 1} = 80000 \times \frac{90}{100} = 72000.$$

$$\text{Value after year 2} = 72000 \times \frac{90}{100} = 64800.$$

Hence the value at the end of 2 years is Rs. 64,800.

297. Marks required to pass = 40% of 650 = $\frac{40}{100} \times 650 = 260$.

Ramesh scored 234 marks.

$$\text{Shortfall} = 260 - 234 = 26 \text{ marks.}$$

So he failed by 26 marks.

298. A fall of 20% leaves 80% of the original population.

$$\text{If the original population is } P, \text{ then } \frac{80}{100} \times P = 9600.$$

$$\text{Therefore } P = 9600 \times \frac{100}{80} = 9600 \times \frac{5}{4} = 12000.$$

(Adding 20% back to 9600 gives 11520, which is the common trap; the percentage must be taken on the original, not on the reduced, figure.)

299. Fall in value = 650000 - 520000 = 130000.

Rate of depreciation is always computed on the value at the beginning of the year, i.e. on Rs. 6,50,000.

$$\text{Rate} = \frac{130000}{650000} \times 100 = \frac{1}{5} \times 100 = 20\%.$$

300. Percentage of candidates who did not clear = 100% - 65% = 35%.

$$\text{Number of such candidates} = \frac{35}{100} \times 1200 = 35 \times 12 = 420.$$

$$(\text{Check: those who cleared} = \frac{65}{100} \times 1200 = 780, \text{ and } 780 + 420 = 1200.)$$

301. After the first year: $50000 \times \frac{110}{100} = 55000$.

The second year's decrease of 10% applies to 55000, not to 50000.

$$\text{After the second year: } 55000 \times \frac{90}{100} = 49500.$$

So the population is 49500 - an equal rise and fall does not cancel out; there is a net drop of 1%.

302. Let the population two years ago be P .

$$\text{After the first year it becomes } P \times \frac{110}{100}, \text{ and after the second year } P \times \frac{110}{100} \times \frac{120}{100}.$$

$$\text{So } P \times 1.1 \times 1.2 = 66000, \text{ i.e. } 1.32P = 66000.$$

$$\text{Hence } P = \frac{66000}{1.32} = 50000.$$

(Verification: 50000 → 55000 → 66000.)

303. Each year the machine retains 80% of its value.

$$\text{End of year 1: } 150000 \times 0.8 = 120000.$$

$$\text{End of year 2: } 120000 \times 0.8 = 96000 \text{ (still above 80000).}$$

$$\text{End of year 3: } 96000 \times 0.8 = 76800, \text{ which is below Rs. 80,000.}$$

Hence the value first falls below Rs. 80,000 at the end of 3 years.

304. Marks needed to pass = 178 + 22 = 200.

These 200 marks are 40% of the maximum marks T .

$$\text{So } \frac{40}{100} \times T = 200, \text{ giving } T = 200 \times \frac{100}{40} = 500.$$

(Check: 40% of 500 = 200, and 200 - 178 = 22.)

305. Let the maximum marks be T and the pass marks be P .

$$\text{From Anil: } \frac{25}{100}T = P - 30.$$

$$\text{From Bhavna: } \frac{45}{100}T = P + 30.$$

$$\text{Subtracting the first from the second: } \frac{20}{100}T = 60, \text{ so } 0.2T = 60 \text{ and } T = 300.$$

(Then $P = 0.25 \times 300 + 30 = 105$, i.e. the pass percentage is 35%, which is consistent with $0.45 \times 300 = 135 = 105 + 30$.)

306. Let the number of men be m ; then the number of women is $15000 - m$.

Total increase = $15990 - 15000 = 990$.

So $\frac{8}{100}m + \frac{5}{100}(15000 - m) = 990$.

$0.08m + 750 - 0.05m = 990 \Rightarrow 0.03m = 240 \Rightarrow m = 8000$.

(Check: men rise by 640, women 7000 rise by 350; total rise = 990.)

307. Value after year 1 = $200000 \times \frac{85}{100} = 170000$.

Value after year 2 = $170000 \times \frac{90}{100} = 153000$.

Total fall in value = $200000 - 153000 = 47000$.

Required percentage = $\frac{47000}{200000} \times 100 = 23.5\%$.

Since 23.5% is not listed among the first four options, the answer is "None of these". (The shortcut $15 + 10 - \frac{15 \times 10}{100} = 23.5\%$ gives the same result.)

308. Convert each percentage into actual marks.

Quantitative Aptitude: $\frac{60}{100} \times 150 = 90$.

English: $\frac{55}{100} \times 100 = 55$.

General Awareness: $\frac{70}{100} \times 50 = 35$.

Total marks obtained = $90 + 55 + 35 = 180$ out of a total maximum of $150 + 100 + 50 = 300$.

Overall percentage = $\frac{180}{300} \times 100 = 60\%$.

(The plain average of 60, 55, 70 is 61.67%, which is wrong here because the three papers carry different maximum marks.)

309. Let the initial population be P . Successive percentage changes multiply.

$P \times \frac{110}{100} \times \frac{90}{100} \times \frac{120}{100} = 118800$.

The combined factor is $1.1 \times 0.9 = 0.99$, and $0.99 \times 1.2 = 1.188$.

So $1.188P = 118800$, giving $P = \frac{118800}{1.188} = 100000$.

(Verification: $100000 \rightarrow 110000 \rightarrow 99000 \rightarrow 118800$.)

310. Each year the generator retains $80\% = \frac{4}{5}$ of its book value.

Book value after 3 years = $312500 \times \left(\frac{4}{5}\right)^3 = 312500 \times \frac{64}{125}$.

$\frac{312500}{125} = 2500$, so the book value = $2500 \times 64 = 160000$.

Selling price = 180000.

Gain over book value = $180000 - 160000 = \text{Rs. } 20,000$.

311. Let E be the set failing in English and M the set failing in Mathematics.

Percentage failing in at least one subject = $52\% + 42\% - 17\% = 77\%$ (the overlap of 17% is subtracted because it has been counted twice).

Percentage passing in both subjects = $100\% - 77\% = 23\%$.

Number of such candidates = $\frac{23}{100} \times 1000 = 230$.

312. Let the maximum marks be T , the pass marks P and the first-class marks F .

Given: $0.25T = P - 45$; $F = P + 60$; $0.55T = F + 15 = P + 60 + 15 = P + 75$.

Subtracting the first equation from the last: $0.55T - 0.25T = (P + 75) - (P - 45)$, i.e. $0.30T = 120$.

Hence $T = \frac{120}{0.30} = 400$.

(Then $P = 0.25 \times 400 + 45 = 145$ and $F = 205$; check $0.55 \times 400 = 220 = 205 + 15$.)

313. Let the original cost be C and the annual rate be r , with $k = 1 - \frac{r}{100}$.

Then $Ck^2 = 145800$ and $Ck^4 = 118098$.

Dividing: $k^2 = \frac{118098}{145800} = 0.81$, so $k = 0.9$, i.e. the rate is 10% per annum.

Now $C \times (0.9)^2 = 145800 \Rightarrow C = \frac{145800}{0.81} = 180000$.

So the original cost was Rs. 1,80,000. (Check: $180000 \times 0.6561 = 118098$.)

314. Since B grew by 25% to reach 25000, its original population was $\frac{25000 \times 100}{125} = 20000$.

Town A was 20% more than this: $20000 \times \frac{120}{100} = 24000$.

New population of $A = 24000 \times \frac{110}{100} = 26400$.

Excess over B 's new population = $26400 - 25000 = 1400$.

Required percentage = $\frac{1400}{25000} \times 100 = 5.6\%$.

315. Questions attempted = $\frac{80}{100} \times 200 = 160$.

Correct answers = $\frac{70}{100} \times 160 = 112$; wrong answers = $160 - 112 = 48$.

Marks gained = $112 \times 1 = 112$.

Marks deducted = $48 \times \frac{1}{4} = 12$.

Net marks = $112 - 12 = 100$ out of a maximum of 200.

Required percentage = $\frac{100}{200} \times 100 = 50\%$. (Unattempted questions carry no penalty.)

Subtopic 1.4.1

316. Let the numbers be $5x$ and $7x$. Then $5x + 7x = 720$, so $12x = 720$ and $x = 60$. The larger number is $7x = 7 \times 60 = 420$ (the smaller is $5 \times 60 = 300$, and $300 + 420 = 720$, which checks out).

317. The compound ratio is obtained by multiplying the antecedents together and the consequents together: $\frac{3}{4} \times \frac{5}{7} \times \frac{8}{9} = \frac{3 \times 5 \times 8}{4 \times 7 \times 9} = \frac{120}{252}$. Dividing numerator and denominator by 12 gives $\frac{10}{21}$, i.e. 10 : 21.

318. Let the salaries be $4x$ and $5x$. Given $4x = 24,000$, so $x = 6,000$. Bhavna's salary = $5x = 5 \times 6,000 = \text{Rs. } 30,000$. (Check: $24,000 : 30,000 = 4 : 5$.)

319. Total number of parts = $2 + 3 + 4 = 9$. Value of one part = $\frac{11700}{9} = 1300$. Geeta's share = $4 \times 1300 = \text{Rs. } 5,200$. Since Rs. 5,200 does not appear among the first four choices, the correct response is None of these. (Deepak gets Rs. 2,600 and Farhan Rs. 3,900, and $2600 + 3900 + 5200 = 11700$.)

320. The duplicate ratio of $a : b$ is $a^2 : b^2$. Hence the duplicate ratio of $9 : 11$ is $9^2 : 11^2 = 81 : 121$. Note that $18 : 22$ and $27 : 33$ are both merely $9 : 11$ again in disguise, and $121 : 81$ is the duplicate of $11 : 9$, not of $9 : 11$.

321. Make the common term B the same in both ratios. In $A : B = 2 : 3$ multiply by 4 to get $A : B = 8 : 12$; in $B : C = 4 : 5$ multiply by 3 to get $B : C = 12 : 15$. So $A : B : C = 8 : 12 : 15$ and therefore $A : C = 8 : 15$.

322. Compound ratio = $\frac{2}{3} \times \frac{5}{8} = \frac{10}{24} = \frac{5}{12}$, i.e. $5 : 12$. The inverse (reciprocal) ratio of $5 : 12$ is $12 : 5$.

323. Let the numbers be $3x$ and $5x$. Then $\frac{3x+6}{5x+6} = \frac{2}{3}$. Cross-multiplying: $3(3x+6) = 2(5x+6)$, i.e.

$9x+18 = 10x+12$, so $x = 6$. The numbers are 18 and 30; the smaller is 18. (Check: $\frac{18+6}{30+6} = \frac{24}{36} = \frac{2}{3}$.)

324. Combine the ratios through the common term (Bhaskar). $A : B = 3 : 4 = 9 : 12$ (multiplying by 3) and $B : C = 6 : 7 = 12 : 14$ (multiplying by 2). Hence $A : B : C = 9 : 12 : 14$, with $9 + 12 + 14 = 35$

parts. One part = $\frac{24500}{35} = 700$. Chitra's share = $14 \times 700 = \text{Rs. } 9,800$. (Arjun gets Rs. 6,300, Bhaskar Rs. 8,400, and the three sum to Rs. 24,500.)

325. Let the incomes be $5x$ and $4x$ and the expenditures be $3y$ and $2y$. Savings give $5x - 3y = 9000$ and $4x - 2y = 9000$. From the second equation $2y = 4x - 9000$, so $3y = 6x - 13500$. Substituting into the first: $5x - (6x - 13500) = 9000$, i.e. $-x + 13500 = 9000$, so $x = 4500$. Naveen's income = $5x = \text{Rs. } 22,500$. (Then $2y = 18000 - 9000 = 9000$, so $y = 4500$; expenditures are Rs. 13,500 and Rs. 9,000, and both savings equal Rs. 9,000.)

326. Milk = $\frac{5}{7} \times 21 = 15$ litres and water = $\frac{2}{7} \times 21 = 6$ litres. The milk quantity does not change, so for a 1 : 1 mixture the water must also become 15 litres. Water to be added = $15 - 6 = 9$ litres. (New mixture: 15 litres milk and 15 litres water in 30 litres.)

327. Let the present ages be $5x$ and $7x$. Six years hence: $\frac{5x+6}{7x+6} = \frac{3}{4}$. Cross-multiplying: $4(5x+6) = 3(7x+6)$, i.e. $20x + 24 = 21x + 18$, so $x = 6$. Sunita's present age = $7x = 42$ years, which is not listed among the first four options, so the answer is None of these. (Check: ages become 36 and 48, and $36 : 48 = 3 : 4$.)

328. Let the numbers of coins be $3x$, $5x$ and $7x$. Their total value is $3x(1) + 5x(2) + 7x(5) = 3x + 10x + 35x = 48x$ rupees. So $48x = 2400$, giving $x = 50$. Number of Rs. 2 coins = $5x = 250$. (Check: 150 one-rupee coins = Rs. 150, 250 two-rupee coins = Rs. 500, 350 five-rupee coins = Rs. 1,750; total Rs. 2,400.)

329. The compound ratio is $\frac{3}{4} \times \frac{x}{5} \times \frac{10}{9} = \frac{30x}{180} = \frac{x}{6}$. Setting this equal to $\frac{2}{3}$ gives $\frac{x}{6} = \frac{2}{3}$, so $3x = 12$ and $x = 4$. (Check: $\frac{3}{4} \times \frac{4}{5} \times \frac{10}{9} = \frac{120}{180} = \frac{2}{3}$, i.e. $2 : 3$ as required.)

330. Let the total be T . Anand = $\frac{1}{2}(T - A)$ gives $2A = T - A$, so $A = \frac{T}{3}$. Bharti = $\frac{2}{3}(T - B)$ gives $3B = 2T - 2B$, so $B = \frac{2T}{5}$. Then $C = T - \frac{T}{3} - \frac{2T}{5} = T \left(\frac{15 - 5 - 6}{15} \right) = \frac{4T}{15}$. Hence $A : B : C = \frac{1}{3} : \frac{2}{5} : \frac{4}{15} = 5 : 6 : 4$ (multiplying throughout by 15). Since $A = 4000$ corresponds to 5 parts, one part = 800, so Chandan gets $4 \times 800 = \text{Rs. } 3,200$. (Total = Rs. 12,000; Bharti gets Rs. 4,800, and $\frac{2}{3}(4000 + 3200) = 4800$ as required.)

331. Take $3k$ litres from A and $2k$ litres from B, total $5k$ litres. Milk from A = $\frac{5}{8} \times 3k = \frac{15k}{8}$; milk from B = $\frac{7}{12} \times 2k = \frac{7k}{6}$. Total milk = $\frac{15k}{8} + \frac{7k}{6} = \frac{45k + 28k}{24} = \frac{73k}{24}$. Total mixture = $5k = \frac{120k}{24}$, so water = $\frac{120k - 73k}{24} = \frac{47k}{24}$. Hence milk : water = $73 : 47$.

332. Put $x = 4t$ and $y = 3t$. Then $3x^2 = 3 \times 16t^2 = 48t^2$ and $2y^2 = 2 \times 9t^2 = 18t^2$. So the required ratio is $(48t^2 + 18t^2) : (48t^2 - 18t^2) = 66t^2 : 30t^2$. Cancelling $6t^2$ gives $11 : 5$.

333. Dividing in the inverse ratio of $2 : 3 : 5$ means the shares are proportional to $\frac{1}{2} : \frac{1}{3} : \frac{1}{5}$. Multiplying each term by the LCM 30 gives $15 : 10 : 6$. Total parts = $15 + 10 + 6 = 31$, so one part = $\frac{15500}{31} = 500$. Mohan corresponds to 6 parts, so his share = $6 \times 500 = \text{Rs. } 3,000$. (Kiran gets Rs. 7,500 and Latha Rs. 5,000; note the largest number in the original ratio receives the smallest share.)

334. Let the numbers be $3k$, $4k$ and $5k$. Then $9k^2 + 16k^2 + 25k^2 = 1250$, i.e. $50k^2 = 1250$, so $k^2 = 25$ and $k = 5$ (taking the positive value). The numbers are 15, 20 and 25, and their sum is 60. (Check: $225 + 400 + 625 = 1250$.)

335. Take the salaries as $200x$, $300x$ and $500x$ (a convenient scaling of $2 : 3 : 5$). New salaries: Ravi $= 200x \times 1.15 = 230x$; Meena $= 300x \times 1.10 = 330x$; Suresh $= 500x \times 1.20 = 600x$. The new ratio is $230 : 330 : 600$, and dividing throughout by 10 gives $23 : 33 : 60$.

336. Initially milk $= \frac{7}{10} \times 60 = 42$ litres and water $= \frac{3}{10} \times 60 = 18$ litres. Removing 15 litres removes $\frac{15}{60} = \frac{1}{4}$ of the mixture, so $\frac{3}{4}$ of each remains: milk $= \frac{3}{4} \times 42 = 31.5$ litres and water $= \frac{3}{4} \times 18 = 13.5$ litres. Adding 15 litres of pure water makes the water $13.5 + 15 = 28.5$ litres. New ratio $= 31.5 : 28.5 = 315 : 285 = 21 : 19$ (dividing by 15). Total is still 60 litres.

Subtopic 1.4.2

337. Cost varies directly as the number of pens, so cost per pen is constant. Cost of one pen $= \frac{180}{12} = 15$. Hence the cost of 18 pens $= 18 \times 15 = 270$. So the required cost is Rs. 270.

338. Number of workers and number of days are in inverse variation, so (workers) $\times$ (days) is constant. Total work $= 15 \times 24 = 360$ worker-days. With 18 workers, days required $= \frac{360}{18} = 20$ days.

339. If x is the fourth proportional, then $8 : 12 :: 20 : x$, i.e. $\frac{8}{12} = \frac{20}{x}$. Cross-multiplying, $8x = 12 \times 20 = 240$, so $x = \frac{240}{8} = 30$. Note that the fourth proportional is $\frac{12 \times 20}{8}$; inverting the ratio and computing $\frac{8 \times 20}{12}$ would be wrong.

340. If m is the mean proportional between a and b , then $a : m :: m : b$, so $m^2 = ab$. Here $m^2 = 9 \times 49 = 441$, hence $m = \sqrt{441} = 21$.

341. Inverse variation means $xy = k$ (a constant). From the given data, $k = 15 \times 8 = 120$. When $y = 12$, $x = \frac{120}{12} = 10$. (The value 22.5 would arise from treating the relation as direct variation, which is wrong here.)

342. Distance per litre $= \frac{240}{16} = 15$ km. Since distance varies directly as petrol used, petrol needed $= \frac{375}{15} = 25$ litres.

343. If x is the third proportional to 6 and 12, then $6 : 12 :: 12 : x$, so $6x = 12 \times 12 = 144$ and $x = \frac{144}{6} = 24$.

344. Let value $= kw^2$. Take the weights of the pieces as 1 unit and 2 units, so the whole diamond weighed 3 units. Then $k \times 3^2 = 72,000$, giving $9k = 72,000$ and $k = 8,000$. Value of the two pieces together $= k(1^2 + 2^2) = 8,000 \times 5 = 40,000$. Loss $= 72,000 - 40,000 = \text{Rs. } 32,000$.

345. The total labour required is fixed: operators $\times$ hours per day $\times$ days $=$ constant. Total operator-hours $= 12 \times 8 \times 15 = 1440$. With 18 operators working 10 hours a day, one day supplies $18 \times 10 = 180$ operator-hours. Days required $= \frac{1440}{180} = 8$ days.

346. Write $y = ax + \frac{b}{x}$. Putting $x = 1$, $y = 7$ gives $a + b = 7$. Putting $x = 2$, $y = 8$ gives $2a + \frac{b}{2} = 8$, i.e. $4a + b = 16$. Subtracting the first equation from this, $3a = 9$, so $a = 3$ and $b = 4$. Hence $y = 3x + \frac{4}{x}$, and at $x = 4$, $y = 12 + 1 = 13$.

347. Time varies inversely as the number of pipes, so (pipes) $\times$ (time) is constant $= 6 \times 80 = 480$ pipe-minutes. With only 4 pipes working, time $= \frac{480}{4} = 120$ minutes. Extra time $= 120 - 80 = 40$ minutes.

348. Let the extremes be p and q . Continued proportion means $p : 12 :: 12 : q$, so $pq = 12^2 = 144$. Also $p + q = 40$. Then p and q are roots of $t^2 - 40t + 144 = 0$. The discriminant is $1600 - 576 = 1024$, and $\sqrt{1024} = 32$, so $t = \frac{40 \pm 32}{2}$, giving $t = 36$ or $t = 4$. The three numbers are 4, 12, 36, so the smallest is 4.

349. Multiply each term of $\frac{1}{3} : \frac{1}{4} : \frac{1}{6}$ by the LCM 12 to clear the fractions: the proportion becomes $4 : 3 : 2$. Total parts = $4 + 3 + 2 = 9$, so one part = $\frac{6300}{9} = 700$. The shares are 2800, 2100 and 1400. The smallest share is Rs. 1,400.

350. Total work = $40 \times 30 = 1200$ labour-days. Work done in the first 12 days = $40 \times 12 = 480$ labour-days, so work left = $1200 - 480 = 720$ labour-days. Labourers remaining = $40 - 8 = 32$. Since days vary inversely as the number of labourers, days needed = $\frac{720}{32} = 22.5$ days.

351. Let cost = $F + k$ (copies $\times$ pages). First order: $500 \times 80 = 40,000$ page-copies, so $F + 40000k = 46000$. Second order: $300 \times 60 = 18,000$ page-copies, so $F + 18000k = 24000$. Subtracting, $22000k = 22000$, hence $k = 1$ and $F = 46000 - 40000 = 6000$. New order: $750 \times 96 = 72,000$ page-copies, so cost = $6000 + 72000 = \text{Rs. } 78,000$.

352. Let value = kw^3 . Then $k \times 10^3 = 2,00,000$, so $k = \frac{200000}{1000} = 200$. The pieces are in the ratio $2 : 3 : 5$ of a total of 10 parts, so they weigh 2 g, 3 g and 5 g. Their combined value = $200(2^3 + 3^3 + 5^3) = 200(8 + 27 + 125) = 200 \times 160 = 32,000$. Loss = $2,00,000 - 32,000 = \text{Rs. } 1,68,000$, which is not listed. Hence None of these.

353. The relation is $x = \frac{ky^2}{\sqrt{z}}$. Substituting the given values, $16 = \frac{k \times 16}{\sqrt{9}} = \frac{16k}{3}$, so $k = 3$. Now with $y = 6$ and $z = 4$, $x = \frac{3 \times 36}{\sqrt{4}} = \frac{108}{2} = 54$.

354. Let the original numbers be $5x$ clerks and $2x$ officers. After recruitment, $\frac{5x + 12}{2x + 3} = \frac{8}{3}$. Cross-multiplying, $3(5x + 12) = 8(2x + 3)$, i.e. $15x + 36 = 16x + 24$, which gives $x = 12$. So originally there were $5x = 60$ clerks and $2x = 24$ officers. Check: after the drive there are 72 clerks and 27 officers, and $\frac{72}{27} = \frac{8}{3}$, as required. The original number of officers was 24.

355. Old machine-hours = $10 \times 8 \times 6 = 480$, producing 4000 units, so one old machine produces $\frac{4000}{480} = \frac{25}{3}$ units per hour. A new machine is 25% more efficient, so it produces $\frac{25}{3} \times \frac{5}{4} = \frac{125}{12}$ units per hour. In one day, 15 machines running 10 hours give 150 machine-hours, i.e. $150 \times \frac{125}{12} = 1562.5$ units per day. Days required = $\frac{12500}{1562.5} = 8$ days.

356. Continued proportion means $\frac{a}{b} = \frac{b}{c} = \frac{c}{d}$, so the terms form a geometric progression: a, ar, ar^2, ar^3 . Here $a = 3$ and $ar^3 = 81$, so $r^3 = \frac{81}{3} = 27$ and $r = 3$. Thus $b = 3 \times 3 = 9$ and $c = 3 \times 9 = 27$. Hence $b + c = 9 + 27 = 36$.

357. Inverse proportion to 12, 15, 20 means the shares are in the ratio $\frac{1}{12} : \frac{1}{15} : \frac{1}{20}$. Multiplying each term by the LCM 60 gives $5 : 4 : 3$. The largest share is 5 parts and the smallest is 3 parts, so the difference is 2 parts = Rs. 8,000, making one part = Rs. 4,000. Total = $5 + 4 + 3 = 12$ parts = $12 \times 4000 = \text{Rs. } 48,000$.

Subtopic 1.4.3

358. Since both invested for the same period, profit is divided in the ratio of capitals. Ratio = $12000 : 18000 = 2 : 3$. Total parts = $2 + 3 = 5$, so one part = $\frac{15000}{5} = 3000$. Suresh's share = $3 \times 3000 =$

Rs. 9,000.

359. Time is equal for all three, so profit ratio = 5000 : 6000 : 9000 = 5 : 6 : 9. Total parts = 5 + 6 + 9 = 20, so one part = $\frac{12000}{20} = 600$. The smallest investor is Anil with 5 parts, so his share = $5 \times 600 = \text{Rs. } 3,000$.

360. In a compound partnership the profit is shared in the ratio of (capital $\times$ time). Deepak's equivalent capital = $8000 \times 6 = 48000$. Gopal's equivalent capital = $4000 \times 12 = 48000$. Ratio = $48000 : 48000 = 1 : 1$. Hence each gets half of Rs. 9,000, so Gopal's share = Rs. 4,500.

361. Kiran's capital-months = $25000 \times 12 = 3,00,000$. Manoj's capital-months = $30000 \times 8 = 2,40,000$. Ratio = $300000 : 240000 = 5 : 4$. Total parts = 9, so one part = $\frac{27000}{9} = 3000$. Kiran's share = $5 \times 3000 = \text{Rs. } 15,000$.

362. Profit is divided as 3 : 5 : 7, a total of $3 + 5 + 7 = 15$ parts. The smallest investor gets 3 parts = Rs. 4,500, so one part = $\frac{4500}{3} = 1500$. Total profit = $15 \times 1500 = \text{Rs. } 22,500$.

363. Profit ratio = $40000 : 50000 = 4 : 5$. Total parts = 9, so one part = $\frac{18000}{9} = 2000$. Sameer gets $4 \times 2000 = 8000$ and Vijay gets $5 \times 2000 = 10000$. Difference = $10000 - 8000 = \text{Rs. } 2,000$ (which is simply the 1 extra part).

364. The capitals are equal, so the profit is shared in the ratio of the time periods only: 4 : 6 : 8 = 2 : 3 : 4. Total parts = $2 + 3 + 4 = 9$, so one part = $\frac{10800}{9} = 1200$. Zakir's share = $4 \times 1200 = \text{Rs. } 4,800$.

365. Arun's capital-months = $12000 \times 6 + 8000 \times 6 = 72000 + 48000 = 1,20,000$. Bimal's capital-months = $9000 \times 12 = 1,08,000$. Ratio = $120000 : 108000 = 10 : 9$. Total parts = 19, so one part = $\frac{19000}{19} = 1000$. Arun's share = $10 \times 1000 = \text{Rs. } 10,000$.

366. Rahul is in for 12 months: $30000 \times 12 = 3,60,000$. Nikhil joins after 4 months, so he is in for 8 months: $45000 \times 8 = 3,60,000$. Sanjay joins 2 months after Nikhil, i.e. 6 months from the start, so he is in for 6 months: $60000 \times 6 = 3,60,000$. The three capital-month products are equal, so the ratio is 1 : 1 : 1 and each partner receives $\frac{81000}{3} = \text{Rs. } 27,000$.

367. Profit ratio = (capital $\times$ time) ratio = $(5 \times 3) : (9 \times 2) = 15 : 18 = 5 : 6$. Total parts = 11, so one part = $\frac{33000}{11} = 3000$. Farhan gets $5 \times 3000 = 15000$ and Gita gets $6 \times 3000 = 18000$. The difference is 1 part = Rs. 3,000.

368. Ajay's salary = 15% of 20000 = $\frac{15}{100} \times 20000 = 3000$. Remaining profit = $20000 - 3000 = 17000$. Capital ratio = $24000 : 36000 = 2 : 3$, total 5 parts, so one part = $\frac{17000}{5} = 3400$. Ajay's share of the remainder = $2 \times 3400 = 6800$. Total received by Ajay = $3000 + 6800 = \text{Rs. } 9,800$.

369. Irfan's share of profit = $19500 - 7500 = 12000$. Since the periods are equal, capitals are in the same ratio as profits: $\frac{\text{Harish}}{\text{Irfan}} = \frac{7500}{12000} = \frac{5}{8}$. So $\frac{15000}{x} = \frac{5}{8}$, giving $x = \frac{15000 \times 8}{5} = \text{Rs. } 24,000$.

370. Pooja: $20000 \times 3 + 30000 \times 9 = 60000 + 270000 = 3,30,000$. Ravi: $30000 \times 6 + 20000 \times 6 = 180000 + 120000 = 3,00,000$. Ratio = $330000 : 300000 = 11 : 10$. Total parts = 21, so one part = $\frac{42000}{21} = 2000$. Pooja's share = $11 \times 2000 = \text{Rs. } 22,000$.

371. Capital-months are $40000 \times 12 = 4,80,000$; $50000 \times 9 = 4,50,000$; $60000 \times 6 = 3,60,000$. Dividing each by 30000 gives the ratio 16 : 15 : 12, a total of $16 + 15 + 12 = 43$ parts. Mohan holds 15 parts = Rs. 15,000, so one part = 1000. Total profit = $43 \times 1000 = \text{Rs. } 43,000$.

372. Prakash: $25000 \times 4 + 40000 \times 8 = 100000 + 320000 = 4,20,000$. Quresh: $35000 \times 6 + 25000 \times 6 = 210000 + 150000 = 3,60,000$. Ratio = $420000 : 360000 = 7 : 6$. The excess of Prakash over Quresh is $7 - 6 = 1$ part = Rs. 4,000. Total parts = $7 + 6 = 13$, so total profit = $13 \times 4000 = \text{Rs. } 52,000$.

373. Let the total profit be P . Priya's management fee = $0.20P$; the balance $0.80P$ is split in the ratio $45000 : 30000 = 3 : 2$. Priya's share of the balance = $0.80P \times \frac{2}{5} = 0.32P$, so Priya gets $0.20P + 0.32P = 0.52P$. Nitin gets $0.80P \times \frac{3}{5} = 0.48P$. Difference = $0.52P - 0.48P = 0.04P = 1600$, so $P = \frac{1600}{0.04} = \text{Rs. } 40,000$. Check: Priya = 20800, Nitin = 19200, difference = 1600.

374. Let Sunil's capital remain in the business for t months. Anil's capital-months = $20000 \times 12 = 2,40,000$. Sunil's = $30000t$. Then $\frac{240000}{30000t} = \frac{4}{3}$, so $4 \times 30000t = 3 \times 240000$, i.e. $120000t = 720000$, giving $t = 6$. Sunil was in the business for 6 months, so he joined 6 months after the start (i.e. $12 - 6 = 6$).

375. Equal profit shares mean equal capital-months. Manish's capital-months = $30000 \times 12 = 3,60,000$. Let Kavita withdraw Rs. x , so her capital is Rs. 36,000 for 4 months and Rs. $(36000 - x)$ for the remaining 8 months: $36000 \times 4 + (36000 - x) \times 8 = 144000 + 288000 - 8x = 432000 - 8x$. Setting $432000 - 8x = 360000$ gives $8x = 72000$, so $x = \text{Rs. } 9,000$.

376. Arjun: Rs. 45,000 for the first 9 months and Rs. 30,000 for the last 3 months, so $45000 \times 9 + 30000 \times 3 = 405000 + 90000 = 4,95,000$. Bhavna is in from month 3, so Rs. 60,000 from month 3 to month 9, i.e. 6 months, and Rs. 80,000 for the last 3 months: $60000 \times 6 + 80000 \times 3 = 360000 + 240000 = 6,00,000$. Ratio = $495000 : 600000 = 33 : 40$. Total parts = 73, so one part = $\frac{73000}{73} = 1000$. Arjun's share = $33 \times 1000 = \text{Rs. } 33,000$.

377. Let the capitals be Rs. $7k$ and Rs. $5k$. After 6 months Rohit's capital becomes $7k - \frac{1}{7}(7k) = 6k$, and Seema's becomes $5k + \frac{1}{5}(5k) = 6k$. Rohit's capital-months = $7k \times 6 + 6k \times 6 = 42k + 36k = 78k$. Seema's = $5k \times 6 + 6k \times 6 = 30k + 36k = 66k$. Ratio = $78 : 66 = 13 : 11$, total 24 parts, so one part = $\frac{120000}{24} = 5000$. Seema's share = $11 \times 5000 = \text{Rs. } 55,000$.

378. Let the total profit be P . Manoj's commission = $0.10P$, so the divisible profit is $0.90P$. Capital ratio = $30000 : 40000 : 50000 = 3 : 4 : 5$, a total of 12 parts. Naveen gets $\frac{4}{12} \times 0.90P = \frac{1}{3} \times 0.90P = 0.30P$. Setting $0.30P = 12000$ gives $P = \text{Rs. } 40,000$. (Note Rs. 36,000 is only the divisible profit $0.90P$, not the total.) Since Rs. 40,000 is not listed, the answer is *None of these*.

Subtopic 1.4.4

379. The first five multiples of 7 are 7, 14, 21, 28, 35. Their sum is $7 + 14 + 21 + 28 + 35 = 105$. Average = $\frac{105}{5} = 21$. (Shortcut: for an evenly spaced series the average equals the middle term, which is 21.) Hence option C.

380. Total = Average $\times$ Number of items = 18500×6 . Now $18500 \times 6 = 18000 \times 6 + 500 \times 6 = 108000 + 3000 = 111000$. So the total monthly salary is Rs. 1,11,000, which is option A.

381. Sum of all five numbers = $27 \times 5 = 135$. Sum of the four given numbers = $20 + 25 + 30 + 35 = 110$. Fifth number = $135 - 110 = 25$. Hence option D.

382. Sum of the original numbers = $24 \times 6 = 144$. When each number is multiplied by 3, the new sum = $3 \times 144 = 432$, and the count is still 6. New average = $\frac{432}{6} = 72$. In general, multiplying every observation by a constant multiplies the average by that same constant, so the answer is $24 \times 3 = 72$. Since 72 is not listed among options A to D, the correct choice is E, None of these.

383. Total runs = $45 + 52 + 38 + 61 + 44$. Adding step by step: $45 + 52 = 97$; $97 + 38 = 135$; $135 + 61 = 196$; $196 + 44 = 240$. Average = $\frac{240}{5} = 48$ runs. Hence option A.

384. If the average of 20 numbers is zero, their sum is $0 \times 20 = 0$. For the sum to be zero, the positive numbers must be balanced by at least one negative number, so at least one number must be negative.

Therefore at most $20 - 1 = 19$ numbers can be positive. Such a set exists: nineteen 1's and one -19 sum to zero. Hence option D.

385. Total weight of the 5 parcels $= 12 \times 5 = 60$ kg. After removing the 8 kg parcel the remaining weight $= 60 - 8 = 52$ kg over 4 parcels, so the new average $= \frac{52}{4} = 13$ kg. (Shortcut: the removed parcel is $12 - 8 = 4$ kg below the old average, and that 4 kg surplus is shared among the 4 parcels left, raising the average by $\frac{4}{4} = 1$ kg to 13 kg.) Hence option B.

386. Total age of the 30 students $= 14 \times 30 = 420$ years. Including the teacher there are 31 persons and the new average is $14 + 1 = 15$ years, so the new total $= 15 \times 31 = 465$ years. Teacher's age $= 465 - 420 = 45$ years. (Shortcut: teacher's age $=$ new average $+$ increase $\times$ old count $= 15 + 1 \times 30 = 45$.) Hence option C.

387. Wrong total $= 36 \times 40 = 1440$. The entry was short by $76 - 36 = 40$. Correct total $= 1440 + 40 = 1480$. Correct average $= \frac{1480}{40} = 37$. (Shortcut: the average rises by $\frac{40}{40} = 1$, so $36 + 1 = 37$.) Hence option B.

388. Total clerk salary $= 12 \times 22000 = 264000$. Total officer salary $= 8 \times 35000 = 280000$. Combined total $= 264000 + 280000 = 544000$ for 20 employees. Weighted average $= \frac{544000}{20} = 27200$. Note that the plain average of 22000 and 35000 is 28500, which is a trap since the two groups are not of equal size. Hence option A.

389. Sum of all 11 results $= 50 \times 11 = 550$. Sum of the first six $= 49 \times 6 = 294$. Sum of the last six $= 52 \times 6 = 312$. When these two groups are added we get $294 + 312 = 606$, but this counts the sixth result twice, since it belongs to both groups. Therefore sixth result $= 606 - 550 = 56$. Hence option C.

390. Time for the onward trip $= \frac{120}{40} = 3$ hours. Time for the return trip $= \frac{120}{60} = 2$ hours. Total distance $= 120 + 120 = 240$ km and total time $= 3 + 2 = 5$ hours. Average speed $= \frac{240}{5} = 48$ km/h. Average speed is total distance over total time, not the plain average of 40 and 60, which would wrongly give 50. Hence option B.

391. Expenditure in the first three months $= 3 \times 2600 = 7800$. Expenditure in the next four months $= 4 \times 2900 = 11600$. Expenditure in the last five months $= 5 \times 3200 = 16000$. Total yearly expenditure $= 7800 + 11600 + 16000 = 35400$. Total yearly income $=$ expenditure $+$ savings $= 35400 + 4200 = 39600$. Average monthly income $= \frac{39600}{12} = 3300$. Hence option D.

392. The even numbers between 11 and 51 are 12, 14, 16, ..., 50. This is an evenly spaced series, so its average is the mean of the first and last terms: $\frac{12 + 50}{2} = \frac{62}{2} = 31$. (Check: the number of terms is $\frac{50 - 12}{2} + 1 = 20$, and the sum is $\frac{20}{2}(12 + 50) = 620$, giving $\frac{620}{20} = 31$.) Hence option D.

393. Original total age $= 40 \times 8 = 320$ years. New total age $= 42 \times 8 = 336$ years, so the total rose by $336 - 320 = 16$ years. The two members who left contributed $35 + 45 = 80$ years. Therefore the two new members contribute $80 + 16 = 96$ years. Hence option C.

394. Let the number of boys be b ; then the number of girls is $60 - b$. Total marks $= 62 \times 60 = 3720$. So $66b + 56(60 - b) = 3720$, that is $66b + 3360 - 56b = 3720$, giving $10b = 360$ and $b = 36$. (Alligation check: boys are 4 above the mean and girls 6 below, so boys : girls $= 6 : 4 = 3 : 2$, and $\frac{3}{5} \times 60 = 36$.) Hence option D.

395. For an evenly spaced series of five terms the average equals the middle term, so the third number is 61. The five consecutive odd numbers are therefore 57, 59, 61, 63, 65. The smallest is 57 and the second largest is 63. Twice the smallest $= 2 \times 57 = 114$, and $114 - 63 = 51$. Hence option A.

396. Sum of all six numbers $= 3.95 \times 6 = 23.7$. Sum of the first pair $= 3.4 \times 2 = 6.8$. Sum of the second pair $= 3.85 \times 2 = 7.7$. Sum of the remaining two $= 23.7 - 6.8 - 7.7 = 9.2$. Their average $= \frac{9.2}{2} = 4.6$. Hence option B.

397. Runs scored in 16 innings $= 36 \times 16 = 576$. For the average after 17 innings to be 39, the required total $= 39 \times 17 = 663$. Runs needed in the 17th innings $= 663 - 576 = 87$. (Shortcut: he needs 39 for the new innings plus 3 extra for each of the previous 16 innings, that is $39 + 3 \times 16 = 39 + 48 = 87$.) Hence option E.

398. For 11 consecutive numbers the average is the sixth (middle) term, so the middle term is 32 and the numbers run from $32 - 5 = 27$ to $32 + 5 = 37$. Their sum $= 32 \times 11 = 352$. The next four consecutive numbers are 38, 39, 40, 41, whose sum $= 38 + 39 + 40 + 41 = 158$. New total $= 352 + 158 = 510$ over 15 numbers, so the new average $= \frac{510}{15} = 34$. (Check: the 15 numbers 27 to 41 are evenly spaced, so the average is the middle term 34.) Hence option B.

399. Revenue from P $= 40 \times 250 = 10000$. Revenue from Q $= 60 \times 180 = 10800$. Revenue from R $= 300x$. Total units $= 40 + 60 + x = 100 + x$. The overall average gives $10000 + 10800 + 300x = 220(100 + x)$, that is $20800 + 300x = 22000 + 220x$. So $80x = 1200$ and $x = 15$. Hence option D.

Subtopic 1.4.5

400. Let the son's present age be s years, so Mahesh's present age is $(56 - s)$ years. Four years hence the ages are $(s + 4)$ and $(60 - s)$. Given $60 - s = 3(s + 4)$, i.e. $60 - s = 3s + 12$, so $4s = 48$ and $s = 12$. Check: son = 12, Mahesh = 44; after 4 years they are 16 and 48, and $48 = 3 \times 16$.

401. Let the ages be $3x$ and $8x$. Then $3x = 15$, so $x = 5$. The mother's present age $= 8x = 8 \times 5 = 40$ years. After 6 years her age $= 40 + 6 = 46$ years.

402. Total age of all 5 members $= 5 \times 28 = 140$ years. Removing the youngest member, the total age of the remaining 4 members $= 140 - 8 = 132$ years. Their average $= \frac{132}{4} = 33$ years.

403. Let Sohan's present age be b years; then Ravi's age is $(b + 8)$ years. Ten years ago their ages were $(b - 10)$ and $(b - 2)$. Given $b - 2 = 2(b - 10)$, i.e. $b - 2 = 2b - 20$, so $b = 18$. Hence Ravi $= 18 + 8 = 26$ years. Check: ten years ago they were $26 - 10 = 16$ and 8, and $16 = 2 \times 8$.

404. Let the son's present age be s years, so Mr. Iyer's age is $4s$ years. After 16 years, $4s + 16 = 2(s + 16) = 2s + 32$, so $2s = 16$ and $s = 8$ years. Since 8 years is not listed among the first four options, the correct choice is 'None of these'. Check: ages are 8 and 32; after 16 years they are 24 and 48, and $48 = 2 \times 24$.

405. Let the ages be $5x$ and $7x$. Then $\frac{5x + 6}{7x + 6} = \frac{3}{4}$, so $4(5x + 6) = 3(7x + 6)$, i.e. $20x + 24 = 21x + 18$, giving $x = 6$. The ages are 30 and 42 years, and their sum $= 72$ years.

406. Total age of the 30 students $= 30 \times 14 = 420$ years. Including the teacher there are 31 people whose average is $14 + 1 = 15$ years, so their total age $= 31 \times 15 = 465$ years. Hence the teacher's age $= 465 - 420 = 45$ years.

407. Let the ages be $7x$ and $5x$. Ten years hence, $\frac{7x + 10}{5x + 10} = \frac{9}{7}$, so $7(7x + 10) = 9(5x + 10)$, i.e. $49x + 70 = 45x + 90$. Thus $4x = 20$ and $x = 5$. Bimal's present age $= 5x = 25$ years (Anil is 35). Check: after 10 years the ages are 45 and 35, and $45 : 35 = 9 : 7$.

408. Three years ago the total age of the three people $= 3 \times 27 = 81$ years. Each has aged 3 years since, so their present total $= 81 + 3 \times 3 = 90$ years. Five years ago the total age of the wife and child $= 2 \times 20 = 40$ years, so their present total $= 40 + 2 \times 5 = 50$ years. Hence the husband's present age $= 90 - 50 = 40$ years.

409. Let the present ages be F and S . From the first condition, $F - 10 = 3(S - 10)$, so $F = 3S - 20$. From the second, $F + 10 = 2(S + 10)$, so $F = 2S + 10$. Equating, $3S - 20 = 2S + 10$, giving $S = 30$ and $F = 70$. The ratio $= 70 : 30 = 7 : 3$. Check: ten years ago $60 = 3 \times 20$; ten years hence $80 = 2 \times 40$.

410. Let Chetan's age be x years. Then Balu $= 2x$ and Arun $= 2x + 2$. Their total is $x + 2x + (2x + 2) = 5x + 2 = 27$, so $5x = 25$ and $x = 5$. Therefore Balu $= 2 \times 5 = 10$ years. Check: ages are 12, 10, 5, whose sum is 27.

411. Let Sunil's present age be P years. His age at marriage was $(P - 8)$ years, and we are given $P = \frac{6}{5}(P - 8)$. Multiplying by 5, $5P = 6P - 48$, so $P = 48$ years. The son's age $= \frac{1}{12} \times 48 = 4$ years. Check: at marriage Sunil was 40, and $\frac{6}{5} \times 40 = 48$.

412. Let the son's present age be s years, so the father's present age is $(3s + 3)$ years. Three years hence their ages are $(s + 3)$ and $(3s + 6)$. The second condition gives $3s + 6 = 2(s + 3) + 10 = 2s + 16$, so $s = 10$ years. Hence the father's present age $= 3 \times 10 + 3 = 33$ years. Check: three years hence the ages are 13 and 36, and $2 \times 13 + 10 = 36$.

413. Let Rekha's present age be r years. Three years ago she was $(r - 3)$ and her mother was $4(r - 3)$, so the mother's present age $= 4(r - 3) + 3 = 4r - 9$. The father is 5 years older: $4r - 9 + 5 = 4r - 4$. Summing, $r + (4r - 9) + (4r - 4) = 9r - 13 = 104$, so $9r = 117$ and $r = 13$. Check: Rekha 13, mother 43, father 48, total 104; three years ago 10 and 40, and $40 = 4 \times 10$.

414. Let the present ages be $4x$, $7x$ and $9x$, so the present total is $20x$. Eight years ago each was 8 years younger, so the total then was $20x - 3 \times 8 = 20x - 24$. Given $20x - 24 = 56$, we get $20x = 80$ and $x = 4$. Farhan's present age $= 9x = 36$ years. Check: ages 16, 28, 36 sum to 80; eight years ago 8, 20, 28 sum to 56.

415. Present total age $= 4 \times 28 = 112$ years. Let the youngest member's present age be y years, so the other 3 members together have $(112 - y)$ years today. At the birth of the youngest, i.e. y years ago, only those 3 existed and each was y years younger, so their total then $= (112 - y) - 3y = 112 - 4y$. Their average was 24, so $\frac{112 - 4y}{3} = 24$, giving $112 - 4y = 72$, hence $4y = 40$ and $y = 10$ years. Check: others total today $= 102$; ten years ago $= 102 - 30 = 72$, average $= 24$.

416. Let Rohan's present age be r years; his father's age is $(r + 30)$ years. Five years ago the ages were $(r - 5)$ and $(r + 25)$, so $(r - 5)(r + 25) = 400$. Expanding, $r^2 + 20r - 125 = 400$, i.e. $r^2 + 20r - 525 = 0$. Factorising, $(r + 35)(r - 15) = 0$, and since age cannot be negative, $r = 15$ years. Check: ages are 15 and 45; five years ago $10 \times 40 = 400$.

417. The condition 'as much younger than Vikas as he is older than Mohan' means $V - S = S - M$, i.e. $2S = V + M = 74$, so Sanjay $= 37$ years. Since Vikas is 8 years older than Sanjay, $V = 37 + 8 = 45$ years, and therefore $M = 74 - 45 = 29$ years. As 29 is not among the first four options, the answer is 'None of these'. Check: $45 - 37 = 8$ and $37 - 29 = 8$, so Sanjay is indeed equidistant in age from both.

418. Let the younger person's present age be y years, so the elder is $(y + 16)$ years. Six years ago, $(y + 16) - 6 = 3(y - 6)$, i.e. $y + 10 = 3y - 18$, so $2y = 28$ and $y = 14$; the elder is 30. Ten years from now their ages will be 24 and 40, giving the ratio $24 : 40 = 3 : 5$. Check on the given data: six years ago they were 8 and 24, and $24 = 3 \times 8$.

419. Let the son's present age be s years, so the father's age is $4s$ years. Five years ago the ages were $(s - 5)$ and $(4s - 5)$, and we are given $4s - 5 = 7(s - 5) = 7s - 35$, so $3s = 30$ and $s = 10$; the father is 40. Let the required number of years be t . Then $40 + t = 2(10 + t) = 20 + 2t$, giving $t = 20$ years. Check: five years ago the ages were 5 and 35, and $35 = 7 \times 5$; after 20 years they are 30 and 60, and $60 = 2 \times 30$.

420. Original total age $= 8 \times 35 = 280$ years. After the two officers leave, the total for the remaining 6 officers $= 280 - (45 + 51) = 280 - 96 = 184$ years. After the two new officers join there are again 8

officers with average 34, so the new total = $8 \times 34 = 272$ years. Hence the two new officers together account for $272 - 184 = 88$ years, and their average age = $\frac{88}{2} = 44$ years.

Subtopic 1.5.1

421. Profit = SP - CP = $5220 - 4500 = \text{Rs. } 720$. Profit per cent = $\frac{\text{Profit}}{\text{CP}} \times 100 = \frac{720}{4500} \times 100$. Now $\frac{720}{4500} = \frac{72}{450} = \frac{4}{25}$, and $\frac{4}{25} \times 100 = 16$. Hence the profit is 16%.

422. When there is a loss of 12%, the selling price is $(100 - 12) = 88\%$ of the cost price. So SP = $1250 \times \frac{88}{100}$. Compute $1250 \times 88 = 110000$, and $\frac{110000}{100} = 1100$. Hence SP = Rs. 1,100. (Check: loss = $1250 - 1100 = 150$, and $\frac{150}{1250} \times 100 = 12\%$.)

423. $\text{SP} = \text{CP} \times \left(1 + \frac{15}{100}\right) = \text{CP} \times \frac{115}{100}$. Therefore $\text{CP} = 6900 \times \frac{100}{115}$. Since $\frac{6900}{115} = 60$, we get CP = $60 \times 100 = \text{Rs. } 6,000$. (Check: 15% of $6000 = 900$ and $6000 + 900 = 6900$.)

424. Profit is 20% of CP, so $0.20 \times \text{CP} = 960$, giving $\text{CP} = \frac{960 \times 100}{20} = \text{Rs. } 4,800$. Selling price = CP + Profit = $4800 + 960 = \text{Rs. } 5,760$. Note that option A is the cost price, not the selling price.

425. A loss of 20% means SP = 80% of CP, i.e. $2240 = \frac{80}{100} \times \text{CP}$. So $\text{CP} = 2240 \times \frac{100}{80} = 2240 \times \frac{5}{4} = \text{Rs. } 2,800$. Loss = CP - SP = $2800 - 2240 = \text{Rs. } 560$. (Option A is the trap 20% of the selling price.)

426. Let the cost price of one notebook be Rs. 1, so the cost price of 10 notebooks is Rs. 10. Given that the selling price of 8 notebooks is also Rs. 10, the SP of one notebook = $\frac{10}{8} = \text{Rs. } 1.25$. Profit on one notebook = $1.25 - 1 = 0.25$. Profit per cent = $\frac{0.25}{1} \times 100 = 25\%$. (Shortcut: profit per cent = $\frac{10 - 8}{8} \times 100 = 25\%$.)

427. Total CP = $40 \times 25 = \text{Rs. } 1,000$. Total SP = $40 \times 30 = \text{Rs. } 1,200$. Profit = $1200 - 1000 = \text{Rs. } 200$. Profit per cent = $\frac{200}{1000} \times 100 = 20\%$. (Option B, $16\frac{2}{3}\%$, is the trap $\frac{5}{30} \times 100$, which wrongly uses the selling price as the base.)

428. First AC: $\text{CP} = 9600 \times \frac{100}{120} = \text{Rs. } 8,000$. Second AC: $\text{CP} = 9600 \times \frac{100}{80} = \text{Rs. } 12,000$. Total CP = $8000 + 12000 = \text{Rs. } 20,000$, while total SP = $2 \times 9600 = \text{Rs. } 19,200$. Since $\text{SP} < \text{CP}$, there is a loss of $20000 - 19200 = \text{Rs. } 800$. Loss per cent = $\frac{800}{20000} \times 100 = 4\%$. (General rule: equal selling prices with equal gain and loss $x\%$ always give a loss of $\frac{x^2}{100}\% = \frac{400}{100} = 4\%$.)

429. Let the cost price be Rs. 100. Marked price = $100 + 40 = \text{Rs. } 140$. Discount = 15% of $140 = \frac{15}{100} \times 140 = \text{Rs. } 21$. Selling price = $140 - 21 = \text{Rs. } 119$. Profit = $119 - 100 = \text{Rs. } 19$ on a cost of Rs. 100, so the profit per cent is 19%. (Note that $40 - 15 = 25$ is not the answer; discount acts on the marked price, not on the cost price.)

430. Let the cost of pulses be Rs. 1 per gram. When a customer asks for 1 kg, the grocer hands over only 800 g, which costs him Rs. 800, but he charges the price of 1000 g, i.e. Rs. 1,000. Profit = $1000 - 800 = \text{Rs. } 200$ on an outlay of Rs. 800. Profit per cent = $\frac{200}{800} \times 100 = 25\%$. (The trap answer 20% comes from dividing the 200 g shortfall by 1000 g instead of by the actual cost.)

431. Step 1: find the cost price. $\text{CP} = 7200 \times \frac{100}{120} = \text{Rs. } 6,000$. Step 2: required SP for a 30% profit = $6000 \times \frac{130}{100} = \text{Rs. } 7,800$. (Option A is the trap obtained by adding a further 10% to Rs. 7,200 mechanically; the extra 10% must be reckoned on the cost price, not on the old selling price.)

432. Let the cost price be Rs. x . Actual SP = $0.90x$. The hypothetical SP is $0.90x + 1800$ and this equals $1.20x$. So $0.90x + 1800 = 1.20x$, giving $1800 = 0.30x$ and $x = \frac{1800}{0.30} = \text{Rs. } 6,000$. (Check: actual SP = 5400; adding 1800 gives 7200, which is indeed 20% above 6000.)

433. Let Arjun's cost price be Rs. x . Bhaskar pays $1.25x$, and Chandan pays $1.25x \times 1.20 = 1.5x$. Given $1.5x = 9000$, we get $x = \frac{9000}{1.5} = \text{Rs. } 6,000$. (Verification: Arjun's SP = $6000 \times 1.25 = 7500$; Bhaskar's SP = $7500 \times 1.20 = 9000$.)

434. Cost of the first variety = $25 \times 32 = \text{Rs. } 800$. Cost of the second variety = $15 \times 40 = \text{Rs. } 600$. Total cost = $800 + 600 = \text{Rs. } 1,400$ for $25 + 15 = 40$ kg. Total selling price = $40 \times 42 = \text{Rs. } 1,680$. Profit = $1680 - 1400 = \text{Rs. } 280$. Profit per cent = $\frac{280}{1400} \times 100 = 20\%$.

435. Let CP = Rs. 100, so MP = Rs. 160. After the first discount of 10%: price = $160 \times 0.90 = \text{Rs. } 144$. After the second discount of 12.5% (that is, $\frac{1}{8}$ off): reduction = $\frac{144}{8} = 18$, so price = $144 - 18 = \text{Rs. } 126$. Final SP = Rs. 126 on a CP of Rs. 100, hence profit = 26%. (Adding the discounts as $10 + 12.5 = 22.5$ and computing $160 \times 0.775 = 124$ is wrong, because successive discounts do not simply add.)

436. Let the cost be Rs. 100 per kg, i.e. Re. 0.10 per gram. Marked price for 1 kg = Rs. 120; after a 10% discount the customer pays $120 \times 0.90 = \text{Rs. } 108$. But the grocer parts with only 900 g, which costs him $900 \times 0.10 = \text{Rs. } 90$. Profit = $108 - 90 = \text{Rs. } 18$ on an actual outlay of Rs. 90. Profit per cent = $\frac{18}{90} \times 100 = 20\%$. (The 8% in option A ignores the short weighing; it is the profit from mark-up and discount alone.)

437. Let the actual cost price be Rs. x . Then the actual selling price is $1.20x$. In the hypothetical case the cost price is $0.80x$ and the selling price is $1.20x - 1500$, and this must be 25% above the reduced cost: $1.20x - 1500 = 1.25 \times 0.80x = x$. Hence $0.20x = 1500$ and $x = \frac{1500}{0.20} = \text{Rs. } 7,500$. (Check: actual CP = 7500 and actual SP = 9000. Reduced CP = $0.80 \times 7500 = 6000$; reduced SP = $9000 - 1500 = 7500$; profit = 1500, and $\frac{1500}{6000} \times 100 = 25\%$, as required.)

438. Let the cost price be Rs. x . Profit in the first case = $1754 - x$; loss in the second case = $x - 1486$. Equating them: $1754 - x = x - 1486$, so $2x = 1754 + 1486 = 3240$ and $x = \text{Rs. } 1,620$. (Equivalently, CP is the average of the two prices.) Required SP for a 25% profit = $1620 \times \frac{125}{100} = 1620 \times \frac{5}{4} = \text{Rs. } 2,025$.

439. Cost per shirt = $\frac{24000}{80} = \text{Rs. } 300$. Target total SP = $24000 \times 1.20 = \text{Rs. } 28,800$. First lot: $30 \times (300 \times 1.25) = 30 \times 375 = \text{Rs. } 11,250$. Second lot: $20 \times (300 \times 0.90) = 20 \times 270 = \text{Rs. } 5,400$. Revenue still needed = $28800 - 11250 - 5400 = \text{Rs. } 12,150$ from the remaining $80 - 50 = 30$ shirts, whose cost is $30 \times 300 = \text{Rs. } 9,000$. Profit = $12150 - 9000 = \text{Rs. } 3,150$, so the required profit per cent = $\frac{3150}{9000} \times 100 = 35\%$.

440. Let the original CP = Rs. 100. Then SP = 112, and since SP is 80% of the marked price, MP = $\frac{112}{0.80} = \text{Rs. } 140$. Now the cost price becomes $100 \times 1.25 = \text{Rs. } 125$, while MP stays at Rs. 140 and the discount stays at 20%, so SP remains $140 \times 0.80 = \text{Rs. } 112$. Since $112 < 125$, there is a loss of $125 - 112 = \text{Rs. } 13$. Loss per cent = $\frac{13}{125} \times 100 = 10.4\%$.

441. Take 12 apples of each kind (a convenient common multiple of 6 and 4). Cost of the first lot = $\frac{12}{6} \times 50 = 2 \times 50 = \text{Rs. } 100$. Cost of the second lot = $\frac{12}{4} \times 50 = 3 \times 50 = \text{Rs. } 150$. Total cost = Rs. 250 for 24 apples. Selling price = $\frac{24}{5} \times 55 = 24 \times 11 = \text{Rs. } 264$. Profit = $264 - 250 = \text{Rs. } 14$, so profit per cent = $\frac{14}{250} \times 100 = 5.6\%$.

Subtopic 1.5.2

442. Discount is always calculated on the marked price. Discount = 15% of Rs. 2,400 = $\frac{15}{100} \times 2400 =$ Rs. 360. Selling price = Marked price – Discount = 2400 – 360 = Rs. 2,040. (Equivalently, S.P. = $2400 \times 0.85 = 2040$.)

443. Let the marked price be Rs. M . A discount of 20% means the customer pays 80% of M . So $\frac{80}{100} \times M = 1224$, giving $M = \frac{1224 \times 100}{80} = 1530$. Hence the marked price is Rs. 1,530. Check: 20% of 1530 = 306 and $1530 - 306 = 1224$.

444. Take the marked price as Rs. 100. After the first discount the price becomes $100 \times \frac{80}{100} =$ Rs. 80. The second discount of 10% is applied on Rs. 80, not on Rs. 100, so the price becomes $80 \times \frac{90}{100} =$ Rs. 72. Total reduction = $100 - 72 =$ Rs. 28 on Rs. 100, i.e. a single equivalent discount of 28%. (Note it is not $20 + 10 = 30\%$.)

445. Discount amount = $1500 - 1275 =$ Rs. 225. Rate of discount = $\frac{\text{Discount}}{\text{Marked price}} \times 100 = \frac{225}{1500} \times 100 = 15\%$.

446. Discount = 16% of 2500 = $\frac{16}{100} \times 2500 =$ Rs. 400. Amount paid = $2500 - 400 =$ Rs. 2,100. Since Rs. 2,100 is not listed among options (A)–(D), the correct choice is None of these.

447. Selling price = $800 - 10\% \text{ of } 800 = 800 - 80 =$ Rs. 720. Profit = S.P. – C.P. = $720 - 600 =$ Rs. 120. Profit percent = $\frac{120}{600} \times 100 = 20\%$. (Profit percent is always taken on the cost price, not on the marked price.)

448. After the first discount: $1800 \times \frac{90}{100} =$ Rs. 1,620. The second discount of 5% acts on Rs. 1,620: $1620 \times \frac{95}{100} = 1620 - 81 =$ Rs. 1,539. So the customer pays Rs. 1,539.

449. Let the cost price be Rs. 100. Marked price = $100 + 40\% \text{ of } 100 =$ Rs. 140. Discount = 25% of 140 = Rs. 35, so selling price = $140 - 35 =$ Rs. 105. Profit = $105 - 100 =$ Rs. 5 on a cost of Rs. 100, i.e. a profit of 5%.

450. Price after the first discount = $2500 \times \frac{80}{100} =$ Rs. 2,000. The second discount is applied on Rs. 2,000 and brings the price down to Rs. 1,700, so the second discount amount = $2000 - 1700 =$ Rs. 300. Rate = $\frac{300}{2000} \times 100 = 15\%$.

451. Store A: price = $8000 \times \frac{70}{100} =$ Rs. 5,600. Store B: $8000 \times \frac{80}{100} = 6400$, then $6400 \times \frac{85}{100} =$ Rs. 5,440 (equivalent single discount = $100 - 0.8 \times 0.85 \times 100 = 32\%$). Difference = $5600 - 5440 =$ Rs. 160, Store B being cheaper.

452. Required selling price = $1200 \times \frac{120}{100} =$ Rs. 1,440. If the marked price is Rs. M , a 20% discount gives S.P. = $0.8M$. So $0.8M = 1440 \Rightarrow M = \frac{1440}{0.8} = 1800$. The cycle must be marked at Rs. 1,800.

453. Let C.P. = Rs. 100. Then M.P. = Rs. 125 and the required S.P. = Rs. 110. Discount amount = $125 - 110 =$ Rs. 15. Rate of discount = $\frac{15}{125} \times 100 = 12\%$ (taken on the marked price, not on the cost price).

454. If the marked price is Rs. M , the amount paid = $M \times \frac{85}{100} \times \frac{95}{100} = 0.8075M$. So $0.8075M = 3876 \Rightarrow M = \frac{3876}{0.8075} = 4800$. Verification: $4800 \times 0.85 = 4080$ and $4080 \times 0.95 = 3876$. Hence M.P. = Rs. 4,800.

455. Discount on the handbag = 25% of 2400 = Rs. 600. Discount on the shoes = 15% of 1600 = Rs. 240. Total discount = 600 + 240 = Rs. 840 on a total marked price of 2400 + 1600 = Rs. 4,000. Overall rate = $\frac{840}{4000} \times 100 = 21\%$. (It is not the simple average 20%, because the two marked prices are unequal.)

456. Let C.P. = Rs. 100, so M.P. = Rs. 160. After the first discount: $160 \times \frac{80}{100} = \text{Rs. } 128$. Note $12\frac{1}{2}\% = \frac{1}{8}$, so the second discount leaves $\frac{7}{8}$ of the price: $128 \times \frac{7}{8} = \text{Rs. } 112$. Profit = $112 - 100 = \text{Rs. } 12$ on Rs. 100, i.e. 12%.

457. Let the cost price of 1 kg be Rs. 100. Marked price of 1 kg = Rs. 125; after a 10% discount he charges $125 \times 0.9 = \text{Rs. } 112.50$ for what he calls one kilogram. But he actually hands over only 900 g, which costs him $\frac{900}{1000} \times 100 = \text{Rs. } 90$. So on an outlay of Rs. 90 he receives Rs. 112.50. Profit = $112.50 - 90 = \text{Rs. } 22.50$, and profit percent = $\frac{22.50}{90} \times 100 = 25\%$.

458. Take the marked price as Rs. 100. Net price = $100 \times \frac{90}{100} \times \frac{80}{100} \times \frac{75}{100}$. Step by step: $100 \rightarrow 90 \rightarrow 72 \rightarrow 54$. So the customer pays Rs. 54 for goods marked Rs. 100, a total reduction of Rs. 46. The equivalent single discount is therefore 46% (not $10 + 20 + 25 = 55\%$).

459. Scheme A: $12000 \times \frac{80}{100} = 9600$; $9600 \times \frac{90}{100} = 8640$; $8640 \times \frac{95}{100} = 8640 - 432 = \text{Rs. } 8,208$. Scheme B: $12000 \times \frac{70}{100} = 8400$, then $8400 - 100 = \text{Rs. } 8,300$. Since $8208 < 8300$, Scheme A is cheaper, and the saving is $8300 - 8208 = \text{Rs. } 92$.

460. Let C.P. = Rs. 100. Gaining 25% means S.P. = Rs. 125, and this S.P. is 80% of the marked price, so M.P. = $\frac{125}{0.8} = \text{Rs. } 156.25$. With a 30% discount the new S.P. = $156.25 \times \frac{70}{100} = \text{Rs. } 109.375$. Gain = $109.375 - 100 = \text{Rs. } 9.375$ on Rs. 100, i.e. a gain of $9.375\% = 9\frac{3}{8}\%$.

461. Let the marked price of one article be Rs. M . A buyer who takes 15 articles pays for only 12 of them, each at $0.8M$. Amount paid = $12 \times 0.8M = 9.6M$. Marked value of the 15 articles received = $15M$. Total discount = $15M - 9.6M = 5.4M$. Effective rate = $\frac{5.4M}{15M} \times 100 = 36\%$.

462. Present selling price = $5000 \times \frac{80}{100} \times \frac{90}{100} = 5000 \times 0.72 = \text{Rs. } 3,600$. Since this gives a 20% profit, C.P. = $\frac{3600}{1.20} = \text{Rs. } 3,000$. For a 35% profit the required S.P. = $3000 \times 1.35 = \text{Rs. } 4,050$. If the new marked price is Rs. M , then $0.72M = 4050 \Rightarrow M = \frac{4050}{0.72} = 5625$. So it should be marked at Rs. 5,625.

Subtopic 1.5.3

463. Let the cost price be Rs. 1 per gram. The shopkeeper hands over only 900 g, so his cost is Rs. 900. He charges the price of a full kilogram, i.e. Rs. 1000. Profit = $1000 - 900 = \text{Rs. } 100$. Gain percent = $\frac{100}{900} \times 100 = \frac{100}{9} = 11\frac{1}{9}\%$. (In general, gain = $\frac{\text{Error}}{\text{True value} - \text{Error}} \times 100$.)

464. The shortfall on each nominal kilogram = $1000 - 940 = 60$ g. Deepa is weighed out 5 such nominal kilograms, so the total shortfall = $5 \times 60 = 300$ g. (She pays for 5000 g but carries away only $5 \times 940 = 4700$ g, and $5000 - 4700 = 300$ g.)

465. Error = $1000 - 960 = 40$ g. Gain percent = $\frac{\text{Error}}{\text{True weight} - \text{Error}} \times 100 = \frac{40}{960} \times 100 = \frac{100}{24} = 4\frac{1}{6}\%$. Note 4% is the wrong answer obtained by dividing by 1000 instead of 960.

466. Suppose he pays Rs. 1000 and receives 1100 g. His cost for 1100 g is Rs. 1000. He sells at the rate he believes to be cost price, namely Rs. 1000 per kg, i.e. Re. 1 per gram. Selling 1100 g fetches Rs. 1100. Profit = $1100 - 1000 = \text{Rs. } 100$ on an outlay of Rs. 1000, i.e. $\frac{100}{1000} \times 100 = 10\%$.

467. Let the false weight be w g. Selling at cost price, gain = $\frac{1000 - w}{w} \times 100 = 20$. So $\frac{1000 - w}{w} = \frac{1}{5}$, giving $5000 - 5w = w$, i.e. $6w = 5000$ and $w = \frac{5000}{6} = 833\frac{1}{3}$ g. (Using 800 g would give 25%, not 20%.)

468. For Rs. 600 at Rs. 60 per kg Kavita expects 10 kg. Each “kg” delivered is only 750 g, so she receives $10 \times 750 = 7500 \text{ g} = 7.5 \text{ kg}$, whose true worth is $7.5 \times 60 = \text{Rs. } 450$. Her loss = $600 - 450 = \text{Rs. } 150$, so loss percent = $\frac{150}{600} \times 100 = 25\%$. (The shopkeeper’s gain on his cost is $\frac{150}{450} \times 100 = 33\frac{1}{3}\%$ — a different base, hence a common trap.)

469. Error = $1000 - 875 = 125$ g. Gain percent = $\frac{125}{875} \times 100 = \frac{1}{7} \times 100 = \frac{100}{7} = 14\frac{2}{7}\%$. The value $12\frac{1}{2}\%$ comes from wrongly using $\frac{125}{1000}$.

470. Let the cost be Re. 1 per gram. For one nominal kilogram he charges $1000 \times 1.12 = \text{Rs. } 1120$ but delivers only 900 g, which costs him Rs. 900. Profit = $1120 - 900 = \text{Rs. } 220$. Profit percent = $\frac{220}{900} \times 100 = \frac{220}{9} = 24\frac{4}{9}\%$.

471. Take the cost as Re. 1 per gram. Claiming a 10% loss, he charges $1000 \times 0.90 = \text{Rs. } 900$ for a nominal kilogram, but he hands over only 800 g costing him Rs. 800. Profit = $900 - 800 = \text{Rs. } 100$, so profit percent = $\frac{100}{800} \times 100 = 12\frac{1}{2}\%$ — a gain, not a loss.

472. For one nominal kilogram the customer pays $100 \times 0.90 = \text{Rs. } 90$. What he actually receives is 800 g, whose true market worth is $\frac{800}{1000} \times 100 = \text{Rs. } 80$. His loss = $90 - 80 = \text{Rs. } 10$ on an outlay of Rs. 90, so loss percent = $\frac{10}{90} \times 100 = \frac{100}{9} = 11\frac{1}{9}\%$. (The dealer’s own gain is $\frac{10}{80} \times 100 = 12\frac{1}{2}\%$ — computed on a different base, hence the standard trap.)

473. Let cost be Re. 1 per gram, so a genuine kilogram costs Rs. 1000. Marked price = $1000 \times 1.20 = \text{Rs. } 1200$; after 10% discount the selling price for one nominal kilogram = $1200 \times 0.90 = \text{Rs. } 1080$. Goods actually delivered = 900 g, costing Rs. 900. Profit = $1080 - 900 = \text{Rs. } 180$, so profit percent = $\frac{180}{900} \times 100 = 20\%$.

474. Suppose he pays Rs. 1000 per nominal kilogram and receives 1100 g, so his cost per gram = $\frac{1000}{1100}$. While selling he collects Rs. 1000 for 900 g, so his receipt per gram = $\frac{1000}{900}$. Gain percent = $\left(\frac{1000/900}{1000/1100} - 1 \right) \times 100 = \left(\frac{1100}{900} - 1 \right) \times 100 = \frac{200}{900} \times 100 = 22\frac{2}{9}\%$.

475. Total cost = $100 \times 40 = \text{Rs. } 4,000$. His stock is 100 kg = 1,00,000 g. Every “kilogram” he sells contains only 800 g, so the number of units he can sell = $\frac{1,00,000}{800} = 125$. Revenue = $125 \times 44 = \text{Rs. } 5,500$. Profit = $5500 - 4000 = \text{Rs. } 1,500$ (a profit of 37.5%).

476. Let cost be Re. 1 per gram and let the false weight be w g. For a nominal kilogram he charges $1000 \times 1.05 = \text{Rs. } 1050$ and his cost is Rs. w . Gain = $\frac{1050 - w}{w} = \frac{40}{100} = 0.4$. Hence $1050 - w = 0.4w$, so $1.4w = 1050$ and $w = \frac{1050}{1.4} = 750$ g.

477. Let the supplier’s genuine rate be Re. 1 per gram. Buying: he pays Rs. 1000 and gets 1080 g, so his actual cost per gram = $\frac{1000}{1080}$. Selling: for one nominal kilogram the marked price is $1000 \times 1.20 = \text{Rs. } 1200$ and after 10% discount he receives Rs. 1080, while delivering 900 g. So his receipt per gram

$= \frac{1080}{900} = 1.2$. Profit percent $= \left(\frac{1.2}{1000/1080} - 1 \right) \times 100 = (1.2 \times 1.08 - 1) \times 100 = (1.296 - 1) \times 100 = 29.6\%$. Since 29.6% is not listed, the answer is "None of these".

478. Let pure turmeric cost Re. 1 per gram. For each nominal kilogram sold he collects Rs. 1000 but hands over only 900 g of mixture. Of those 900 g, 20% is free powder, so genuine turmeric $= 900 \times 0.80 = 720$ g, costing him Rs. 720. Profit $= 1000 - 720 =$ Rs. 280. Profit percent $= \frac{280}{720} \times 100 = \frac{700}{18} = 38\frac{8}{9}\%$.

479. Let cost be Re. 1 per gram and let the discount be d (as a fraction). For one nominal kilogram, selling price $= 1000 \times 1.40 \times (1 - d)$ and the goods delivered (875 g) cost Rs. 875. Required profit: $\frac{1400(1 - d) - 875}{875} = 0.40$, so $1400(1 - d) = 875 \times 1.40 = 1225$, giving $1 - d = \frac{1225}{1400} = 0.875$ and $d = 0.125 = 12\frac{1}{2}\%$.

480. Trader A: on a nominal kilogram he receives the price of 1000 g but spends on 900 g, so his gain $= \frac{100}{900} \times 100 = \frac{100}{9} = 11\frac{1}{9}\%$. Trader B's gain is 12% by definition. Difference $= 12 - \frac{100}{9} = \frac{108 - 100}{9} = \frac{8}{9}$ percentage point, in B's favour.

481. Let the genuine rate be Re. 1 per gram. Buying: he pays Rs. 1000 and receives 1200 g, so cost per gram $= \frac{1000}{1200} = \frac{5}{6}$. Selling: for a nominal kilogram he collects Rs. 1000 but delivers $(1000 - 10x)$ g, so receipt per gram $= \frac{1000}{1000 - 10x}$. Profit condition: $\frac{1000/(1000 - 10x)}{5/6} = 2$, i.e. $\frac{1200}{1000 - 10x} = 2$, so $1000 - 10x = 600$ and $x = 40$.

482. Amount paid $= 200 \times 35 =$ Rs. 7,000, while the stock actually obtained is 250 kg $= 2,50,000$ g. Since each "kilogram" sold weighs only 800 g, the number of units sold $= \frac{2,50,000}{800} = 312.5$. Revenue $= 312.5 \times 42 =$ Rs. 13,125. Profit $= 13,125 - 7,000 =$ Rs. 6,125 (i.e. 87.5%).

483. Let the cost be Re. 1 per gram, so a genuine kilogram costs Rs. 1000, and let the marked price of a nominal kilogram be Rs. m . Selling price $= 0.9m$, while the goods delivered (900 g) cost Rs. 900. Given profit 10%: $0.9m = 900 \times 1.10 = 990$, so $m = 1100$. Hence the marked price exceeds the cost price of a true kilogram (Rs. 1000) by $\frac{100}{1000} \times 100 = 10\%$.

Subtopic 1.5.4

484. Simple interest is given by $SI = \frac{P \times R \times T}{100}$. Here $P = 12500$, $R = 8$ and $T = 3$. So $SI = \frac{12500 \times 8 \times 3}{100} = \frac{300000}{100} = 3000$. Hence the interest earned is Rs. 3,000.

485. From $SI = \frac{PRT}{100}$ we get $T = \frac{100 \times SI}{P \times R}$. Substituting, $T = \frac{100 \times 4320}{18000 \times 6} = \frac{432000}{108000} = 4$. So the money was lent for 4 years.

486. Rate $R = \frac{100 \times SI}{P \times T} = \frac{100 \times 3360}{9600 \times 5} = \frac{336000}{48000} = 7$. Hence the rate is 7% per annum.

487. Here $T = 2.5$ years. $SI = \frac{7200 \times 9 \times 2.5}{100} = \frac{162000}{100} = 1620$. Amount $= P + SI = 7200 + 1620 = 8820$. So the amount is Rs. 8,820.

488. $P = \frac{100 \times SI}{R \times T} = \frac{100 \times 2100}{7 \times 4} = \frac{210000}{28} = 7500$. Hence the sum is Rs. 7,500.

489. $T = \frac{100 \times 900}{15000 \times 12} = \frac{90000}{180000} = \frac{1}{2}$ year. Converting, $\frac{1}{2} \times 12 = 6$ months. Hence the loan ran for 6 months.

490. Time in years $= \frac{146}{365} = \frac{2}{5} = 0.4$ year. Then $SI = \frac{10000 \times 5 \times 0.4}{100} = \frac{20000}{100} = 200$. Hence Rs. 200 is payable.

491. If the sum P doubles in 12 years, the interest earned in 12 years equals P itself. So the interest earned per year is $\frac{P}{12}$. To become four times, the sum must earn an interest of $4P - P = 3P$. Time required $= \frac{3P}{P/12} = 3 \times 12 = 36$ years.

492. The extra amount earned between year 3 and year 6 is pure interest for 3 years: $17760 - 14880 = 2880$. So interest for 1 year $= \frac{2880}{3} = 960$, and interest for 3 years $= 2880$. Principal $= 14880 - 2880 = 12000$. Hence the sum is Rs. 12,000. (As a check, the rate is $\frac{960 \times 100}{12000} = 8\%$.)

493. Let Rs. x be invested at 10%; then Rs. $(25000 - x)$ is at 7%. For one year, $\frac{10x}{100} + \frac{7(25000 - x)}{100} = 2050$. Multiplying by 100: $10x + 175000 - 7x = 205000$, so $3x = 30000$ and $x = 10000$. Hence Rs. 10,000 was invested at 10%.

494. The extra interest comes only from the extra 2% acting for 5 years: $\frac{P \times 2 \times 5}{100} = 1800$, i.e. $\frac{10P}{100} = 1800$, so $0.1P = 1800$ and $P = 18000$. Since Rs. 18,000 is not listed among the first four options, the answer is None of these.

495. Interest per year from Bhaskar $= \frac{20000 \times 8}{100} = 1600$. Interest per year from Chitra $= \frac{15000 \times 10}{100} = 1500$. Combined interest per year $= 1600 + 1500 = 3100$. Therefore $T = \frac{9300}{3100} = 3$ years.

496. First 2 years: $\frac{30000 \times 6 \times 2}{100} = 3600$. Next 3 years: $\frac{30000 \times 8 \times 3}{100} = 7200$. Interest at the end of 5 years $= 3600 + 7200 = 10800$. Remaining interest $= 13800 - 10800 = 3000$. At 10% the annual interest is $\frac{30000 \times 10}{100} = 3000$, so this takes exactly 1 more year. Total time $= 5 + 1 = 6$ years.

497. Interest for 4 years at 8% is $\frac{P \times 32}{100}$ and for 3 years at 6% is $\frac{P \times 18}{100}$. Their difference is $\frac{P(32 - 18)}{100} = \frac{14P}{100}$. So $\frac{14P}{100} = 1400$, giving $P = \frac{1400 \times 100}{14} = 10000$. Hence the sum is Rs. 10,000.

498. Express each slab as a percentage of the principal. First slab: $3 \times 6 = 18\%$. Second slab: $4 \times 8 = 32\%$. The remaining period is $10 - 3 - 4 = 3$ years at 10%, i.e. $3 \times 10 = 30\%$. Total $= 18 + 32 + 30 = 80\%$ of the principal. So $\frac{80P}{100} = 12000$, giving $P = \frac{12000 \times 100}{80} = 15000$. Hence the sum is Rs. 15,000.

499. Interest he must pay $= \frac{25000 \times 8 \times 5}{100} = 10000$. Since he gains Rs. 4,000, his total earning is $10000 + 4000 = 14000$. Let Rs. x be lent at 12% and Rs. $(25000 - x)$ at 10%, both for 5 years: $\frac{12x \times 5}{100} + \frac{10(25000 - x) \times 5}{100} = 14000$. That is $0.6x + 0.5(25000 - x) = 14000$, so $0.1x + 12500 = 14000$, giving $0.1x = 1500$ and $x = 15000$. Hence Rs. 15,000 was lent at 12%.

500. Let each instalment be Rs. x , paid at the end of years 1, 2 and 3. The first instalment then earns simple interest for 2 years, the second for 1 year and the third for none. Their total value at the end of 3 years must equal Rs. 1,092: $\left(x + \frac{x \times 12 \times 2}{100}\right) + \left(x + \frac{x \times 12 \times 1}{100}\right) + x = 1092$. This gives $1.24x + 1.12x + x = 1092$, i.e. $3.36x = 1092$, so $x = \frac{1092}{3.36} = 325$. Hence each instalment is Rs. 325.

501. The difference in the two amounts is due only to the extra 3% for 4 years: $\frac{P \times 3 \times 4}{100} = 26400 -$

$24000 = 2400$, so $\frac{12P}{100} = 2400$ and $P = 20000$. At the original rate the interest in 4 years is $24000 - 20000 = 4000$. Hence $R = \frac{100 \times 4000}{20000 \times 4} = \frac{400000}{80000} = 5$. The original rate is 5% per annum.

502. Let the sum be P . Then $\frac{P \times R \times 8}{100} = \frac{2P}{5}$. Cancelling P and solving: $\frac{8R}{100} = \frac{2}{5}$, so $8R = 40$ and $R = 5\%$. To double, the sum must earn an interest equal to P : $\frac{P \times 5 \times T}{100} = P$, giving $5T = 100$ and $T = 20$. Hence it doubles in 20 years.

503. Interest earned = $5000 - 4000 = 1000$. Let the rate be $R\%$ and the time also R years. Then $\frac{4000 \times R \times R}{100} = 1000$, i.e. $40R^2 = 1000$, so $R^2 = 25$ and $R = 5$ (the negative root is rejected). Hence the rate is 5% per annum, the money having been kept for 5 years.

504. Since only the interest is withdrawn, the principal stays P throughout. Interest in the first phase = $\frac{P \times 10 \times 3}{100} = \frac{30P}{100}$. Interest in the second phase = $\frac{P \times 12 \times 2}{100} = \frac{24P}{100}$. Total = $\frac{54P}{100} = 8100$, so $P = \frac{8100 \times 100}{54} = 15000$. Hence the sum invested was Rs. 15,000.

Subtopic 1.5.5

505. Amount = $P \left(1 + \frac{R}{100}\right)^n = 5000 \left(1 + \frac{10}{100}\right)^2$. So amount = $5000 \times \frac{11}{10} \times \frac{11}{10} = 5000 \times \frac{121}{100} =$ Rs. 6,050. (Check: interest of year 1 is Rs. 500, giving Rs. 5,500; interest of year 2 is 10% of Rs. 5,500 = Rs. 550, giving Rs. 6,050.)

506. For half-yearly compounding the rate is halved and the number of periods is doubled: rate = 5% per half-year, number of periods = 2. Amount = $8000 \left(1 + \frac{5}{100}\right)^2 = 8000 \times \frac{21}{20} \times \frac{21}{20} = 8000 \times \frac{441}{400} =$ Rs. 8,820. Compound interest = $8820 - 8000 =$ Rs. 820. (Simple interest would have been Rs. 800, so the extra Rs. 20 is interest on the first half-year's interest.)

507. Simple interest = $\frac{12000 \times 10 \times 2}{100} =$ Rs. 2,400. Compound amount = $12000 \times \frac{121}{100} =$ Rs. 14,520, so compound interest = Rs. 2,520. Difference = $2520 - 2400 =$ Rs. 120. (Shortcut: for 2 years the difference is $P \left(\frac{R}{100}\right)^2 = 12000 \times \frac{1}{100} =$ Rs. 120.)

508. For quarterly compounding the annual rate is divided by 4 and each quarter counts as one period: rate = $\frac{20}{4} = 5\%$ per quarter, and 6 months = 2 quarters. Amount = $10000 \left(1 + \frac{5}{100}\right)^2 = 10000 \times \frac{21}{20} \times \frac{21}{20} =$ Rs. 11,025. Interest = $11025 - 10000 =$ Rs. 1,025. (Simple interest for 6 months would be Rs. 1,000.)

509. Let the sum be P . Then $P \left(1 + \frac{5}{100}\right)^3 = 9261$, i.e. $P \times \frac{21}{20} \times \frac{21}{20} \times \frac{21}{20} = 9261$. Hence $P = 9261 \times \frac{8000}{9261} =$ Rs. 8,000, since $21^3 = 9261$ and $20^3 = 8000$.

510. Amount = $15000 \left(\frac{11}{10}\right)^3 = 15000 \times \frac{1331}{1000} =$ Rs. 19,965. Compound interest = $19965 - 15000 =$ Rs. 4,965. (Rs. 19,965 is the amount, not the interest; Rs. 4,500 is the simple interest.)

511. We need $4000 \left(1 + \frac{R}{100}\right)^2 = 4410$, so $\left(1 + \frac{R}{100}\right)^2 = \frac{4410}{4000} = \frac{441}{400}$. Taking the square root, $1 + \frac{R}{100} = \frac{21}{20}$, so $\frac{R}{100} = \frac{1}{20}$ and $R = 5\%$.

512. Let the sum be P . Simple interest for 3 years $= \frac{P \times 10 \times 3}{100} = 0.3P$. Compound amount $= P \left(\frac{11}{10}\right)^3 = 1.331P$, so compound interest $= 0.331P$. Difference $= 0.331P - 0.3P = 0.031P$. Thus $0.031P = 620$, giving $P = \frac{620}{0.031} = \text{Rs. } 20,000$.

513. Compounded annually for 1 year, the interest is simply 20% of Rs. 20,000 = Rs. 4,000. Compounded half-yearly: rate = 10% per half-year for 2 periods, so amount $= 20000 \left(\frac{11}{10}\right)^2 = \text{Rs. } 24,200$ and interest = Rs. 4,200. Extra interest $= 4200 - 4000 = \text{Rs. } 200$.

514. Simple interest for 2 years is Rs. 1,000, so the interest of one year is Rs. 500. The excess of compound interest over simple interest for 2 years, namely $1050 - 1000 = \text{Rs. } 50$, is exactly one year's interest on the first year's interest of Rs. 500. Hence $\frac{500 \times R}{100} = 50$, giving $R = 10\%$. Now $\frac{P \times 10 \times 2}{100} = 1000$, so $P = \text{Rs. } 5,000$.

515. The interest of the third year is $7986 - 7260 = \text{Rs. } 726$, earned on Rs. 7,260. So $R = \frac{726}{7260} \times 100 = 10\%$. Then $P \left(\frac{11}{10}\right)^2 = 7260$, i.e. $P \times \frac{121}{100} = 7260$, giving $P = 7260 \times \frac{100}{121} = \text{Rs. } 6,000$. Since Rs. 6,000 does not appear among options (A) to (D), the correct choice is "None of these".

516. Each instalment must be discounted back to the present. Present value of the first instalment $= \frac{3600}{1.2} = \text{Rs. } 3,000$. Present value of the second instalment $= \frac{3600}{(1.2)^2} = \frac{3600}{1.44} = \text{Rs. } 2,500$. Sum borrowed $= 3000 + 2500 = \text{Rs. } 5,500$. (Verification: $5500 \times 1.2 = 6600$; after paying Rs. 3,600 the balance is Rs. 3,000, which grows to $3000 \times 1.2 = \text{Rs. } 3,600$ and is cleared by the second instalment.)

517. Amount after the first year $= 25000 \times \frac{110}{100} = \text{Rs. } 27,500$. Amount after the second year $= 27500 \times \frac{112}{100} = \text{Rs. } 30,800$. Total interest $= 30800 - 25000 = \text{Rs. } 5,800$. (Adding the rates to get 22% of Rs. 25,000 = Rs. 5,500 ignores the interest on the first year's interest and is wrong.)

518. Let the sum be P and the annual growth factor be $k = 1 + \frac{R}{100}$. Given $Pk^9 = 8P$, so $k^9 = 8 = 2^3$, hence $k^3 = 2$: the sum doubles every 3 years. To become 4 times, we need $k^n = 4 = 2^2 = (k^3)^2 = k^6$, so $n = 6$ years.

519. Each deposit must be grown separately up to the end of year 3. The first deposit is invested for 3 full years: $2000 \left(\frac{11}{10}\right)^3 = 2000 \times 1.331 = \text{Rs. } 2,662$. The second deposit is invested for 2 years: $2000 \left(\frac{11}{10}\right)^2 = 2000 \times 1.21 = \text{Rs. } 2,420$. The third deposit is invested for 1 year: $2000 \times 1.1 = \text{Rs. } 2,200$. Total $= 2662 + 2420 + 2200 = \text{Rs. } 7,282$. (Rs. 6,620 would be the total if the deposits were made at the end of each year, and Rs. 7,986 wrongly grows all three deposits for 3 years.)

520. Let Rs. x go into the first scheme. For one year at 10% compounded annually the interest is $0.10x$. The second scheme gives 10% per half-year for 2 periods, so its effective annual rate is $\left(\frac{11}{10}\right)^2 - 1 = 0.21$, i.e. 21%, and the interest on Rs. $(16000 - x)$ is $0.21(16000 - x)$. Total: $0.10x + 0.21(16000 - x) = 2700$, i.e. $3360 - 0.11x = 2700$, so $0.11x = 660$ and $x = \text{Rs. } 6,000$. (Check: $600 + 0.21 \times 10000 = 600 + 2100 = \text{Rs. } 2,700$.)

521. At the end of year 1 the deposit becomes $12000 \times 1.1 = \text{Rs. } 13,200$. After withdrawing Rs. 4,000, the balance is Rs. 9,200. This grows for two more years: $9200 \times \left(\frac{11}{10}\right)^2 = 9200 \times \frac{121}{100} = \text{Rs. } 11,132$. Total received $= 4000 + 11132 = \text{Rs. } 15,132$.

522. Compounded half-yearly: rate = 10% per half-year and there are 3 half-years, so amount = $10000 \left(\frac{11}{10}\right)^3 = \text{Rs. } 13,310$. Compounded annually: interest is compounded for the full year and charged simply for the remaining half year, so amount = $10000 \times \frac{120}{100} \times \left(1 + \frac{10}{100}\right) = 12000 \times 1.1 = \text{Rs. } 13,200$. The principal is the same in both cases, so the difference in interest equals the difference in amounts = $13310 - 13200 = \text{Rs. } 110$.

523. Let the sum be P and the annual growth factor be k . Then $Pk^3 = 6690$ and $Pk^6 = 10035$. Dividing, $k^3 = \frac{10035}{6690} = \frac{3}{2}$. Substituting back, $P \times \frac{3}{2} = 6690$, so $P = 6690 \times \frac{2}{3} = \text{Rs. } 4,460$.

524. From the simple interest, $\frac{P \times 10 \times 2}{100} = 3200$, so $0.2P = 3200$ and $P = \text{Rs. } 16,000$. Quarterly compounding at 20% per annum means 5% per quarter, and 9 months = 3 quarters. Amount = $16000 \left(\frac{21}{20}\right)^3 = 16000 \times \frac{9261}{8000} = \text{Rs. } 18,522$. Compound interest = $18522 - 16000 = \text{Rs. } 2,522$. (Rs. 2,400 is the simple interest for 9 months at 20%.)

525. End of year 1: the debt is $5000 \times 1.1 = \text{Rs. } 5,500$; after repaying Rs. 2,000 the balance is Rs. 3,500. End of year 2: the debt is $3500 \times 1.1 = \text{Rs. } 3,850$; after repaying Rs. 3,000 the balance is Rs. 850. End of year 3: the debt is $850 \times 1.1 = \text{Rs. } 935$, which is the amount he must pay to clear the loan.

Subtopic 1.5.6

526. For 2 years the difference between CI and SI is $D = P \left(\frac{r}{100}\right)^2$. Here $P = 8000$ and $r = 10$, so $D = 8000 \times \left(\frac{10}{100}\right)^2 = 8000 \times \frac{1}{100} = 80$. Check directly: $SI = \frac{8000 \times 10 \times 2}{100} = 1600$ and $CI = 8000 [(1.1)^2 - 1] = 8000 \times 0.21 = 1680$, so the difference is $1680 - 1600 = 80$. Rs. 80 is not listed among options A to D, so the correct choice is None of these.

527. For 2 years, difference = $P \left(\frac{r}{100}\right)^2$. So $128 = P \times \left(\frac{8}{100}\right)^2 = P \times 0.0064$. Hence $P = \frac{128}{0.0064} = 20000$. Verify: $SI = \frac{20000 \times 8 \times 2}{100} = 3200$, $CI = 20000 [(1.08)^2 - 1] = 20000 \times 0.1664 = 3328$, difference = 128. The sum is Rs. 20,000.

528. $SI = \frac{10000 \times 10 \times 3}{100} = 3000$. Amount under CI = $10000 \times (1.1)^3 = 10000 \times 1.331 = 13310$, so $CI = 13310 - 10000 = 3310$. Difference = $3310 - 3000 = 310$. (The standard formula also gives $D = P \frac{r^2(300 + r)}{10^6} = 10000 \times \frac{100 \times 310}{10^6} = 310$.)

529. For 2 years, $D = P \left(\frac{r}{100}\right)^2$, so $10 = 6250 \times \left(\frac{r}{100}\right)^2$. Then $\left(\frac{r}{100}\right)^2 = \frac{10}{6250} = \frac{1}{625}$, giving $\frac{r}{100} = \frac{1}{25}$ and $r = 4$. Check: $SI = \frac{6250 \times 4 \times 2}{100} = 500$, $CI = 6250 [(1.04)^2 - 1] = 6250 \times 0.0816 = 510$, difference = 10. The rate is 4%.

530. The sum borrowed equals the present value of the two instalments. Present value = $\frac{1210}{1.1} + \frac{1210}{(1.1)^2} = 1100 + 1000 = 2100$. So Anita borrowed Rs. 2,100. (Note Rs. 2,420 is simply the total money paid, not the sum borrowed.)

531. Let each instalment be x . Then $\frac{x}{1.2} + \frac{x}{(1.2)^2} = 1100$, i.e. $\frac{x}{1.2} + \frac{x}{1.44} = 1100$. Multiplying through by 1.44: $1.2x + x = 1584$, so $2.2x = 1584$ and $x = 720$. Check: $\frac{720}{1.2} = 600$ and $\frac{720}{1.44} = 500$; $600 + 500 = 1100$. Each instalment is Rs. 720.

532. From $SI = \frac{P \times 6 \times 2}{100} = 600$ we get $0.12P = 600$, so $P = 5000$. Difference between CI and SI for 2 years $= P \left(\frac{r}{100} \right)^2 = 5000 \times (0.06)^2 = 5000 \times 0.0036 = 18$. Hence $CI = 600 + 18 = 618$. Direct check: $5000 [(1.06)^2 - 1] = 5000 \times 0.1236 = 618$.

533. For 3 years, $D = P \left[\left(1 + \frac{r}{100} \right)^3 - 1 - \frac{3r}{100} \right]$. With $r = 5$: $(1.05)^3 = 1.157625$, so the bracket $= 1.157625 - 1 - 0.15 = 0.007625$. Thus $122 = 0.007625P$, giving $P = \frac{122}{0.007625} = 16000$. Verify: $SI = \frac{16000 \times 5 \times 3}{100} = 2400$ and $CI = 16000 \times 0.157625 = 2522$; difference $= 122$. The sum is Rs. 16,000.

534. With half-yearly compounding the rate per half year is 5% and there are 2 periods. Amount $= 20000 \times (1.05)^2 = 20000 \times 1.1025 = 22050$, so interest $= 2050$. Simple interest $= \frac{20000 \times 10 \times 1}{100} = 2000$. Excess $= 2050 - 2000 = 50$. So the difference is Rs. 50.

535. The cash price is the down payment plus the present value of the two instalments. Present value $= \frac{4840}{1.1} + \frac{4840}{(1.1)^2} = 4400 + 4000 = 8400$. Hence cash price $= 8000 + 8400 = 16400$. Check: a balance of 8400 grows to $8400 \times 1.1 = 9240$; paying 4840 leaves 4400, which grows to $4400 \times 1.1 = 4840$ and is cleared by the second instalment. (Rs. 17,680 is merely the total money paid, $8000 + 2 \times 4840$.) The cash price is Rs. 16,400.

536. Let each instalment be x , paid at the end of years 1, 2 and 3. The first instalment earns simple interest for 2 years, the second for 1 year, the third for none. Their total value at the end of year 3 is $x \left(1 + \frac{24}{100} \right) + x \left(1 + \frac{12}{100} \right) + x = 1.24x + 1.12x + x = 3.36x$. Setting $3.36x = 1092$ gives $x = \frac{1092}{3.36} = 325$. Each instalment is Rs. 325.

537. Step 1: $45 = P \left(\frac{15}{100} \right)^2 = P \times 0.0225$, so $P = \frac{45}{0.0225} = 2000$. Step 2: $(1.15)^2 = 1.3225$, so $CI = 2000 \times (1.3225 - 1) = 2000 \times 0.3225 = 645$. (Cross-check: $SI = \frac{2000 \times 15 \times 2}{100} = 600$ and $645 - 600 = 45$.) The compound interest is Rs. 645.

538. Step 1: find the rate. $\left(1 + \frac{r}{100} \right)^3 = \frac{9261}{8000} = 1.157625$. Since $\sqrt[3]{1.157625} = 1.05$, we get $r = 5\%$ (note $9261 = 21^3$ and $8000 = 20^3$, so the ratio is $\left(\frac{21}{20} \right)^3$). Step 2: $CI = 9261 - 8000 = 1261$ and $SI = \frac{8000 \times 5 \times 3}{100} = 1200$. Difference $= 1261 - 1200 = 61$.

539. Let each instalment be x . Then $\frac{x}{1.25} + \frac{x}{(1.25)^2} = 3600$, i.e. $\frac{x}{1.25} + \frac{x}{1.5625} = 3600$. Multiplying by 1.5625: $1.25x + x = 5625$, so $2.25x = 5625$ and $x = 2500$. Total amount repaid $= 2 \times 2500 = 5000$. Total interest $= 5000 - 3600 = 1400$. So she pays Rs. 1,400 as interest.

540. Write $k = \frac{r}{100}$. For 2 years the difference is $D_2 = Pk^2$; for 3 years it is $D_3 = Pk^2(3 + k)$. Dividing, $\frac{D_3}{D_2} = 3 + k = \frac{620}{200} = 3.1$, so $k = 0.1$ and $r = 10\%$. Then $Pk^2 = 200$ gives $P \times 0.01 = 200$, so $P = 20000$. Check for 3 years: $SI = 6000$, $CI = 20000 \times 0.331 = 6620$, difference $= 620$. The sum is Rs. 20,000.

541. Step 1: for 3 years at 10%, the difference factor is $(1.1)^3 - 1 - 0.30 = 1.331 - 1.30 = 0.031$. So $0.031P = 1240$, giving $P = \frac{1240}{0.031} = 40000$. Step 2: $SI = \frac{40000 \times 8 \times 5}{100} = \frac{1600000}{100} = 16000$. The simple interest is Rs. 16,000.

542. Test the tenures. For 2 years the difference is $P \left(\frac{r}{100} \right)^2 = 10000 \times (0.2)^2 = 400$, which is too small. For 3 years, $CI = 10000 [(1.2)^3 - 1] = 10000 \times 0.728 = 7280$ and $SI = \frac{10000 \times 20 \times 3}{100} = 6000$, so the difference is $7280 - 6000 = 1280$, which matches. (For 4 years it would already be $10000 \times 1.0736 - 8000 = 2736$, so the answer is unique.) The sum was lent for 3 years.

543. Let each instalment be x . Then $\frac{x}{1.2} + \frac{x}{(1.2)^2} + \frac{x}{(1.2)^3} = 36400$, i.e. $\frac{x}{1.2} + \frac{x}{1.44} + \frac{x}{1.728} = 36400$. Multiplying throughout by 1.728: $1.44x + 1.2x + x = 36400 \times 1.728$, so $3.64x = 62899.2$ and $x = 17280$. Check: $\frac{17280}{1.2} = 14400$, $\frac{17280}{1.44} = 12000$, $\frac{17280}{1.728} = 10000$; these add to 36400. Each instalment is Rs. 17,280.

544. Step 1: recover the sum. $(1.12)^2 = 1.2544$, so $CI = P(1.2544 - 1) = 0.2544P$. From $0.2544P = 3180$ we get $P = \frac{3180}{0.2544} = 12500$. Step 2: $SI = \frac{12500 \times 9 \times 4}{100} = \frac{450000}{100} = 4500$. (Cross-check on step 1: $12500 \times 1.2544 = 15680$, and $15680 - 12500 = 3180$.) The simple interest is Rs. 4,500.

545. End of year 1: outstanding = $12000 \times 1.1 = 13200$; after paying Rs. 4,000 the balance is $13200 - 4000 = 9200$. End of year 2: $9200 \times 1.1 = 10120$; after paying Rs. 5,000 the balance is $10120 - 5000 = 5120$. End of year 3: $5120 \times 1.1 = 5632$. He owes Rs. 5,632. (Rs. 5,120 is the balance one year earlier, before the final year's interest.)

546. Step 1: the third year's growth factor is $\frac{8575}{7350} = \frac{7}{6}$, so $1 + \frac{r}{100} = \frac{7}{6}$ and $\frac{r}{100} = \frac{1}{6}$ (that is, $r = 16\frac{2}{3}\%$). Step 2: the sum is $P = 7350 \div \left(\frac{7}{6} \right)^2 = 7350 \times \frac{36}{49} = 5400$. Step 3: for 2 years the difference is $P \left(\frac{r}{100} \right)^2 = 5400 \times \frac{1}{36} = 150$. (Check: $CI = 7350 - 5400 = 1950$, $SI = 2 \times 5400 \times \frac{1}{6} = 1800$, difference = 150.)

Subtopic 1.5.7

547. The ratio 3 : 1 means the mixture is divided into $3 + 1 = 4$ equal parts, of which water forms 1 part. Value of one part = $\frac{40}{4} = 10$ litres. Therefore water = $1 \times 10 = 10$ litres (and milk = $3 \times 10 = 30$ litres, which indeed totals 40 litres). Hence option C.

548. Apply the rule of alligation with mean price Rs. 220. Difference on the dearer side = $280 - 220 = 60$. Difference on the cheaper side = $220 - 180 = 40$. By alligation, quantity of cheaper : quantity of dearer = $60 : 40 = 3 : 2$. Check: taking 3 kg and 2 kg, cost = $3 \times 180 + 2 \times 280 = 540 + 560 = 1100$ for 5 kg, i.e. $\frac{1100}{5} = 220$ per kg. Hence option B.

549. Originally, milk = $60 \times \frac{2}{3} = 40$ litres and water = $60 \times \frac{1}{3} = 20$ litres. Adding water does not change the milk, so milk stays 40 litres while water becomes $20 + 15 = 35$ litres. New ratio = $40 : 35 = 8 : 7$. Hence option A.

550. Total cost = $8 \times 45 + 12 \times 65 = 360 + 780 = \text{Rs. } 1,140$. Total quantity = $8 + 12 = 20$ kg. Cost per kg of the mixture = $\frac{1140}{20} = \text{Rs. } 57$. Hence option C.

551. Total money spent = $45 \times 50 = \text{Rs. } 2,250$, since the water costs nothing. Total volume of the mixture = $45 + 5 = 50$ litres. Cost price per litre = $\frac{2250}{50} = \text{Rs. } 45$. Since Rs. 45 does not appear among options A to D, the answer is option E.

552. Let the second variety cost Rs. x per kg. The total quantity is $8 + 12 = 20$ kg, so the total value of the mixture = $20 \times 46 = \text{Rs. } 920$. Equating the two ways of counting the cost, $8 \times 40 + 12x = 920$, i.e. $320 + 12x = 920$, so $12x = 600$ and $x = 50$. Check: $8 \times 40 + 12 \times 50 = 320 + 600 = \text{Rs. } 920$ for 20 kg, i.e. $\frac{920}{20} = \text{Rs. } 46$ per kg. Hence option B.

553. Treat the rates as prices and apply alligation with mean value 7.5%. Difference from the higher rate = $10 - 7.5 = 2.5$. Difference from the lower rate = $7.5 - 6 = 1.5$. The amount at the lower rate : the amount at the higher rate = $2.5 : 1.5 = 5 : 3$. Check with Rs. 500 and Rs. 300: interest = $30 + 30 =$ Rs. 60 on Rs. 800, which is 7.5%. Hence option B.

554. Initially milk = $40 \times \frac{7}{10} = 28$ litres and water = $40 \times \frac{3}{10} = 12$ litres. Adding water leaves the milk unchanged at 28 litres. In the required ratio 7 : 5, the 7 parts correspond to 28 litres, so one part = 4 litres and the water must become $5 \times 4 = 20$ litres. Water to be added = $20 - 12 = 8$ litres. As 8 litres is not listed in options A to D, the answer is option E.

555. Each operation leaves a fraction $\frac{50-5}{50} = \frac{45}{50} = \frac{9}{10}$ of the milk present just before it. After two such operations, milk left = $50 \times \left(\frac{9}{10}\right)^2 = 50 \times \frac{81}{100} = 40.5$ litres. (Verification: after the first replacement milk = 45 litres in 50 litres; drawing 5 litres removes 4.5 litres of milk, leaving 40.5 litres.) Hence option B.

556. Take 2 litres from A and 3 litres from B, giving 5 litres in all. From A the milk is $2 \times \frac{4}{5} = \frac{8}{5}$ litres. From B the milk is $3 \times \frac{2}{5} = \frac{6}{5}$ litres. Total milk = $\frac{8}{5} + \frac{6}{5} = \frac{14}{5}$ litres out of 5 litres, so water = $5 - \frac{14}{5} = \frac{11}{5}$ litres. Ratio of milk to water = $\frac{14}{5} : \frac{11}{5} = 14 : 11$. Hence option C.

557. Total cost price = $26 \times 20 + 30 \times 36 = 520 + 1080 =$ Rs. 1,600. Total quantity = $26 + 30 = 56$ kg. Total selling price = $56 \times 30 =$ Rs. 1,680. Profit = $1680 - 1600 =$ Rs. 80. Profit percent = $\frac{80}{1600} \times 100 = 5\%$. Hence option B.

558. Water is free, so its price is Rs. 0 per litre; milk is the dearer item at Rs. 48 and the mean price is Rs. 40. By alligation, quantity of water : quantity of milk = $(48 - 40) : (40 - 0) = 8 : 40 = 1 : 5$. Check: 1 litre of water with 5 litres of milk gives 6 litres costing $5 \times 48 =$ Rs. 240, i.e. $\frac{240}{6} =$ Rs. 40 per litre. Hence option B.

559. Suppose he uses m litres of milk costing Rs. c per litre, so his cost is Rs. mc . He adds w litres of free water and sells all $(m + w)$ litres at the cost rate Rs. c , receiving $c(m + w)$. Profit = cw , so profit percent = $\frac{cw}{cm} \times 100 = \frac{w}{m} \times 100$. Setting $\frac{w}{m} \times 100 = 25$ gives $\frac{w}{m} = \frac{1}{4}$, i.e. water : milk = 1 : 4. Hence option C.

560. Initially spirit = $60 \times \frac{7}{12} = 35$ litres. Since the mixture removed is replaced by an equal volume of water, the total stays 60 litres. In the final ratio 7 : 9, spirit forms $\frac{7}{16}$ of the whole, i.e. $60 \times \frac{7}{16} = 26.25$ litres. If x litres of mixture is drawn off, the spirit remaining is $35 \left(1 - \frac{x}{60}\right)$. So $35 \left(1 - \frac{x}{60}\right) = 26.25$, giving $1 - \frac{x}{60} = 0.75$, hence $\frac{x}{60} = 0.25$ and $x = 15$ litres. Hence option A.

561. Let the original milk be $5k$ litres and water be k litres. Pouring in water leaves the milk unchanged, so after the addition milk = $5k$ and water = $k + 20$. The new ratio gives $\frac{5k}{k+20} = \frac{5}{3}$, so $15k = 5k + 100$, hence $10k = 100$ and $k = 10$. Original milk = 50 litres, original water = 10 litres, so the original mixture = $50 + 10 = 60$ litres. (Check: after adding 20 litres of water, milk : water = $50 : 30 = 5 : 3$.) Hence option C.

562. Let x litres be drawn out each time. After two replacements the milk remaining is $80 \left(1 - \frac{x}{80}\right)^2$. Setting this equal to 45: $\left(1 - \frac{x}{80}\right)^2 = \frac{45}{80} = \frac{9}{16}$, so $1 - \frac{x}{80} = \frac{3}{4}$, giving $\frac{x}{80} = \frac{1}{4}$ and $x = 20$ litres. (Check: after the first step milk = 60 litres in 80; drawing 20 litres removes 15 litres of milk, leaving 45 litres.) Hence option D.

563. Work with the fraction of milk in each vessel. In P the milk fraction is $\frac{5}{8}$, in Q it is $\frac{3}{8}$, and the required mixture must have milk fraction $\frac{9}{16}$. Apply alligation on these fractions: difference on the P side = $\frac{5}{8} - \frac{9}{16} = \frac{10-9}{16} = \frac{1}{16}$; difference on the Q side = $\frac{9}{16} - \frac{3}{8} = \frac{9-6}{16} = \frac{3}{16}$. The ratio P : Q equals the Q-difference : the P-difference = $\frac{3}{16} : \frac{1}{16} = 3 : 1$. Check with 3 litres from P and 1 litre from Q: milk = $3 \times \frac{5}{8} + 1 \times \frac{3}{8} = \frac{18}{8} = 2.25$ litres out of 4, so water = 1.75, and $2.25 : 1.75 = 9 : 7$. Hence option A.

564. Total cost = $40 \times 32 + 60 \times 27 = 1280 + 1620 = \text{Rs. } 2,900$ for $40 + 60 = 100$ kg. Cost price of the mixture = $\frac{2900}{100} = \text{Rs. } 29$ per kg. For a 20% profit, selling price = $29 \times \frac{120}{100} = 29 \times 1.2 = \text{Rs. } 34.80$ per kg. Hence option B.

565. Interest for 2 years is Rs. 2,240, so the interest for one year is $\frac{2240}{2} = \text{Rs. } 1,120$. This is $\frac{1120}{12000} \times 100 = \frac{28}{3}\%$ of the whole sum, which is the mean rate. Apply alligation between 8% and 12% with mean $\frac{28}{3}\%$: difference on the 12% side = $12 - \frac{28}{3} = \frac{8}{3}$; difference on the 8% side = $\frac{28}{3} - 8 = \frac{4}{3}$. So the part at 8% : the part at 12% = $\frac{8}{3} : \frac{4}{3} = 2 : 1$. Hence the part at 12% = $12000 \times \frac{1}{3} = \text{Rs. } 4,000$. (Check: Rs. 8,000 at 8% gives Rs. 640 a year and Rs. 4,000 at 12% gives Rs. 480 a year; total for 2 years = $2(640 + 480) = \text{Rs. } 2,240$.) Hence option C.

566. From X: milk = $20 \times \frac{3}{5} = 12$ litres, water = 8 litres. From Y: milk = $30 \times \frac{7}{10} = 21$ litres, water = 9 litres. Combining, milk = $12 + 21 = 33$ litres and water = $8 + 9 = 17$ litres. Adding 10 litres of water makes the water $17 + 10 = 27$ litres, while the milk stays 33 litres. Ratio = $33 : 27 = 11 : 9$ (dividing both by 3). Hence option B.

567. Let the quantities be a kg of the first variety and b kg each of the second and third, so the total is $(a + 2b)$ kg. Total cost = $60a + 75b + 100b = 60a + 175b$. The mixture must cost Rs. 80 per kg, so $60a + 175b = 80(a + 2b) = 80a + 160b$. Rearranging, $175b - 160b = 80a - 60a$, i.e. $15b = 20a$, giving $\frac{a}{b} = \frac{15}{20} = \frac{3}{4}$. Taking $a = 3$ and $b = 4$, the ratio is $3 : 4 : 4$. Check: cost = $3 \times 60 + 4 \times 75 + 4 \times 100 = 180 + 300 + 400 = \text{Rs. } 880$ for 11 kg, i.e. $\frac{880}{11} = \text{Rs. } 80$ per kg. Hence option D.

Subtopic 1.6.1

568. Take the total work as the LCM of 12 and 18, i.e. 36 units.
Ramesh's efficiency = $\frac{36}{12} = 3$ units/day; Sunita's efficiency = $\frac{36}{18} = 2$ units/day.
Combined efficiency = $3 + 2 = 5$ units/day.
Time = $\frac{36}{5} = 7\frac{1}{5}$ days.

569. Let Bhaskar's efficiency be 1 unit/day; then Anil's efficiency is 2 units/day.
Together they do $1 + 2 = 3$ units/day and finish in 12 days, so the total work = $3 \times 12 = 36$ units.
Bhaskar alone works at 1 unit/day, so he needs $\frac{36}{1} = 36$ days.

570. Total work = $15 \times 20 = 300$ clerk-days.
With 25 clerks, the time required = $\frac{300}{25} = 12$ days.
(Equivalently, men and days are inversely proportional: $15 \times 20 = 25 \times d \Rightarrow d = 12$.)

571. Kavita's one-day work = $\frac{1}{10}$ of the report.

$$\text{Work done in 4 days} = 4 \times \frac{1}{10} = \frac{4}{10} = \frac{2}{5}.$$

$$\text{Fraction left} = 1 - \frac{2}{5} = \frac{3}{5}.$$

572. Take the total work as 24 units (LCM of 8 and 12).

$$\text{Combined efficiency} = \frac{24}{8} = 3 \text{ units/day; Deepak's efficiency} = \frac{24}{12} = 2 \text{ units/day.}$$

$$\text{Farhan's efficiency} = 3 - 2 = 1 \text{ unit/day.}$$

$$\text{Farhan alone needs } \frac{24}{1} = 24 \text{ days.}$$

573. His one-day work = $\frac{1}{4} \div 5 = \frac{1}{20}$ of the survey.

Therefore the whole survey takes 20 days.

(Quick check: $\frac{1}{4}$ of the work takes 5 days, so the full work takes $5 \times 4 = 20$ days.)

574. Let Nitin's efficiency be 100; then Meena's efficiency is 125, so efficiency ratio Meena : Nitin = $125 : 100 = 5 : 4$.

For the same work, time is inversely proportional to efficiency, so time ratio Meena : Nitin = $4 : 5$.

$$\text{Meena's time} = \frac{4}{5} \times 25 = 20 \text{ days.}$$

575. Total work = 60 units (LCM of 20 and 30). Ajay = $\frac{60}{20} = 3$ units/day, Bipin = $\frac{60}{30} = 2$ units/day.

In 5 days together they do $5 \times (3 + 2) = 25$ units.

Remaining = $60 - 25 = 35$ units, done by Bipin alone at 2 units/day, needing $\frac{35}{2} = 17\frac{1}{2}$ days.

$$\text{Total time} = 5 + 17\frac{1}{2} = 22\frac{1}{2} \text{ days.}$$

$$\begin{aligned} \text{576. Adding the three one-day works: } (P + Q) + (Q + R) + (P + R) &= \frac{1}{12} + \frac{1}{15} + \frac{1}{20}. \\ &= \frac{5 + 4 + 3}{60} = \frac{12}{60} = \frac{1}{5}. \end{aligned}$$

The left side equals $2(P + Q + R)$, so $P + Q + R = \frac{1}{10}$ of the task per day.

Hence all three together need 10 days.

577. Total work = 120 units (LCM of 24 and 30). Sohan = 5 units/day, Tarun = 4 units/day.

One pair of days (Sohan, then Tarun) gives $5 + 4 = 9$ units.

$120 \div 9 = 13$ pairs with remainder 3: in $13 \times 2 = 26$ days they complete $13 \times 9 = 117$ units.

Remaining = 3 units. Day 27 is Sohan's turn at 5 units/day, so he needs $\frac{3}{5}$ of a day.

$$\text{Total} = 26\frac{3}{5} \text{ days.}$$

578. One-day work of Umesh = $\frac{1}{6}$, of Vimal = $\frac{1}{8}$, of all three together = $\frac{1}{3}$.

$$\text{Wasim's one-day work} = \frac{1}{3} - \left(\frac{1}{6} + \frac{1}{8}\right) = \frac{8}{24} - \frac{7}{24} = \frac{1}{24}.$$

All three work for the same 3 days, so wages are shared in the ratio of their rates: $\frac{1}{6} : \frac{1}{8} : \frac{1}{24} = 4 : 3 : 1$.

$$\text{Wasim's share} = \frac{1}{4 + 3 + 1} \times 4800 = \frac{4800}{8} = \text{Rs. } 600.$$

579. Total work = $12 \times 18 = 216$ man-days.

Work done in the first 6 days = $12 \times 6 = 72$ man-days.

Remaining work = $216 - 72 = 144$ man-days.

The strength is now $12 + 4 = 16$ men, so the time required = $\frac{144}{16} = 9$ more days.

580. Efficiency ratio Xavier : Yogesh = $3 : 1$, so the ratio of times taken is $1 : 3$.

Let Xavier take x days and Yogesh $3x$ days. Then $3x - x = 40 \Rightarrow x = 20$.

So Xavier takes 20 days and Yogesh 60 days.

Total work = 60 units; Xavier = 3 units/day, Yogesh = 1 unit/day, together = 4 units/day.

Time together = $\frac{60}{4} = 15$ days.

581. Let one man's one-day work be m and one woman's be w .

$$(6m + 8w) \times 10 = 1 \Rightarrow 6m + 8w = \frac{1}{10} \dots (i)$$

$$(26m + 48w) \times 2 = 1 \Rightarrow 26m + 48w = \frac{1}{2} \dots (ii)$$

Multiplying (i) by 6: $36m + 48w = \frac{3}{5}$. Subtracting (ii): $10m = \frac{3}{5} - \frac{1}{2} = \frac{1}{10}$, so $m = \frac{1}{100}$.

From (i): $8w = \frac{1}{10} - \frac{6}{100} = \frac{4}{100}$, so $w = \frac{1}{200}$.

Rate of 15 men and 20 women = $\frac{15}{100} + \frac{20}{200} = \frac{3}{20} + \frac{1}{10} = \frac{5}{20} = \frac{1}{4}$ per day.

Hence they need 4 days.

582. In 20 days of joint work they finish $\frac{20}{30} = \frac{2}{3}$ of the migration.

Remaining work = $1 - \frac{2}{3} = \frac{1}{3}$, and Girish alone does this in 20 days.

So Girish does $\frac{1}{3}$ of the work in 20 days, hence the whole work in $20 \times 3 = 60$ days.

583. Let the total time be T days. Imran works on all T days, while Jyoti works for $(T - 5)$ days.

$$\frac{T}{15} + \frac{T-5}{20} = 1.$$

Multiplying throughout by 60: $4T + 3(T - 5) = 60$.

$$4T + 3T - 15 = 60 \Rightarrow 7T = 75 \Rightarrow T = \frac{75}{7} = 10\frac{5}{7} \text{ days.}$$

Since $10\frac{5}{7}$ is not among the first four options, the answer is "None of these".

584. Total work = 48 units (LCM of 8, 12 and 16). Rates: Kiran = 6, Lalit = 4, Manoj = 3 units/day.

One cycle of 3 days gives $6 + 4 + 3 = 13$ units.

$48 \div 13 = 3$ cycles with remainder 9: in $3 \times 3 = 9$ days, 39 units are done, leaving 9 units.

Day 10 is Kiran's: he does 6 units, leaving 3 units.

Day 11 is Lalit's at 4 units/day, so he needs $\frac{3}{4}$ of a day.

$$\text{Total} = 10 + \frac{3}{4} = 10\frac{3}{4} \text{ days.}$$

585. In 25 days, 60 men put in $60 \times 25 = 1500$ man-days, and this represents 40% of the work.

So the whole work = $\frac{1500}{0.4} = 3750$ man-days.

Remaining work = 60% of 3750 = 2250 man-days, to be done in $40 - 25 = 15$ days.

Men required = $\frac{2250}{15} = 150$.

Additional men needed = $150 - 60 = 90$.

586. Let Om alone take x days; then Naveen alone takes $(x + 5)$ days.

$$\frac{1}{x} + \frac{1}{x+5} = \frac{1}{6}.$$

$$\frac{(x+5) + x}{x(x+5)} = \frac{1}{6} \Rightarrow 6(2x+5) = x^2 + 5x.$$

$$12x + 30 = x^2 + 5x \Rightarrow x^2 - 7x - 30 = 0 \Rightarrow (x-10)(x+3) = 0.$$

Rejecting the negative root, $x = 10$. So Om alone takes 10 days and Naveen 15 days; check: $\frac{1}{10} + \frac{1}{15} =$

$$\frac{3+2}{30} = \frac{1}{6}.$$

587. Efficiency ratio Prakash : Rehana = 160 : 100 = 8 : 5, so take their rates as 8 and 5 units/day.

Together they do $8 + 5 = 13$ units/day for 15 days, so the total work = $13 \times 15 = 195$ units.

Prakash alone in 6 days does $6 \times 8 = 48$ units.

Remaining = $195 - 48 = 147$ units, to be done by Rehana at 5 units/day.

Time = $\frac{147}{5} = 29\frac{2}{5}$ days.

588. One assignment = $10 \times 12 = 120$ woman-days, so one woman does $\frac{1}{120}$ of it per day.

The same assignment = $8 \times 10 = 80$ man-days, so one man does $\frac{1}{80}$ of it per day.

Rate of 5 women and 4 men = $\frac{5}{120} + \frac{4}{80} = \frac{1}{24} + \frac{1}{20} = \frac{5+6}{120} = \frac{11}{120}$ assignment per day.

Work to be done = 2 assignments, so time = $2 \div \frac{11}{120} = \frac{240}{11} = 21\frac{9}{11}$ days.

Subtopic 1.6.2

589. Wages are shared in the ratio of the work done, which for men working the same number of days is the ratio of their one-day rates. Ramesh's one-day work = $\frac{1}{12}$, Suresh's one-day work = $\frac{1}{18}$. Ratio = $\frac{1}{12} : \frac{1}{18}$. Multiplying both parts by the LCM 36 gives 3 : 2. Total parts = $3 + 2 = 5$, so one part = $\frac{4500}{5} = 900$. Ramesh's share = $3 \times 900 = \text{Rs. } 2,700$.

590. Anita's one-day work = $\frac{1}{10}$ and Babita's one-day work = $\frac{1}{15}$. In one pair of days (Anita on day 1, Babita on day 2) the work done = $\frac{1}{10} + \frac{1}{15} = \frac{3}{30} + \frac{2}{30} = \frac{5}{30} = \frac{1}{6}$. To finish the whole work we need $\frac{1}{6}$ to be repeated 6 times, i.e. 6 pairs of days. Since $6 \times \frac{1}{6} = 1$, the work ends exactly at the close of the 6th pair, that is after $6 \times 2 = 12$ days.

591. Since all three work for the same number of days, wages are divided in the ratio of their one-day rates: $\frac{1}{6} : \frac{1}{8} : \frac{1}{12}$. Multiplying every term by the LCM 24 gives 4 : 3 : 2. Total parts = $4 + 3 + 2 = 9$, so one part = $\frac{2700}{9} = 300$. Chetan corresponds to 2 parts, so his share = $2 \times 300 = \text{Rs. } 600$.

592. Ratio of one-day rates = $\frac{1}{9} : \frac{1}{18}$. Multiplying both parts by the LCM 18 gives 2 : 1, so the payment splits as 2 : 1. The difference between the shares = $2 - 1 = 1$ part, and this one part is given as Rs. 1,200. The total payment = $2 + 1 = 3$ parts = $3 \times 1200 = \text{Rs. } 3,600$. (Check: Iqbal gets Rs. 2,400 and Javed gets Rs. 1,200, a difference of Rs. 1,200.)

593. Deepak's one-day work = $\frac{1}{12}$ and Farhan's one-day work = $\frac{1}{24}$. Work done in one pair of days = $\frac{1}{12} + \frac{1}{24} = \frac{2}{24} + \frac{1}{24} = \frac{3}{24} = \frac{1}{8}$. Six days contain exactly 3 such pairs, so the work completed = $3 \times \frac{1}{8} = \frac{3}{8}$.

594. Combined one-day work = $\frac{1}{8}$ and Gopal's one-day work = $\frac{1}{12}$. So Hemant's one-day work = $\frac{1}{8} - \frac{1}{12} = \frac{3}{24} - \frac{2}{24} = \frac{1}{24}$. Ratio of wages = $\frac{1}{12} : \frac{1}{24} = 2 : 1$. Total parts = 3, one part = $\frac{6000}{3} = 2000$. Gopal's share = $2 \times 2000 = \text{Rs. } 4,000$.

595. Kiran does $\frac{1}{4}$ per day and Lata does $\frac{1}{8}$ per day. Day 1 (Kiran): total = $\frac{2}{8}$. Day 2 (Lata): total = $\frac{3}{8}$. Day 3 (Kiran): total = $\frac{5}{8}$. Day 4 (Lata): total = $\frac{6}{8}$. The work left is $\frac{2}{8} = \frac{1}{4}$, and day 5 is Kiran's turn; she does exactly $\frac{1}{4}$ in a full day. Hence the work is completed on the 5th day.

596. Take the total work as 24 units, so Mahesh does 3 units per day and Naveen does 2 units per day. A pair of days (Naveen then Mahesh) gives $2 + 3 = 5$ units. After 4 pairs, i.e. 8 days, the work done $= 4 \times 5 = 20$ units, leaving 4 units. Day 9 is Naveen's turn: he does 2 units, leaving 2 units. Day 10 is Mahesh's turn at 3 units per day, so he needs $\frac{2}{3}$ of a day. Total time $= 9 + \frac{2}{3} = 9\frac{2}{3}$ days.

597. One-day work of all three $= \frac{1}{3} = \frac{8}{24}$. Pankaj and Qadir together do $\frac{1}{6} + \frac{1}{8} = \frac{4}{24} + \frac{3}{24} = \frac{7}{24}$ in a day. So Rakesh's one-day work $= \frac{8}{24} - \frac{7}{24} = \frac{1}{24}$. As all three work for the same 3 days, the wage ratio equals the rate ratio $\frac{4}{24} : \frac{3}{24} : \frac{1}{24} = 4 : 3 : 1$. Total parts = 8, one part $= \frac{4800}{8} = 600$. Rakesh's share $= 1 \times 600 = \text{Rs. } 600$.

598. Let the work last T days. Tarun works all T days and Sanjay works $T - 5$ days. Then $\frac{T - 5}{20} + \frac{T}{30} = 1$. Multiplying by 60: $3(T - 5) + 2T = 60$, so $3T - 15 + 2T = 60$, giving $5T = 75$ and $T = 15$. Thus Sanjay worked 10 days and did $\frac{10}{20} = \frac{1}{2}$ of the work, while Tarun worked 15 days and did $\frac{15}{30} = \frac{1}{2}$. The shares are therefore equal, and Tarun gets $\frac{9000}{2} = \text{Rs. } 4,500$.

599. Let the total work be 24 units. Then Umesh does 3 units per day, Vikas 2 units per day and Wasim 1 unit per day. One full rotation of 3 days gives $3 + 2 + 1 = 6$ units. To finish 24 units we need $\frac{24}{6} = 4$ complete rotations. Since the count comes out exact, the work ends at the close of the 4th rotation, i.e. after $4 \times 3 = 12$ days.

600. First find the daily wage of one workman. Total man-days in the first job $= 8 \times 12 = 96$. Hence one man-day costs $\frac{19200}{96} = \text{Rs. } 200$. In the second job the man-days $= 12 \times 10 = 120$. At the same rate the wage bill $= 120 \times 200 = \text{Rs. } 24,000$.

601. Take the work as 60 units, so Yogesh does 5 units per day and Zakir 4 units per day. A pair of days gives 9 units. After 5 pairs, i.e. 10 days, work done $= 45$ units, leaving 15 units. Day 11 (Yogesh): 5 units, leaving 10. Day 12 (Zakir): 4 units, leaving 6. Day 13 (Yogesh): 5 units, leaving 1 unit. Day 14 is Zakir's turn at 4 units per day, so he needs $\frac{1}{4}$ of a day. Total $= 13 + \frac{1}{4} = 13\frac{1}{4}$ days.

602. Let the work last T days. Ajay and Bimal work T days each and Chandan works $T - 4$ days. Then $\frac{T}{24} + \frac{T}{30} + \frac{T - 4}{40} = 1$. Multiplying by 120: $5T + 4T + 3(T - 4) = 120$, so $12T - 12 = 120$, giving $T = 11$. Work done: Ajay $\frac{11}{24} = \frac{55}{120}$, Bimal $\frac{11}{30} = \frac{44}{120}$, Chandan $\frac{7}{40} = \frac{21}{120}$. These add to $\frac{120}{120} = 1$, confirming the split. Chandan's share $= \frac{21}{120} \times 12000 = \text{Rs. } 2,100$.

603. Take the work as 36 units, so Dinesh does 3 units per day and Elias 2 units per day. Either way a pair of days gives 5 units. After 7 pairs, i.e. 14 days, work done $= 35$ units and 1 unit remains. If Dinesh began, day 15 belongs to Dinesh, who needs $\frac{1}{3}$ of a day for 1 unit, giving $14\frac{1}{3}$ days. If Elias began, day 15 belongs to Elias, who needs $\frac{1}{2}$ of a day, giving $14\frac{1}{2}$ days. The difference $= \frac{1}{2} - \frac{1}{3} = \frac{1}{6}$ day, which is not listed, so the answer is None of these.

604. Adding the three given rates counts every man twice: $2(a + b + c) = \frac{1}{12} + \frac{1}{15} + \frac{1}{20} = \frac{5}{60} + \frac{4}{60} + \frac{3}{60} = \frac{12}{60} = \frac{1}{5}$. So $a + b + c = \frac{1}{10}$. Now $b = (a + b + c) - (a + c) = \frac{1}{10} - \frac{1}{20} = \frac{1}{20}$, $a = \frac{1}{10} - \frac{1}{15} = \frac{1}{30}$ and $c = \frac{1}{10} - \frac{1}{12} = \frac{1}{60}$. Ratio $a : b : c = \frac{1}{30} : \frac{1}{20} : \frac{1}{60}$; multiplying by 60 gives $2 : 3 : 1$. Total parts $= 6$, one part $= \frac{15000}{6} = 2500$. Bimal's share $= 3 \times 2500 = \text{Rs. } 7,500$.

605. Amit and Bharat together do $\frac{1}{10} + \frac{1}{15} = \frac{3}{30} + \frac{2}{30} = \frac{1}{6}$ in a day. Take the work as 18 units: the

pair does 3 units on their day and Chandan does $\frac{18}{9} = 2$ units on his day. One two-day cycle gives $3 + 2 = 5$ units. After 3 cycles, i.e. 6 days, work done = 15 units, leaving 3 units. Day 7 is the pair's turn and they do exactly 3 units in that full day. Hence the work finishes on the 7th day.

606. The total wage for a labourer is his daily charge multiplied by the number of days he needs. Anil: $12 \times 600 = \text{Rs. } 7,200$. Bipin: $18 \times 500 = \text{Rs. } 9,000$. Chirag: $24 \times 400 = \text{Rs. } 9,600$. The smallest of these is Rs. 7,200, so Anil should be engaged. Note that the cheapest daily rate belongs to Chirag, yet he is the costliest overall because he is slow; comparing daily rates alone would mislead.

607. In 12 alternate days Harish works on days 1, 3, 5, 7, 9, 11, that is 6 days, and Ismail also works 6 days. Harish's contribution = $\frac{6}{10} = \frac{3}{5}$ of the work. Hence Ismail's contribution = $1 - \frac{3}{5} = \frac{2}{5}$, done in 6 days, so his one-day work = $\frac{2}{5} \times \frac{1}{6} = \frac{1}{15}$, i.e. Ismail alone would need 15 days. Wages follow the work done, not the days, so Ismail's share = $\frac{2}{5} \times 7500 = \text{Rs. } 3,000$.

608. Take the work as 20 units, so each man does 1 unit per day. In a block of 3 days Jagdish does 3 units and Kailash adds 1 unit on the third day, giving 4 units per block. To reach 20 units we need $\frac{20}{4} = 5$ blocks, i.e. $5 \times 3 = 15$ days. In these 15 days Jagdish worked all 15 days doing 15 units, and Kailash worked on 5 days doing 5 units. Ratio of work = $15 : 5 = 3 : 1$, total 4 parts, one part = $\frac{24000}{4} = 6000$. Kailash's share = $1 \times 6000 = \text{Rs. } 6,000$.

609. Take the work as 60 units. Then Lalit does 4 units per day, Manoj 3 units per day and Nitin 2 units per day. One rotation of 3 days gives $4 + 3 + 2 = 9$ units. After 6 rotations, i.e. 18 days, work done = 54 units, leaving 6 units. Day 19 is Lalit's turn: he does 4 units, leaving 2 units. Day 20 is Manoj's turn at 3 units per day, so he needs $\frac{2}{3}$ of a day. Total time = $19 + \frac{2}{3} = 19\frac{2}{3}$ days.

Subtopic 1.6.3

610. Work done in 1 hour by A = $\frac{1}{12}$ and by B = $\frac{1}{18}$. Together, the part filled in 1 hour = $\frac{1}{12} + \frac{1}{18}$. Taking LCM 36: $\frac{3}{36} + \frac{2}{36} = \frac{5}{36}$. Hence the whole tank takes $\frac{36}{5} = 7.2$ hours. Now 0.2 hour = $0.2 \times 60 = 12$ minutes, so the time is 7 hours 12 minutes.

611. The inlet fills $\frac{1}{10}$ of the cistern per hour; the leak empties $\frac{1}{15}$ per hour. Since they act in opposite directions, the net filling in 1 hour = $\frac{1}{10} - \frac{1}{15}$. Taking LCM 30: $\frac{3}{30} - \frac{2}{30} = \frac{1}{30}$. So $\frac{1}{30}$ of the cistern is filled per hour, and the full cistern needs 30 hours.

612. In 1 minute the two pipes together fill $\frac{1}{20} + \frac{1}{30}$. Taking LCM 60: $\frac{3}{60} + \frac{2}{60} = \frac{5}{60} = \frac{1}{12}$. So in 4 minutes the part filled = $4 \times \frac{1}{12} = \frac{4}{12} = \frac{1}{3}$.

613. The pipe fills $\frac{1}{4}$ of the reservoir in 3 hours. Therefore the time for the whole reservoir = $3 \div \frac{1}{4} = 3 \times 4 = 12$ hours. (Check: rate = $\frac{1}{4} \div 3 = \frac{1}{12}$ of the reservoir per hour, so the full tank needs 12 hours.)

614. Part filled in 1 hour by the three pipes together = $\frac{1}{10} + \frac{1}{15} + \frac{1}{30}$. Taking LCM 30: $\frac{3}{30} + \frac{2}{30} + \frac{1}{30} = \frac{6}{30} = \frac{1}{5}$. Since $\frac{1}{5}$ of the tank is filled per hour, the full tank takes 5 hours.

615. Time = $\frac{\text{Capacity}}{\text{Rate}} = \frac{3600}{45}$ minutes. Now $\frac{3600}{45} = 80$ minutes. Converting, 80 minutes = $60 + 20$ minutes = 1 hour 20 minutes.

616. Pipe A fills $\frac{1}{9}$ of the cistern per hour. Being twice as efficient, pipe B fills $2 \times \frac{1}{9} = \frac{2}{9}$ per hour (that is, B alone would need 4.5 hours). Together they fill $\frac{1}{9} + \frac{2}{9} = \frac{3}{9} = \frac{1}{3}$ per hour. Hence the cistern is full in 3 hours.

617. In 1 hour both together fill $\frac{1}{12} + \frac{1}{15}$. Taking LCM 60: $\frac{5}{60} + \frac{4}{60} = \frac{9}{60} = \frac{3}{20}$. In 3 hours they fill $3 \times \frac{3}{20} = \frac{9}{20}$. Remaining part = $1 - \frac{9}{20} = \frac{11}{20}$. Pipe B fills $\frac{1}{15}$ per hour, so the time needed = $\frac{11}{20} \div \frac{1}{15} = \frac{11}{20} \times 15 = \frac{165}{20} = 8.25$ hours = 8 hours 15 minutes.

618. Let the leak alone empty the full cistern in L hours. Working together, inlet minus leak gives the actual filling rate: $\frac{1}{8} - \frac{1}{L} = \frac{1}{10}$. So $\frac{1}{L} = \frac{1}{8} - \frac{1}{10}$. Taking LCM 40: $\frac{5}{40} - \frac{4}{40} = \frac{1}{40}$. Hence $L = 40$ hours, which is not listed among options A to D, so the answer is None of these.

619. The first pipe runs for the whole 18 minutes and fills $\frac{18}{20} = \frac{9}{10}$ of the tank. The remaining part = $1 - \frac{9}{10} = \frac{1}{10}$ must have been filled by the second pipe. The second pipe fills $\frac{1}{30}$ per minute, so the time it ran = $\frac{1}{10} \div \frac{1}{30} = \frac{1}{10} \times 30 = 3$ minutes. Hence it was closed 3 minutes after being opened.

620. In 5 minutes both together fill $\frac{5}{12}$ of the tank, leaving $1 - \frac{5}{12} = \frac{7}{12}$. The pipe that keeps running fills $\frac{7}{12}$ in 21 minutes, so its rate = $\frac{7}{12} \div 21 = \frac{7}{12 \times 21} = \frac{1}{36}$ per minute, i.e. it alone needs 36 minutes. The closed pipe's rate = $\frac{1}{12} - \frac{1}{36} = \frac{3}{36} - \frac{1}{36} = \frac{2}{36} = \frac{1}{18}$ per minute. Hence it alone fills the tank in 18 minutes.

621. Let the capacity be C litres. The leak removes $\frac{C}{8}$ litres per hour. The tap admits 6 litres per minute = $6 \times 60 = 360$ litres per hour. With both acting, the cistern still empties, at the net rate $\frac{C}{12}$ litres per hour. So $\frac{C}{8} - 360 = \frac{C}{12}$, giving $\frac{C}{8} - \frac{C}{12} = 360$. Taking LCM 24: $\frac{3C - 2C}{24} = 360$, so $\frac{C}{24} = 360$ and $C = 8640$ litres.

622. Let pipe B fill b part of the tank per minute. Then pipe A fills $3b$ per minute. Together they fill $b + 3b = 4b$ per minute, and this equals $\frac{1}{36}$. So $4b = \frac{1}{36}$, giving $b = \frac{1}{144}$. Since B fills $\frac{1}{144}$ of the tank per minute, B alone needs 144 minutes.

623. Net part filled per minute = $\frac{1}{15} + \frac{1}{20} - \frac{1}{30}$. Taking LCM 60: $\frac{4}{60} + \frac{3}{60} - \frac{2}{60} = \frac{5}{60} = \frac{1}{12}$. So the tank fills in 12 minutes. Pipe C empties 600 litres in 30 minutes, i.e. $\frac{600}{30} = 20$ litres per minute. Running for the whole 12 minutes, C discharges $20 \times 12 = 240$ litres.

624. Take the capacity as the LCM of 6 and 8, i.e. 24 units. Then A fills $\frac{24}{6} = 4$ units per hour and B fills $\frac{24}{8} = 3$ units per hour. One cycle of 2 hours (A then B) fills $4 + 3 = 7$ units. After 3 cycles, i.e. 6 hours, the cistern holds $3 \times 7 = 21$ units, leaving $24 - 21 = 3$ units. The 7th hour belongs to A, who fills 4 units per hour, so A needs $\frac{3}{4}$ hour = 45 minutes for the remaining 3 units. Total time = 6 hours 45 minutes.

625. Let the outlet alone empty the tank in x minutes. Net filling per minute: $\frac{1}{30} + \frac{1}{40} - \frac{1}{x} = \frac{1}{60}$. First, $\frac{1}{30} + \frac{1}{40} = \frac{4}{120} + \frac{3}{120} = \frac{7}{120}$. So $\frac{1}{x} = \frac{7}{120} - \frac{1}{60} = \frac{7}{120} - \frac{2}{120} = \frac{5}{120} = \frac{1}{24}$. Hence $x = 24$ minutes.

626. In the first 2 hours (no leak) the pipe fills $\frac{2}{6} = \frac{1}{3}$ of the tank, leaving $1 - \frac{1}{3} = \frac{2}{3}$. This remaining

$\frac{2}{3}$ is filled during the next $8 - 2 = 6$ hours with the leak active. Let the leak alone empty the tank in L hours. Then $\left(\frac{1}{6} - \frac{1}{L}\right) \times 6 = \frac{2}{3}$, so $\frac{1}{6} - \frac{1}{L} = \frac{2}{3} \times \frac{1}{6} = \frac{1}{9}$. Therefore $\frac{1}{L} = \frac{1}{6} - \frac{1}{9} = \frac{3}{18} - \frac{2}{18} = \frac{1}{18}$, giving $L = 18$ hours.

627. For the first 20 minutes only A and B run, at $60+40 = 100$ litres per minute, filling $100 \times 20 = 2000$ litres. Water still required $= 4800 - 2000 = 2800$ litres. After C opens, the net inflow $= 100 - 30 = 70$ litres per minute. Time for the rest $= \frac{2800}{70} = 40$ minutes. Total time $= 20 + 40 = 60$ minutes.

628. Let the two together take t minutes. Then A alone takes $t+6$ and B alone takes $t+24$ minutes. So $\frac{1}{t+6} + \frac{1}{t+24} = \frac{1}{t}$. Combining the left side: $\frac{(t+24) + (t+6)}{(t+6)(t+24)} = \frac{2t+30}{(t+6)(t+24)}$. Cross-multiplying with $\frac{1}{t}$: $t(2t+30) = (t+6)(t+24)$, i.e. $2t^2 + 30t = t^2 + 30t + 144$. This gives $t^2 = 144$, so $t = 12$ minutes. (Check: A = 18, B = 36; $\frac{1}{18} + \frac{1}{36} = \frac{3}{36} = \frac{1}{12}$.)

629. In 1 minute A and B together fill $\frac{1}{20} + \frac{1}{30} = \frac{3}{60} + \frac{2}{60} = \frac{5}{60} = \frac{1}{12}$. In 5 minutes they fill $\frac{5}{12}$, leaving $1 - \frac{5}{12} = \frac{7}{12}$. After that only B runs against the leak, at the net rate $\frac{1}{30} - \frac{1}{60} = \frac{2}{60} - \frac{1}{60} = \frac{1}{60}$ per minute. Time for the rest $= \frac{7}{12} \div \frac{1}{60} = \frac{7}{12} \times 60 = 35$ minutes. Total $= 5 + 35 = 40$ minutes.

630. Let the hourly rates be p , q and r . Then $p + q = \frac{1}{8}$, $q + r = \frac{1}{12}$ and $p + r = \frac{1}{16}$. Adding all three: $2(p + q + r) = \frac{1}{8} + \frac{1}{12} + \frac{1}{16}$. Taking LCM 48: $\frac{6}{48} + \frac{4}{48} + \frac{3}{48} = \frac{13}{48}$. So $p + q + r = \frac{13}{96}$ of the reservoir per hour. The time for all three together is the reciprocal, $\frac{96}{13}$ hours (that is, $7\frac{5}{13}$ hours).

Subtopic 1.6.4

631. Convert the time to hours: 4 hours 30 minutes $= 4\frac{1}{2} = \frac{9}{2}$ hours. Average speed $= \frac{\text{distance}}{\text{time}} = \frac{315}{\frac{9}{2}} = 315 \times \frac{2}{9} = 70$ km/h. Since 70 km/h is not listed among the first four options, the correct choice is 'None of these'.

632. To convert km/h into m/s, multiply by $\frac{5}{18}$, because 1 km = 1000 m and 1 hour = 3600 seconds, so $1 \text{ km/h} = \frac{1000}{3600} = \frac{5}{18} \text{ m/s}$. Therefore $72 \text{ km/h} = 72 \times \frac{5}{18} = 4 \times 5 = 20 \text{ m/s}$.

633. Time $= \frac{\text{distance}}{\text{speed}} = \frac{24}{16} = \frac{3}{2}$ hours. Now $\frac{3}{2}$ hours $= 1 \text{ hour} + \frac{1}{2} \times 60 = 1 \text{ hour } 30 \text{ minutes}$.

634. Time required $= \frac{420}{60} = 7$ hours. Adding 7 hours to the departure time 5:30 am gives 12:30 pm.

635. A pole has negligible width, so in passing it the train covers a distance equal to its own length, 180 m, in 9 seconds. Speed $= \frac{180}{9} = 20 \text{ m/s}$. Converting to km/h, multiply by $\frac{18}{5}$: $20 \times \frac{18}{5} = 72 \text{ km/h}$.

636. The distance is fixed at 200 km. To cover it in 2 hours the required speed $= \frac{200}{2} = 100 \text{ km/h}$. (Its original speed was $\frac{200}{2.5} = 80 \text{ km/h}$, so it must be raised to 100 km/h.)

637. Convert the speed: $12 \text{ km/h} = 12 \times \frac{5}{18} = \frac{10}{3} \text{ m/s}$. Time $= \frac{900}{\frac{10}{3}} = 900 \times \frac{3}{10} = 270$ seconds. Since $270 = 4 \times 60 + 30$, the time is 4 minutes 30 seconds.

638. Let the distance be d km. Walking at 5 km/h takes $\frac{d}{5}$ hours and at 6 km/h takes $\frac{d}{6}$ hours. The first arrival is 10 minutes late and the second is 5 minutes early, so the slower journey takes $10 + 5 = 15$ minutes = $\frac{1}{4}$ hour longer. Hence $\frac{d}{5} - \frac{d}{6} = \frac{1}{4}$, i.e. $\frac{6d - 5d}{30} = \frac{1}{4}$, so $\frac{d}{30} = \frac{1}{4}$ and $d = \frac{30}{4} = 7\frac{1}{2}$ km.

639. Time for the first stretch = $\frac{60}{30} = 2$ hours. Time for the second stretch = $\frac{90}{45} = 2$ hours. Total distance = $60 + 90 = 150$ km and total time = $2 + 2 = 4$ hours. Average speed = $\frac{\text{total distance}}{\text{total time}} = \frac{150}{4} = 37.5$ km/h. Note that the plain average of 30 and 45, namely 37.5, coincides here only because the two times happen to be equal.

640. Speed = $72 \times \frac{5}{18} = 20$ m/s. To cross a platform completely, the train must cover its own length plus the platform's length. Total distance covered = $20 \times 27 = 540$ m. Therefore the platform's length = $540 - 240 = 300$ metres.

641. By 10:30 am the van has been travelling for $1\frac{1}{2}$ hours, so it is $40 \times 1.5 = 60$ km ahead. Both then move in the same direction, so the jeep closes the gap at the relative speed $60 - 40 = 20$ km/h. Time to close 60 km = $\frac{60}{20} = 3$ hours. Adding 3 hours to 10:30 am gives 1:30 pm.

642. In the first hour (6:00 to 7:00 am) the bus from P covers 50 km alone, so at 7:00 am the gap between them is $270 - 50 = 220$ km. Moving towards each other, they close the gap at $50 + 60 = 110$ km/h, so they meet after $\frac{220}{110} = 2$ hours, i.e. at 9:00 am. The bus from P has then been running for 3 hours, covering $50 \times 3 = 150$ km. So they meet 150 km from P .

643. For a fixed distance, time is inversely proportional to speed. Increasing the speed by 25% multiplies it by $\frac{5}{4}$, so the time is multiplied by $\frac{4}{5}$. Original time = 3 hours 45 minutes = $\frac{15}{4}$ hours. New time = $\frac{15}{4} \times \frac{4}{5} = 3$ hours.

644. Let the distance covered by train be x km; then the road distance is $(300 - x)$ km. Total time gives $\frac{300 - x}{40} + \frac{x}{70} = 6$. Multiplying throughout by 280 (the LCM of 40 and 70): $7(300 - x) + 4x = 1680$, so $2100 - 7x + 4x = 1680$, giving $-3x = -420$ and $x = 140$. Check: 140 km by train takes 2 hours and 160 km by road takes 4 hours, a total of 6 hours.

645. Convert both speeds: $90 \times \frac{5}{18} = 25$ m/s and $72 \times \frac{5}{18} = 20$ m/s. Since they run in the same direction, the relative speed is $25 - 20 = 5$ m/s. To pass completely, the faster train must cover the sum of the two lengths, $180 + 120 = 300$ m. Time = $\frac{300}{5} = 60$ seconds.

646. Let the speeds be a and b and let T be the time until they cross. The distance from A to the crossing point is covered by the first train in T hours and by the second train in 16 hours, so $aT = 16b$. Similarly, the distance from B to the crossing point gives $bT = 9a$. Multiplying the two equations: $abT^2 = 144ab$, so $T^2 = 144$ and $T = 12$ hours. Substituting in $aT = 16b$: $12a = 16b$, so $\frac{a}{b} = \frac{4}{3}$. With $a = 48$, we get $b = 48 \times \frac{3}{4} = 36$ km/h. (In general $\frac{a}{b} = \sqrt{\frac{16}{9}} = \frac{4}{3}$.)

647. Let the original speed be v km/h and let D be the distance still remaining when the failure occurs in the first case. The reduced speed is $\frac{3v}{5}$, so the extra running time on the remaining stretch is $\frac{D}{3v/5} - \frac{D}{v} = \frac{5D}{3v} - \frac{D}{v} = \frac{2D}{3v}$. Adding the 1 hour halt, the total delay is $1 + \frac{2D}{3v} = 4$, so $\frac{2D}{3v} = 3$ and $D = 4.5v$. In the second case the remaining distance is $(D - 60)$ and the delay is $1 + \frac{2(D - 60)}{3v} = 3$, so $\frac{2(D - 60)}{3v} = 2$ and $D - 60 = 3v$. Substituting $D = 4.5v$: $4.5v - 60 = 3v$, giving $1.5v = 60$ and

$v = 40$ km/h, hence $D = 180$ km. The train had already run for 2 hours before the halt, covering $2 \times 40 = 80$ km. Total journey = $80 + 180 = 260$ km.

648. Let the total distance be D km. First half: time = $\frac{D/2}{30} = \frac{D}{60}$ hours. Second half: since the two speeds are used for equal times, the average speed over that half is the simple mean $\frac{60 + 40}{2} = 50$ km/h, so the time is $\frac{D/2}{50} = \frac{D}{100}$ hours. Total time = $\frac{D}{60} + \frac{D}{100} = \frac{5D + 3D}{300} = \frac{8D}{300}$. Average speed = $\frac{D}{8D/300} = \frac{300}{8} = 37.5$ km/h.

649. Meeting at the starting point requires each runner to have completed a whole number of laps. Arun's time for one lap = $\frac{1200}{5} = 240$ seconds; Bhavesh's time for one lap = $\frac{1200}{3} = 400$ seconds. They are both at the start together after the LCM of 240 and 400 seconds. Since $240 = 2^4 \times 3 \times 5$ and $400 = 2^4 \times 5^2$, the LCM = $2^4 \times 3 \times 5^2 = 1200$ seconds = 20 minutes. (Beware: they first meet somewhere on the track after $\frac{1200}{5+3} = 150$ seconds, but that point is not the starting point.)

650. Let the distance be d km and the speed v km/h; 40 minutes = $\frac{2}{3}$ hour. From the first condition, $\frac{d}{v} - \frac{d}{v+3} = \frac{2}{3}$, i.e. $\frac{3d}{v(v+3)} = \frac{2}{3}$, so $9d = 2v(v+3)$. From the second, $\frac{d}{v-2} - \frac{d}{v} = \frac{2}{3}$, i.e. $\frac{2d}{v(v-2)} = \frac{2}{3}$, so $3d = v(v-2)$. Substituting $d = \frac{v^2 - 2v}{3}$ into the first equation: $9 \times \frac{v^2 - 2v}{3} = 2v^2 + 6v$, i.e. $3v^2 - 6v = 2v^2 + 6v$, so $v^2 = 12v$ and $v = 12$ km/h. Then $d = \frac{144 - 24}{3} = 40$ km. Check: $\frac{40}{12} = 3\frac{1}{3}$ h, $\frac{40}{15} = 2\frac{2}{3}$ h and $\frac{40}{10} = 4$ h, each differing by 40 minutes.

651. Let the speed be v m/s and the length of the train be L metres. Crossing a man means covering only the train's own length: $L = 12v$. Crossing the platform means covering the train's length plus 180 m: $L + 180 = 21v$. Subtracting the first from the second gives $180 = 9v$, so $v = 20$ m/s. In km/h this is $20 \times \frac{18}{5} = 72$ km/h (and the train is $L = 12 \times 20 = 240$ m long). Since 72 km/h is not among the first four options, the answer is 'None of these'.

Subtopic 1.6.5

652. To pass a pole, a train must cover a distance equal to its own length, because the pole has no length. First convert the speed into metres per second: 54 km/h = $54 \times \frac{5}{18} = 15$ m/s. Required time = $\frac{\text{length of train}}{\text{speed}} = \frac{180}{15} = 12$ seconds.

653. To cross a platform completely, the train must cover its own length plus the length of the platform. Total distance = $240 + 160 = 400$ m. Speed = $72 \times \frac{5}{18} = 20$ m/s. Time = $\frac{400}{20} = 20$ seconds.

654. When two bodies move in opposite directions, the relative speed is the sum of their speeds: $60 + 40 = 100$ km/h = $100 \times \frac{5}{18} = \frac{250}{9}$ m/s. To cross each other completely they must cover the sum of their lengths, $150 + 100 = 250$ m. Time = $\frac{250}{250/9} = 250 \times \frac{9}{250} = 9$ seconds.

655. Relative to Ramesh, the train covers only its own length of 150 m in 10 seconds. So the relative speed = $\frac{150}{10} = 15$ m/s = $15 \times \frac{18}{5} = 54$ km/h. Since both move in the same direction, relative speed = speed of train - speed of Ramesh. Hence speed of train = $54 + 6 = 60$ km/h.

656. Speed = $45 \times \frac{5}{18} = 12.5$ m/s. In 30 seconds the train covers $12.5 \times 30 = 375$ m. This distance equals the length of the bridge plus the length of the train, so the bridge = $375 - 120 = 255$ m. Since 255 m is not listed among the first four options, the correct choice is 'None of these'.

657. A man has no length of his own, so the train passes him after covering only its own length of 110 m relative to him. As they move in opposite directions, the relative speed is the sum of the speeds $= 60 + 6 = 66 \text{ km/h} = 66 \times \frac{5}{18} = \frac{55}{3} \text{ m/s}$. Time $= \frac{110}{55/3} = 110 \times \frac{3}{55} = 6 \text{ seconds}$.

658. The trains approach each other, so the gap between them closes at the relative speed $= 60 + 40 = 100 \text{ km/h}$. The gap to be closed is the whole distance, 300 km. Time to meet $= \frac{300}{100} = 3 \text{ hours}$. (Check: in 3 hours the first covers 180 km and the second 120 km, and $180 + 120 = 300 \text{ km}$.)

659. Let the length of the train be L metres. Passing a post means covering L metres, so the speed is $\frac{L}{15} \text{ m/s}$. Crossing the platform means covering $L + 200$ metres in 25 seconds, so the speed is also $\frac{L + 200}{25} \text{ m/s}$. Equating: $\frac{L}{15} = \frac{L + 200}{25}$, so $25L = 15L + 3000$, giving $10L = 3000$ and $L = 300 \text{ m}$.

660. For motion in the same direction the relative speed is the difference of the speeds: $72 - 54 = 18 \text{ km/h} = 18 \times \frac{5}{18} = 5 \text{ m/s}$. For one train to overtake the other completely, the relative displacement must equal the sum of the lengths $= 200 + 300 = 500 \text{ m}$. Time $= \frac{500}{5} = 100 \text{ seconds}$.

661. Let the speed of the train be $v \text{ km/h}$ and its length L metres. Against the first labourer the relative speed is $(v - 4) \text{ km/h}$, so $L = (v - 4) \times \frac{5}{18} \times 9$. Against the second, $L = (v - 8) \times \frac{5}{18} \times 10$. Since both equal L , we get $9(v - 4) = 10(v - 8)$, i.e. $9v - 36 = 10v - 80$, so $v = 44 \text{ km/h}$. Then $L = (44 - 4) \times \frac{5}{18} \times 9 = 40 \times \frac{45}{18} = 100 \text{ m}$.

662. When two trains start simultaneously towards each other and take a and b hours respectively to complete the journey after meeting, the ratio of their speeds is $\sqrt{b} : \sqrt{a}$. Here the Lucknow train takes $a = 9$ hours afterwards and the Kanpur train takes $b = 16$ hours, so speed of Lucknow train : speed of Kanpur train $= \sqrt{16} : \sqrt{9} = 4 : 3$. Hence $\frac{60}{x} = \frac{4}{3}$, giving $x = 45 \text{ km/h}$.

663. Opposite directions, so relative speed $= 54 + 36 = 90 \text{ km/h} = 90 \times \frac{5}{18} = 25 \text{ m/s}$. In 12 seconds the relative displacement is $25 \times 12 = 300 \text{ m}$, and this equals the sum of the two lengths. Therefore the second train $= 300 - 180 = 120 \text{ m}$.

664. By 10 a.m. the goods train has already run for 2 hours, covering $40 \times 2 = 80 \text{ km}$. From 10 a.m. onwards both move in the same direction, so the gap closes at the relative speed $= 60 - 40 = 20 \text{ km/h}$. Time to close the 80 km gap $= \frac{80}{20} = 4 \text{ hours}$. So the express overtakes it 4 hours after 10 a.m., that is at 2 p.m. (Check: the express covers $60 \times 4 = 240 \text{ km}$ and the goods train $40 \times 6 = 240 \text{ km}$.)

665. Let the common length be L metres. Passing a post gives the speeds directly: the first train's speed is $\frac{L}{10} \text{ m/s}$ and the second's is $\frac{L}{15} \text{ m/s}$. In opposite directions the relative speed $= \frac{L}{10} + \frac{L}{15} = \frac{3L + 2L}{30} = \frac{L}{6} \text{ m/s}$. The distance to cover is $L + L = 2L$ metres. Time $= \frac{2L}{L/6} = 12 \text{ seconds}$. Note that the answer does not depend on L .

666. Let the first train be $L \text{ m}$ long, so the second is $\frac{L}{2} \text{ m}$. Opposite directions give relative speed $= 45 + 27 = 72 \text{ km/h} = 72 \times \frac{5}{18} = 20 \text{ m/s}$. In 12 seconds the relative displacement $= 20 \times 12 = 240 \text{ m}$, which equals the sum of the lengths: $L + \frac{L}{2} = \frac{3L}{2} = 240$, so $L = 160 \text{ m}$. Now the first train's own speed $= 45 \times \frac{5}{18} = 12.5 \text{ m/s}$, and in 60 seconds it covers $12.5 \times 60 = 750 \text{ m}$. That distance is the bridge plus the train, so the bridge $= 750 - 160 = 590 \text{ m}$.

667. In both cases the distance covered relative to each other is the sum of the lengths $= 160 + 140 = 300 \text{ m}$. Same direction: relative speed $= \frac{300}{60} = 5 \text{ m/s}$, and this equals $u - v$. Opposite directions:

relative speed = $\frac{300}{12} = 25$ m/s, and this equals $u + v$. Adding the two equations: $2u = 30$, so $u = 15$ m/s = $15 \times \frac{18}{5} = 54$ km/h. (The slower train works out to $v = 10$ m/s = 36 km/h.)

668. If the two trains take a and b hours to finish their journeys after crossing, then the time taken to reach the crossing point is $\sqrt{ab}$ hours for each of them. Here $\sqrt{4 \times 9} = 6$ hours. So the train from A runs 6 hours before the crossing and 4 hours after it, a total journey time of 10 hours. Distance = $60 \times 10 = 600$ km. (Check: the ratio of speeds is $\sqrt{9} : \sqrt{4} = 3 : 2$, so the other train runs at 40 km/h and takes $6 + 9 = 15$ hours, and $40 \times 15 = 600$ km.)

669. The trains move in opposite directions, so the relative speed = $63 + 45 = 108$ km/h = $108 \times \frac{5}{18} = 30$ m/s. The seated passenger has no length, so the faster train passes him after covering only its own length: $\frac{150}{30} = 5$ seconds. For the trains to pass each other completely, the relative displacement must be the sum of the lengths, $150 + 120 = 270$ m, taking $\frac{270}{30} = 9$ seconds. The excess = $9 - 5 = 4$ seconds.

670. Both move in the same direction, so the relative speed = $45 - 9 = 36$ km/h = $36 \times \frac{5}{18} = 10$ m/s. The engine must first close the gap of 240 m to reach the jogger, and then the whole train of length 120 m must move past him. So the total relative displacement needed = $240 + 120 = 360$ m. Time = $\frac{360}{10} = 36$ seconds.

671. By 9 a.m. the first train has already travelled for one hour, covering 40 km. The gap remaining at 9 a.m. is $200 - 40 = 160$ km. From then on both trains move towards each other, so the gap closes at the relative speed = $40 + 60 = 100$ km/h. Time to meet = $\frac{160}{100} = 1.6$ hours = 1 hour 36 minutes. Adding this to 9 a.m. gives 10:36 a.m.

672. Same direction: relative speed = $60 - 45 = 15$ km/h = $15 \times \frac{5}{18} = \frac{25}{6}$ m/s. In 48 seconds the relative displacement = $\frac{25}{6} \times 48 = 200$ m, and this equals the sum of the two lengths. So the second train = $200 - 150 = 50$ m. Opposite directions: relative speed = $60 + 45 = 105$ km/h = $105 \times \frac{5}{18} = \frac{175}{6}$ m/s. The distance is still 200 m, so the time = $\frac{200}{175/6} = \frac{1200}{175} = \frac{48}{7} = 6\frac{6}{7}$ seconds.

Subtopic 1.6.6

673. Downstream speed = speed in still water + speed of stream = $12 + 3 = 15$ km/h. Time = $\frac{\text{Distance}}{\text{Speed}} = \frac{45}{15} = 3$ hours. Hence the boat takes 3 hours.

674. If b is the speed in still water and s the speed of the stream, then downstream speed = $b + s = 18$ and upstream speed = $b - s = 12$. Subtracting, $2s = 18 - 12 = 6$, so $s = 3$ km/h. (Adding would give $2b = 30$, i.e. $b = 15$ km/h, which is not what is asked.)

675. Downstream speed = $\frac{36}{3} = 12$ km/h. Downstream speed = $b + s$, so $b + 2 = 12$, giving $b = 10$ km/h.

676. Upstream speed = $b - s = 15 - 5 = 10$ km/h. Time = $\frac{30}{10} = 3$ hours.

677. Upstream speed = $\frac{40}{4} = 10$ km/h. Since upstream speed = $b - s$, we get $12 - s = 10$, so $s = 2$ km/h.

678. Downstream speed = $b + s = 20$ and $s = 4$, so $b = 20 - 4 = 16$ km/h. Upstream speed = $b - s = 16 - 4 = 12$ km/h. (Note 16 km/h is the still-water speed, not the upstream speed.)

679. Speed of stream $s = 3$ km/h, so speed in still water $b = 5 \times 3 = 15$ km/h. Downstream speed $= b + s = 15 + 3 = 18$ km/h.

680. Downstream speed $= 10 + 2 = 12$ km/h, upstream speed $= 10 - 2 = 8$ km/h. Time downstream $= \frac{48}{12} = 4$ hours; time upstream $= \frac{48}{8} = 6$ hours. Total time $= 4 + 6 = 10$ hours. (Note that dividing 96 by the still-water speed 10 would wrongly give 9.6 hours; the two legs must be timed separately.)

681. Downstream speed $= \frac{24}{3} = 8$ km/h and upstream speed $= \frac{18}{3} = 6$ km/h. Speed in still water $= \frac{8+6}{2} = 7$ km/h. Time for 84 km $= \frac{84}{7} = 12$ hours.

682. Let $x = \frac{1}{\text{downstream speed}}$ and $y = \frac{1}{\text{upstream speed}}$. Then $36x + 40y = 8$ and $48x + 24y = 7$. Multiply the first by 4: $144x + 160y = 32$; multiply the second by 3: $144x + 72y = 21$. Subtracting, $88y = 11$, so $y = \frac{1}{8}$ and upstream speed $= 8$ km/h. Substituting, $36x = 8 - 40 \times \frac{1}{8} = 3$, so $x = \frac{1}{12}$ and downstream speed $= 12$ km/h. Speed of stream $= \frac{12-8}{2} = 2$ km/h.

683. For the same distance, time is inversely proportional to speed, so upstream speed $= \frac{1}{2} \times$ downstream speed, i.e. $b - s = \frac{b+s}{2}$. Then $2b - 2s = b + s$, giving $b = 3s = 3 \times 4 = 12$ km/h. Downstream speed $= 12 + 4 = 16$ km/h, so distance in 3 hours $= 16 \times 3 = 48$ km.

684. Let the stream speed be s . Then $\frac{30}{15+s} + \frac{30}{15-s} = 4.5$. Combining, $\frac{30(15-s) + 30(15+s)}{225 - s^2} = 4.5$, i.e. $\frac{900}{225 - s^2} = 4.5$. So $225 - s^2 = 200$, giving $s^2 = 25$ and $s = 5$ km/h.

685. Downstream speed $= 6 + 2 = 8$ km/h and upstream speed $= 6 - 2 = 4$ km/h. If the distance is x km, then $\frac{x}{8} + \frac{x}{4} = 3$. Taking LCM, $\frac{x+2x}{8} = 3$, so $3x = 24$ and $x = 8$ km. Since 8 km is not among the first four options, the answer is None of these.

686. Let the still-water speed be b km/h. The distance is the same both ways, so $4(b+3) = 6(b-3)$. Expanding, $4b+12 = 6b-18$, so $2b = 30$ and $b = 15$ km/h. Distance $= 4 \times (15+3) = 4 \times 18 = 72$ km.

687. Downstream speed $= 16$ km/h, upstream speed $= 8$ km/h. Let the one-way distance be D . Total distance $= 2D$ and total time $= \frac{D}{16} + \frac{D}{8} = \frac{D+2D}{16} = \frac{3D}{16}$. Average speed $= \frac{2D}{3D/16} = \frac{32}{3}$ km/h ≈ 10.67 km/h. This is the harmonic mean $\frac{2 \times 16 \times 8}{16+8}$, not the still-water speed 12 km/h.

688. Let the still-water speed be b km/h and the current be s km/h. Measure positions from the milestone, taking downstream as positive. In the first $\frac{1}{2}$ hour the boat goes upstream to $-\frac{b-s}{2}$ while the bottle drifts to $+\frac{s}{2}$. Let the return take t hours at downstream speed $b+s$; the boat is then at $-\frac{b-s}{2} + (b+s)t$ and the bottle at $\frac{s}{2} + st$. Equating, $-\frac{b-s}{2} + (b+s)t = \frac{s}{2} + st$, which simplifies to $bt = \frac{b}{2}$, so $t = \frac{1}{2}$ hour regardless of b . The bottle therefore drifts for $\frac{1}{2} + \frac{1}{2} = 1$ hour in total. Since it covered 2 km in that hour and a floating object moves at exactly the speed of the stream, $s = \frac{2}{1} = 2$ km/h. (Shortcut: relative to the water the boat simply moves away for 30 minutes and back for 30 minutes, so the drift time is 1 hour.)

689. Let the upstream speed be u . Since the distance is the same, $3(b+s) = 5(b-s)$, so downstream speed $= \frac{5u}{3}$ where $u = b-s$. Now $s = \frac{(b+s) - (b-s)}{2} = \frac{\frac{5u}{3} - u}{2} = \frac{u}{3}$. The distance $= 5u$.

A raft drifts at the speed of the stream, so its time $= \frac{5u}{u/3} = 15$ hours. (Equivalently, raft time $= \frac{2t_1t_2}{t_2 - t_1} = \frac{2 \times 3 \times 5}{5 - 3} = 15$.)

690. Equal times for 4 km downstream and 3 km upstream means $\frac{4}{b+s} = \frac{3}{b-s}$, so downstream : upstream speed $= 4 : 3$. Let downstream speed $= 4k$ and upstream speed $= 3k$. Then $\frac{48}{4k} + \frac{48}{3k} = 14$, i.e. $\frac{12}{k} + \frac{16}{k} = 14$, so $\frac{28}{k} = 14$ and $k = 2$. Hence downstream speed $= 8$ km/h and upstream speed $= 6$ km/h, giving stream speed $= \frac{8-6}{2} = 1$ km/h.

691. Let the upstream time be T . Then the downstream time is $0.75T$. Since the distance is the same, speed is inversely proportional to time, so $\frac{\text{downstream speed}}{\text{upstream speed}} = \frac{T}{0.75T} = \frac{4}{3}$. Thus $\frac{21+s}{21-s} = \frac{4}{3}$, giving $63 + 3s = 84 - 4s$, so $7s = 21$ and $s = 3$ km/h. Check: downstream 24 km/h, upstream 18 km/h, and $\frac{18}{24} = 0.75$, i.e. 25% less time downstream.

692. The boat from A moves with the current, so its speed $= 18 + 2 = 20$ km/h. The boat from B moves against the current, so its speed $= 14 - 2 = 12$ km/h. They approach each other at $20 + 12 = 32$ km/h, so they meet after $\frac{120}{32} = 3.75$ hours. Distance from A $= 20 \times 3.75 = 75$ km.

693. From the downstream trip, $b + s = \frac{30}{2} = 15$. With the current doubled, the upstream speed is $b - 2s = \frac{30}{5} = 6$. Subtracting the second equation from the first: $(b + s) - (b - 2s) = 15 - 6$, i.e. $3s = 9$, so $s = 3$ km/h. Then $b = 15 - 3 = 12$ km/h. Check: $b - 2s = 12 - 6 = 6$ km/h, and $\frac{30}{6} = 5$ hours.

Subtopic 1.6.7

694. When Anil finishes the race he has covered 100 m, and at that same instant Vikram is 20 m behind the finish, i.e. Vikram has covered $100 - 20 = 80$ m. Both distances are covered in the same time, and for equal times speed is proportional to distance. Hence Anil's speed : Vikram's speed $= 100 : 80 = 5 : 4$.

695. Beating a runner by 10 seconds means Bhavna finishes the full 200 m ten seconds before Reema does. Reema's time $= 50$ s, so Bhavna's time $= 50 - 10 = 40$ s. Therefore Bhavna's speed $= \frac{200}{40} = 5$ m/s.

696. When two runners move in the same direction on a circular track, the faster one meets the slower one only after gaining a full lap on him. Relative speed $= 5 - 3 = 2$ m/s. Gain required $=$ one full lap $= 400$ m. Time $= \frac{400}{2} = 200$ seconds.

697. Convert the speeds: $18 \text{ km/h} = 18 \times \frac{5}{18} = 5$ m/s and $27 \text{ km/h} = 27 \times \frac{5}{18} = 7.5$ m/s. Moving in opposite directions, the gap between them closes at the sum of the speeds, i.e. $5 + 7.5 = 12.5$ m/s. Between two successive meetings they together cover one full lap, 500 m. Time $= \frac{500}{12.5} = 40$ seconds.

698. Ashok's time $= 4 \times 60 + 54 = 294$ s and Prem's time $= 300$ s, so Ashok finishes $300 - 294 = 6$ seconds ahead. Prem's speed $= \frac{1000}{300} = \frac{10}{3}$ m/s. In the 6 seconds still left for Prem he covers $\frac{10}{3} \times 6 = 20$ m, which is exactly the gap when Ashok crosses the line. Hence Ashok beats Prem by 20 m.

699. The statement means that after Kiran finishes, Manoj still needs 6 seconds to cover his remaining 30 m. So Manoj's speed $= \frac{30}{6} = 5$ m/s. Manoj's total time for the race $= \frac{300}{5} = 60$ seconds.

700. Relative speed (same direction) = $9 - 6 = 3$ km/h = $3 \times \frac{5}{18} = \frac{5}{6}$ m/s. The faster walker must gain one complete lap of 900 m on the slower one. Time = $\frac{900}{5/6} = 900 \times \frac{6}{5} = 1080$ seconds = $\frac{1080}{60} = 18$ minutes.

701. From the first race, while Rajat runs 100 m Sohan runs 80 m, so Rajat : Sohan = 100 : 80. From the second race, while Sohan runs 100 m Tarun runs 75 m, so Sohan : Tarun = 100 : 75. Now take a race in which Rajat covers 100 m. In that time Sohan covers 80 m, and in the time Sohan covers 80 m Tarun covers $80 \times \frac{75}{100} = 60$ m. So when Rajat finishes, Tarun has run only 60 m; Rajat beats Tarun by $100 - 60 = 40$ m.

702. Let the speeds be $3k$ m/s and $4k$ m/s. Because of the 140 m head start Meena has to run only $500 - 140 = 360$ m, while Nandini must run the full 500 m. Meena's time = $\frac{360}{3k} = \frac{120}{k}$ s and Nandini's time = $\frac{500}{4k} = \frac{125}{k}$ s. Meena's time is smaller, so Meena wins. In Meena's winning time $\frac{120}{k}$ s, Nandini covers $4k \times \frac{120}{k} = 480$ m, so she is $500 - 480 = 20$ m short of the line. Meena wins by 20 m, which is not listed, so the answer is None of these.

703. Step 1: Find the length of the track. Running in opposite directions they close a full lap at the combined speed $3 + 5 = 8$ m/s, so the length is $L = 8 \times 45 = 360$ m.

Step 2: Each runner is at the starting point only after completing whole laps. The first runner takes $\frac{360}{3} = 120$ s per lap and the second takes $\frac{360}{5} = 72$ s per lap. They are together at the start at the LCM of 120 and 72, which is 360 seconds = 6 minutes.

704. In the first race Ramesh runs 1000 m in exactly the time Suresh runs $1000 - 200 = 800$ m. Since the times are equal, Ramesh's speed : Suresh's speed = $1000 : 800 = 5 : 4$. For a dead heat, both must take the same time, so the distances they run must be in the ratio 5 : 4. If Ramesh runs 600 m, Suresh must run $600 \times \frac{4}{5} = 480$ m. Hence the start to be given = $600 - 480 = 120$ m.

705. A runner returns to the starting point only at whole multiples of his own lap time. Lap times are $\frac{500}{3}$ s, $\frac{500}{4} = 125$ s and $\frac{500}{5} = 100$ s. The required instant is the LCM of these three times, which for fractions equals $\frac{\text{LCM of numerators}}{\text{HCF of denominators}} = \frac{500}{1} = 500$ s. Check: in 500 s the runners complete $\frac{500}{500/3} = 3$, $\frac{500}{125} = 4$ and $\frac{500}{100} = 5$ complete laps, all whole numbers. Hence 500 seconds.

706. From the first race, Arun : Bharat = $400 : 360 = 10 : 9$. From the second race, Bharat : Chirag = $300 : 270 = 10 : 9$. Combining, $\frac{\text{Arun}}{\text{Chirag}} = \frac{10}{9} \times \frac{10}{9} = \frac{100}{81}$, so Arun : Chirag = 100 : 81. In the time Arun covers 600 m, Chirag covers $600 \times \frac{81}{100} = 486$ m. Therefore Arun beats Chirag by $600 - 486 = 114$ m.

707. Speeds: 36 km/h = $36 \times \frac{5}{18} = 10$ m/s and 45 km/h = $45 \times \frac{5}{18} = 12.5$ m/s. Relative speed = $12.5 - 10 = 2.5$ m/s. Total time = $20 \times 60 = 1200$ s, so the extra distance gained by the faster rider = $2.5 \times 1200 = 3000$ m. Each overtake needs a gain of one full lap, 400 m, and $\frac{3000}{400} = 7.5$. Only complete gains count, so the faster cyclist overtakes the slower one 7 times.

708. Let the track be L and the speeds $5v$ and $7v$. Running in opposite directions they meet whenever their combined distance is a whole number of laps, i.e. at times $t_k = \frac{kL}{12v}$ for $k = 1, 2, 3, \dots$. At time t_k Sameer has run $5v \cdot t_k = \frac{5kL}{12}$, so the meeting point lies at a distance $\frac{5k}{12}L$ from the start (measured along Sameer's direction), taken modulo L . Since $\gcd(5, 12) = 1$, the fractions $\frac{5k}{12} \pmod{1}$ run through

all of $\frac{0}{12}, \frac{1}{12}, \dots, \frac{11}{12}$ before repeating. Hence there are 12 distinct meeting points, i.e. the sum of the terms of the reduced speed ratio, $5 + 7 = 12$.

709. Let Pramod take p seconds and Ravi take q seconds for the full 1600 m.

Second situation (start measured in time): both run 1600 m, but Ravi begins 8 minutes = 480 s earlier and they finish together, so $480 + p = q$, i.e. $q = p + 480$.

First situation (start measured in distance): Ravi has to run only $1600 - 400 = 1200$ m. Since he covers 1600 m in q s, he covers 1200 m in $\frac{1200}{1600}q = \frac{3q}{4}$ s. Pramod finishes 2 minutes = 120 s earlier, so $p = \frac{3q}{4} - 120$.

Substituting $q = p + 480$: $p = \frac{3(p + 480)}{4} - 120 = \frac{3p}{4} + 360 - 120$, so $\frac{p}{4} = 240$ and $p = 960$ s = 16 minutes.

Check: $q = 960 + 480 = 1440$ s = 24 min, so Ravi's speed = $\frac{1600}{1440} = \frac{10}{9}$ m/s and he needs $1200 \times \frac{9}{10} = 1080$ s for 1200 m, which is $1080 - 960 = 120$ s = 2 minutes more than Pramod. Hence 16 minutes.

710. Two runners moving in the same direction are together again whenever the faster has gained a whole number of laps on the slower, i.e. at multiples of $\frac{L}{\text{difference of speeds}}$.

Anil and Bala: difference $5 - 3 = 2$ m/s, so they meet every $\frac{400}{2} = 200$ s.

Bala and Chandra: difference $7 - 5 = 2$ m/s, so they meet every $\frac{400}{2} = 200$ s.

Anil and Chandra: difference $7 - 3 = 4$ m/s, so they meet every $\frac{400}{4} = 100$ s.

All three coincide when all three conditions hold together, i.e. at the LCM of 200, 200 and 100, which is 200 seconds.

Check: in 200 s they cover 600 m, 1000 m and 1400 m; reducing modulo 400 gives 200 m, 200 m and 200 m, so all three are indeed at the same point 200 m from the start. At 100 s the positions are 300 m, 100 m and 300 m, so they are not all together then. Hence 200 seconds.

711. Let Farhan's speed be v m/s. Then Deepak's speed = $v + 25\%$ of $v = \frac{5v}{4}$ m/s. Deepak runs the full 5000 m, taking $\frac{5000}{5v/4} = \frac{5000 \times 4}{5v} = \frac{4000}{v}$ seconds. Because of the 1 km head start Farhan runs only $5000 - 1000 = 4000$ m, taking $\frac{4000}{v}$ seconds. The two times are exactly equal, so neither runner wins: the race ends in a dead heat.

712. Let Amit's and Bipin's speeds be a and b m/s.

Dead-heat condition: Amit runs 800 m in the same time that Bipin runs $800 - 160 = 640$ m, so $\frac{800}{a} = \frac{640}{b}$, giving $\frac{a}{b} = \frac{800}{640} = \frac{5}{4}$, i.e. $b = \frac{4a}{5}$.

Second condition: with a 100 m start Bipin runs 700 m in time $\frac{700}{b} = \frac{700 \times 5}{4a} = \frac{875}{a}$ s, while Amit takes $\frac{800}{a}$ s. The difference is 15 s: $\frac{875}{a} - \frac{800}{a} = 15 \Rightarrow \frac{75}{a} = 15 \Rightarrow a = 5$ m/s.

Check: $a = 5$, $b = 4$; Amit takes 160 s, Bipin takes $\frac{700}{4} = 175$ s, a gap of 15 s, and $\frac{640}{4} = 160$ s confirms the dead heat.

713. Step 1: Time of first meeting. Relative speed = $10 - 4 = 6$ m/s and the faster runner must gain one full lap of 300 m, so the meeting occurs after $\frac{300}{6} = 50$ seconds.

Step 2: Locate the point. In 50 s the slower runner covers $4 \times 50 = 200$ m, which is less than one lap, so he is 200 m from the start. (Check with the faster runner: $10 \times 50 = 500$ m = $300 + 200$, i.e. one complete lap plus 200 m, the same point.) Hence they meet 200 m from the starting point.

714. For the same distance, time is inversely proportional to speed, so Sunil's time : Tarun's time = $4 : 5$. Let Tarun's time be t seconds; then Sunil's time is $\frac{4t}{5}$ seconds. Taking the moment Tarun starts

as $t = 0$, Sunil starts at 180 s and finishes at $180 + \frac{4t}{5}$, while Tarun finishes at t . Sunil finishes 120 s earlier, so $180 + \frac{4t}{5} = t - 120$. Then $300 = t - \frac{4t}{5} = \frac{t}{5}$, giving $t = 1500$ s = 25 minutes. (Check: Sunil's time = 1200 s = 20 min; he starts at 3 min and finishes at 23 min, which is 2 min before Tarun's 25 min.)

Subtopic 1.7.1

715. Let the number of pens sold be x . Each pen fetches Rs. 15, so the total collection is $15x$. Given $15x = 675$. Dividing both sides by 15, $x = \frac{675}{15} = 45$. Hence 45 pens were sold, which is option C.

716. Bring the x terms to the left and the constants to the right. Subtracting $4x$ from both sides gives $7x - 4x - 9 = 12$, i.e. $3x - 9 = 12$. Adding 9 to both sides gives $3x = 21$. Dividing by 3, $x = 7$. Check: LHS = $7(7) - 9 = 40$ and RHS = $4(7) + 12 = 40$, so $x = 7$ is correct.

717. Let the numbers be x (larger) and y (smaller). Then $x + y = 48$ and $x - y = 12$. Adding the two equations eliminates y : $2x = 60$, so $x = 30$. Substituting back, $y = 48 - 30 = 18$. The larger number is 30. Check: $30 + 18 = 48$ and $30 - 18 = 12$.

718. Let the cost of one pen be Rs. p . Four notebooks cost $4 \times 50 =$ Rs. 200. So the equation is $200 + 3p = 290$. Subtracting 200 from both sides, $3p = 90$, hence $p = 30$. One pen costs Rs. 30.

719. Subtract 5 from both sides: $\frac{2x}{3} = 8$. Multiply both sides by 3: $2x = 24$. Divide by 2: $x = 12$. Check: $\frac{2 \times 12}{3} + 5 = 8 + 5 = 13$.

720. Let Suresh's commission be s thousand rupees. Then Deepak's is $s + 15$. Their total is $s + (s + 15) = 85$, i.e. $2s + 15 = 85$. Subtracting 15, $2s = 70$, so $s = 35$. Suresh earned Rs. 35 thousand and Deepak Rs. 50 thousand, which indeed differ by 15 and total 85.

721. Expand both sides: $5y - 15 = 3y + 3$. Subtract $3y$ from both sides: $2y - 15 = 3$. Add 15: $2y = 18$, so $y = 9$. Check: LHS = $5(9 - 3) = 30$ and RHS = $3(9 + 1) = 30$, so $y = 9$ is correct.

722. Let Anita's present age be a years, so her father's present age is $3a$ years. After 12 years their ages will be $a + 12$ and $3a + 12$. The condition gives $3a + 12 = 2(a + 12)$. Expanding, $3a + 12 = 2a + 24$. Subtracting $2a$ and 12 from both sides, $a = 12$. So Anita is 12 and her father is 36. Check: after 12 years they will be 24 and 48, and $48 = 2 \times 24$.

723. Let the breadth be b metres; then the length is $2b + 5$ metres. Perimeter of a rectangle is $2(\text{length} + \text{breadth})$, so $2(2b + 5 + b) = 100$, i.e. $2(3b + 5) = 100$. Dividing by 2, $3b + 5 = 50$, so $3b = 45$ and $b = 15$. Then the length is $2(15) + 5 = 35$ metres. Check: perimeter = $2(35 + 15) = 100$ m.

724. Let the tens digit be t and the units digit be u , so the number is $10t + u$ and the reversed number is $10u + t$. Given $t + u = 11$. The second condition gives $(10u + t) - (10t + u) = 27$, i.e. $9u - 9t = 27$, so $u - t = 3$. Adding $t + u = 11$ and $u - t = 3$ gives $2u = 14$, so $u = 7$ and $t = 4$. The original number is 47. Check: digits sum to 11 and $74 - 47 = 27$.

725. Let the numerator be n ; then the denominator is $n + 5$ and the fraction is $\frac{n}{n + 5}$. Adding 3 to both parts gives $\frac{n + 3}{n + 8} = \frac{3}{4}$. Cross-multiplying, $4(n + 3) = 3(n + 8)$, i.e. $4n + 12 = 3n + 24$, so $n = 12$. The original fraction is $\frac{12}{17}$. Check: $\frac{12 + 3}{17 + 3} = \frac{15}{20} = \frac{3}{4}$.

726. Let Arun's share be Rs. a . Then Bhavna gets $a + 500$ and Chetan gets $2(a + 500) = 2a + 1000$. The total is $a + (a + 500) + (2a + 1000) = 6300$, i.e. $4a + 1500 = 6300$. So $4a = 4800$ and $a = 1200$. Bhavna gets 1700 and Chetan gets $2 \times 1700 =$ Rs. 3,400. Check: $1200 + 1700 + 3400 = 6300$.

727. Let the number of Rs. 5 coins be x and the number of Rs. 10 coins be y . Then $x + y = 60$ and $5x + 10y = 480$. Multiply the first equation by 5: $5x + 5y = 300$. Subtracting this from the value

equation gives $5y = 180$, so $y = 36$ and $x = 24$. Check: $24 \times 5 + 36 \times 10 = 120 + 360 = 480$. So there are 36 coins of Rs. 10.

728. Let Sunil's salary be s and Anil's be a . The conditions give $s + 20000 = 2a$ and $a + 10000 = s$. Substituting $s = a + 10000$ into the first equation: $a + 10000 + 20000 = 2a$, i.e. $a + 30000 = 2a$, so $a = 30000$ and $s = 40000$. Check: $40000 + 20000 = 60000 = 2 \times 30000$, and $30000 + 10000 = 40000$. Sunil's salary is Rs. 40,000, which is not listed, so the answer is None of these.

729. Let the savings be $5x$ and $7x$. After each saves Rs. 3,000 more, $\frac{5x+3000}{7x+3000} = \frac{11}{15}$. Cross-multiplying, $15(5x+3000) = 11(7x+3000)$, i.e. $75x + 45000 = 77x + 33000$. So $12000 = 2x$ and $x = 6000$. Kavita's savings are $7x =$ Rs. 42,000 (Priya's are Rs. 30,000). Check: $\frac{33000}{45000} = \frac{11}{15}$.

730. Let the present ages be m and s years. Ten years ago: $m - 10 = 4(s - 10)$, so $m = 4s - 30$. Ten years hence: $m + 10 = 2(s + 10)$, so $m = 2s + 10$. Equating the two expressions for m : $4s - 30 = 2s + 10$, giving $2s = 40$ and $s = 20$. Then $m = 2(20) + 10 = 50$. The sum is $50 + 20 = 70$. Check: ten years ago $40 = 4 \times 10$; ten years hence $60 = 2 \times 30$.

731. Let a chair cost c and a table cost t . Then $2c + 3t = 12000$ and $3c + 2t = 10500$. Multiply the first by 3 and the second by 2: $6c + 9t = 36000$ and $6c + 4t = 21000$. Subtracting, $5t = 15000$, so $t = 3000$. Substituting into $2c + 3t = 12000$: $2c + 9000 = 12000$, so $c = 1500$. Hence $7c + 8t = 7(1500) + 8(3000) = 10500 + 24000 =$ Rs. 34,500.

732. Let the tens digit be t and the units digit be u , so the number is $10t + u$. First condition: $10t + u = 4(t + u)$, i.e. $10t + u = 4t + 4u$, so $6t = 3u$ and $u = 2t$. Second condition: $10t + u + 27 = 10u + t$, i.e. $9u - 9t = 27$, so $u - t = 3$. Substituting $u = 2t$ gives $2t - t = 3$, so $t = 3$ and $u = 6$. The number is 36. Note that 24 and 48 also satisfy the first condition but fail the reversal condition ($24 + 27 = 51 \neq 42$; $48 + 27 = 75 \neq 84$), while $36 + 27 = 63$ is indeed the reversal.

733. Let the number of clerks be c and officers be o . Then $c + o = 45$ and $1200c + 2000o = 68400$. From the first equation $c = 45 - o$. Substituting: $1200(45 - o) + 2000o = 68400$, i.e. $54000 + 800o = 68400$. So $800o = 14400$ and $o = 18$, giving $c = 27$. Check: $27 \times 1200 + 18 \times 2000 = 32400 + 36000 = 68400$. Since 27 is not among the first four options, the answer is None of these.

734. Let the first part be Rs. x ; the second part is $24000 - x$. The condition gives $\frac{2x}{5} - \frac{24000 - x}{3} = 3000$. Multiplying throughout by 15: $6x - 5(24000 - x) = 45000$, i.e. $6x - 120000 + 5x = 45000$. So $11x = 165000$ and $x = 15000$. The second part is $24000 - 15000 =$ Rs. 9,000, which is the smaller part. Check: $\frac{2}{5}(15000) = 6000$ and $\frac{1}{3}(9000) = 3000$, and $6000 - 3000 = 3000$.

735. A pair $a_1x + b_1y = c_1$ and $a_2x + b_2y = c_2$ has infinitely many solutions when $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$. Here that means $\frac{2}{k-1} = \frac{3}{k+2} = \frac{7}{3k}$. From the first equality, $2(k+2) = 3(k-1)$, i.e. $2k + 4 = 3k - 3$, so $k = 7$. Verify with the third ratio: $\frac{3}{k+2} = \frac{3}{9} = \frac{1}{3}$ and $\frac{7}{3k} = \frac{7}{21} = \frac{1}{3}$, which agree. Hence $k = 7$.

Subtopic 1.7.2

736. Factorise $x^2 - 13x + 42 = 0$. We need two numbers whose product is 42 and whose sum is 13. These are 6 and 7. So $x^2 - 6x - 7x + 42 = 0$, i.e. $x(x - 6) - 7(x - 6) = 0$, giving $(x - 6)(x - 7) = 0$. Hence $x = 6$ or $x = 7$. Option (C) is rejected because $3 + 14 = 17 \neq 13$ and option (D) because $2 + 21 = 23 \neq 13$.

737. For $ax^2 + bx + c = 0$ the discriminant is $D = b^2 - 4ac$. Here $a = 2$, $b = -7$, $c = 5$, so $D = (-7)^2 - 4 \times 2 \times 5 = 49 - 40 = 9$. Since $D > 0$ the roots are real and unequal; and since $D = 9$ is a perfect square (and the coefficients are rational), the roots are also rational. Indeed $x = \frac{7 \pm 3}{4}$, i.e. $x = \frac{5}{2}$ or $x = 1$ – both rational and distinct.

738. For $ax^2 + bx + c = 0$, the sum of the roots is $-\frac{b}{a}$ and the product is $\frac{c}{a}$. Here $a = 5$, $b = -20$, $c = 12$. Sum $= -\frac{-20}{5} = 4$. (Option (C), $\frac{12}{5}$, is the product of the roots, not the sum, so it is a distractor.)

739. If the roots are α and β , the equation is $x^2 - (\alpha + \beta)x + \alpha\beta = 0$. Here $\alpha + \beta = 3 + (-8) = -5$ and $\alpha\beta = 3 \times (-8) = -24$. So the equation is $x^2 - (-5)x + (-24) = 0$, i.e. $x^2 + 5x - 24 = 0$. Check: $(x + 8)(x - 3) = x^2 + 5x - 24$, whose roots are -8 and 3 .

740. Roots are equal when the discriminant is zero: $D = b^2 - 4ac = 0$. Here $a = 1$, $b = -k$, $c = 16$, so $k^2 - 4 \times 1 \times 16 = 0$, i.e. $k^2 = 64$, so $k = \pm 8$. Since k is positive, $k = 8$. Verification: $x^2 - 8x + 16 = (x - 4)^2 = 0$ has the repeated root $x = 4$.

741. From I: $x^2 - 7x + 12 = (x - 3)(x - 4) = 0$, so $x = 3$ or $x = 4$. From II: $y^2 - 9y + 20 = (y - 4)(y - 5) = 0$, so $y = 4$ or $y = 5$. Now compare every pair: $3 < 4$, $3 < 5$, $4 = 4$, $4 < 5$. In no case is x greater than y , and in one case they are equal, so the strict relation $x < y$ is not always true. The correct relation is $x \leq y$.

742. For $ax^2 + bx + c = 0$, the product of the roots is $\frac{c}{a}$. Here $a = 7$ and $c = -21$, so the product $= \frac{-21}{7} = -3$. (Option (C) is $\frac{b}{a}$ with a sign change, i.e. the sum of the roots $-\frac{9}{7}$, and is therefore a distractor.)

743. From the equation, $\alpha + \beta = -\frac{-6}{1} = 6$ and $\alpha\beta = \frac{4}{1} = 4$. Use the identity $\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$. Substituting, $\alpha^2 + \beta^2 = 6^2 - 2 \times 4 = 36 - 8 = 28$. (Note that 36 is $(\alpha + \beta)^2$, not $\alpha^2 + \beta^2$.)

744. From I: $D = (-11)^2 - 4 \times 2 \times 15 = 121 - 120 = 1$, so $x = \frac{11 \pm 1}{4}$, giving $x = 3$ or $x = \frac{5}{2} = 2.5$. From II: $D = (-7)^2 - 4 \times 2 \times 6 = 49 - 48 = 1$, so $y = \frac{7 \pm 1}{4}$, giving $y = 2$ or $y = \frac{3}{2} = 1.5$. The smallest value of x is 2.5 and the largest value of y is 2. Since $2.5 > 2$, every value of x exceeds every value of y . Hence $x > y$.

745. Let the roots be a and $a + 3$. Sum of roots $= -\frac{-11}{1} = 11$, so $a + (a + 3) = 11$, i.e. $2a = 8$, so $a = 4$. The roots are therefore 4 and 7. Product of roots $= \frac{k}{1} = k$, so $k = 4 \times 7 = 28$. Check: $x^2 - 11x + 28 = (x - 4)(x - 7)$, and $7 - 4 = 3$ as required.

746. For equal roots, $D = 0$. Here $a = 1$, $b = 2(k + 2)$, $c = 9k$, so $D = 4(k + 2)^2 - 36k = 0$. Dividing by 4: $(k + 2)^2 - 9k = 0$, i.e. $k^2 + 4k + 4 - 9k = 0$, i.e. $k^2 - 5k + 4 = 0$. Factorising, $(k - 1)(k - 4) = 0$, so $k = 1$ or $k = 4$. Both are valid, and their sum is $1 + 4 = 5$. (Alternatively, from $k^2 - 5k + 4 = 0$ the sum of its roots is directly 5.)

747. Here $\alpha + \beta = \frac{9}{2}$ and $\alpha\beta = \frac{7}{2}$. Now $\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha + \beta}{\alpha\beta} = \frac{9/2}{7/2} = \frac{9}{7}$. Verification by actually solving: $2x^2 - 9x + 7 = (2x - 7)(x - 1)$, so the roots are $\frac{7}{2}$ and 1; then $\frac{2}{7} + 1 = \frac{9}{7}$.

748. Let the number of notebooks bought be x . Then the price per notebook is $\frac{1200}{x}$ rupees, and in the second case it is $\frac{1200}{x + 10}$ rupees. Given $\frac{1200}{x} - \frac{1200}{x + 10} = 4$. Multiplying through by $x(x + 10)$: $1200(x + 10) - 1200x = 4x(x + 10)$, i.e. $12000 = 4x^2 + 40x$. Dividing by 4: $x^2 + 10x - 3000 = 0$. Then $D = 100 + 12000 = 12100$ and $\sqrt{12100} = 110$, so $x = \frac{-10 \pm 110}{2}$. Rejecting the negative root, $x = 50$. Check: $\frac{1200}{50} = 24$ and $\frac{1200}{60} = 20$, a difference of Rs. 4.

749. Let the roots be a and $5a$. Product of roots $= 20$, so $a \times 5a = 20$, i.e. $5a^2 = 20$, so $a^2 = 4$ and $a = \pm 2$. Sum of roots $= p$, so $a + 5a = 6a = p$. If $a = 2$, then $p = 12$; if $a = -2$, then $p = -12$. Since p is positive, $p = 12$. Check: $x^2 - 12x + 20 = (x - 2)(x - 10)$, and $2 : 10 = 1 : 5$.

750. From the equation, $\alpha + \beta = 7$ and $\alpha\beta = 5$. Use the identity $\alpha^3 + \beta^3 = (\alpha + \beta)^3 - 3\alpha\beta(\alpha + \beta)$. Substituting, $\alpha^3 + \beta^3 = 7^3 - 3 \times 5 \times 7 = 343 - 105 = 238$. (A common error is to forget the factor 3, which would give $343 - 35 = 308$, option (D).)

751. From the given equation, $\alpha + \beta = 8$ and $\alpha\beta = 5$. For the new equation, the sum of the roots is $\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2 + \beta^2}{\alpha\beta} = \frac{(\alpha + \beta)^2 - 2\alpha\beta}{\alpha\beta} = \frac{64 - 10}{5} = \frac{54}{5}$. The product of the new roots is $\frac{\alpha}{\beta} \times \frac{\beta}{\alpha} = 1$. Hence the required equation is $x^2 - \frac{54}{5}x + 1 = 0$; multiplying through by 5 to clear the fraction gives $5x^2 - 54x + 5 = 0$. (Option (D) keeps the sum $\frac{54}{5}$ but drops the denominator, and is therefore a distractor.)

752. From I: $D = (-19)^2 - 4 \times 3 \times 28 = 361 - 336 = 25$, so $x = \frac{19 \pm 5}{6}$, giving $x = 4$ or $x = \frac{14}{6} = \frac{7}{3} \approx 2.33$. From II: $D = 81 - 80 = 1$, so $y = \frac{9 \pm 1}{4}$, giving $y = \frac{5}{2} = 2.5$ or $y = 2$. Now compare: taking $x = \frac{7}{3} \approx 2.33$ and $y = 2.5$ gives $x < y$, but taking $x = 4$ and $y = 2$ gives $x > y$. Since both directions occur, no consistent relationship exists.

753. The discriminant is $D = (k - 3)^2 - 4k = k^2 - 6k + 9 - 4k = k^2 - 10k + 9 = (k - 1)(k - 9)$. The roots are imaginary when $D < 0$, i.e. when $(k - 1)(k - 9) < 0$, which holds for $1 < k < 9$. Among the options only $k = 5$ lies strictly between 1 and 9. Checking the others: $k = 0$ gives $D = 9 > 0$ (real, distinct); $k = 1$ gives $D = 0$ (real, equal); $k = 9$ gives $D = 0$ (real, equal); $k = 10$ gives $D = 9 > 0$ (real, distinct). For $k = 5$, $D = 25 - 50 + 9 = -16 < 0$, so the roots are imaginary.

754. Let the original speed be x km/h. The time taken is $\frac{300}{x}$ hours, and at the increased speed it is $\frac{300}{x+5}$ hours. Given $\frac{300}{x} - \frac{300}{x+5} = 2$. Multiplying through by $x(x+5)$: $300(x+5) - 300x = 2x(x+5)$, i.e. $1500 = 2x^2 + 10x$. Dividing by 2: $x^2 + 5x - 750 = 0$. Then $D = 25 + 3000 = 3025$ and $\sqrt{3025} = 55$, so $x = \frac{-5 \pm 55}{2}$, giving $x = 25$ or $x = -30$. A speed cannot be negative, so $x = 25$. Check: $\frac{300}{25} = 12$ hours and $\frac{300}{30} = 10$ hours, a difference of 2 hours. (Note that 30, option (C), is the increased speed, not the original one.)

755. First solve the equation that is fully known: $x^2 - 5x + 6 = (x - 2)(x - 3) = 0$, so its roots are 2 and 3. The common root must be one of these. If the common root is $x = 2$: substituting into $2x^2 - 9x + k = 0$ gives $2(4) - 9(2) + k = 8 - 18 + k = 0$, so $k = 10$. If the common root is $x = 3$: $2(9) - 9(3) + k = 18 - 27 + k = 0$, so $k = 9$. Both values are admissible, and their sum is $10 + 9 = 19$.

756. The discriminant is $D = [-(k + 1)]^2 - 4(k - 2) = k^2 + 2k + 1 - 4k + 8 = k^2 - 2k + 9$. Complete the square: $k^2 - 2k + 9 = (k - 1)^2 + 8$. Since $(k - 1)^2 \geq 0$ for every real k , we get $D \geq 8 > 0$ always. A strictly positive discriminant means the roots are real and distinct for every real value of k . This rules out (A) (equal roots would need $D = 0$, which never happens), (C) (imaginary roots would need $D < 0$), and (D) (for example $k = 0$ gives $D = 9 > 0$, so the roots are real even though $k < 2$).

Subtopic 1.7.3

757. Equation I: $x^2 - 7x + 12 = 0$ factorises as $(x - 3)(x - 4) = 0$, so $x = 3$ or $x = 4$. Equation II: $y^2 - 9y + 20 = 0$ factorises as $(y - 4)(y - 5) = 0$, so $y = 4$ or $y = 5$. Now compare the largest value of x with the smallest value of y : the largest x is 4 and the smallest y is 4. Since $x_{\max} = y_{\min}$, no value of x can exceed a value of y , and equality does occur for the pair (4, 4). Checking every pair: $3 < 4$, $3 < 5$, $4 = 4$, $4 < 5$. Hence $x \leq y$.

758. Equation I: two numbers with sum 10 and product 21 are 3 and 7, so $(x - 3)(x - 7) = 0$ and $x = 3$ or $x = 7$. Equation II: two numbers with sum 5 and product 6 are 2 and 3, so $(y - 2)(y - 3) = 0$ and $y = 2$ or $y = 3$. The smallest value of x is 3 and the largest value of y is 3, so x never falls below

y . Pairwise: $3 > 2$, $3 = 3$, $7 > 2$, $7 > 3$. Because equality is attained for the pair $(3, 3)$, the strict relation $x > y$ fails and the exact relation is $x \geq y$.

759. Equation I: $x^2 - 11x + 30 = 0$ gives $(x - 5)(x - 6) = 0$, so $x = 5$ or $x = 6$. Equation II: $y^2 - 7y + 10 = 0$ gives $(y - 2)(y - 5) = 0$, so $y = 2$ or $y = 5$. The smallest value of x is 5 and the largest value of y is 5, so x never falls below y . Pairwise: $5 > 2$, $5 = 5$, $6 > 2$, $6 > 5$. Because equality is attained once, the exact relation is $x \geq y$, not the strict $x > y$.

760. Equation I: split the middle term, $3x^2 - 6x - 4x + 8 = 0$, i.e. $3x(x - 2) - 4(x - 2) = 0$, so $(3x - 4)(x - 2) = 0$ and $x = \frac{4}{3}$ or $x = 2$. Equation II: $2y^2 - 3y - 2y + 3 = 0$, i.e. $(2y - 3)(y - 1) = 0$, so $y = \frac{3}{2}$ or $y = 1$. Now test the pairs: with $x = \frac{4}{3} \approx 1.33$ and $y = 1.5$ we get $x < y$; with $x = 2$ and $y = 1$ we get $x > y$. Two opposite outcomes occur, so no single relation holds and the relationship cannot be established.

761. Equation I: two numbers with sum 15 and product 56 are 7 and 8, so $(x - 7)(x - 8) = 0$ and $x = 7$ or $x = 8$. Equation II: two numbers with sum 5 and product 6 are 2 and 3, so $y = 2$ or $y = 3$. The smallest x is 7 and the largest y is 3; since $7 > 3$, every value of x exceeds every value of y . No equality is possible, so the strict relation $x > y$ holds.

762. Equation I: $(x - 1)(x - 2) = 0$, so $x = 1$ or $x = 2$. Equation II: $(y - 4)(y - 5) = 0$, so $y = 4$ or $y = 5$. The largest value of x is 2 and the smallest value of y is 4. Since $2 < 4$, every value of x is strictly less than every value of y , and equality never occurs. Hence $x < y$.

763. Equation I: a cube root has a single real value. Since $14 \times 14 \times 14 = 2744$, we get $x = 14$. Equation II: a square gives two roots, $y = +13$ or $y = -13$, because $13^2 = 169$ and $(-13)^2 = 169$. Compare: $14 > 13$ and $14 > -13$. Every value of x exceeds every value of y with no equality, so $x > y$.

764. Equation I: split $-19x$ as $-10x - 9x$: $6x^2 - 10x - 9x + 15 = 0$, i.e. $2x(3x - 5) - 3(3x - 5) = 0$, so $(2x - 3)(3x - 5) = 0$ and $x = \frac{3}{2} = 1.5$ or $x = \frac{5}{3} \approx 1.67$. Equation II: split $-8y$ as $-2y - 6y$: $4y^2 - 2y - 6y + 3 = 0$, i.e. $2y(2y - 1) - 3(2y - 1) = 0$, so $(2y - 1)(2y - 3) = 0$ and $y = 0.5$ or $y = 1.5$. The smallest x is 1.5 and the largest y is 1.5, so x is never below y , and equality occurs for the pair $(1.5, 1.5)$. Therefore $x \geq y$.

765. For surd quadratics, look for roots that are multiples of $\sqrt{3}$. Equation I: try $x = a\sqrt{3}$ and $x = b\sqrt{3}$ with $a + b = 8$ and $ab \times 3 = 45$, so $ab = 15$. Then $a = 5, b = 3$, giving $x = 5\sqrt{3} \approx 8.66$ or $x = 3\sqrt{3} \approx 5.20$. Equation II: $a + b = 6$ and $ab \times 3 = 24$, so $ab = 8$, giving $a = 4, b = 2$ and $y = 4\sqrt{3} \approx 6.93$ or $y = 2\sqrt{3} \approx 3.46$. Now compare: $5\sqrt{3} > 4\sqrt{3}$ gives $x > y$, but $3\sqrt{3} < 4\sqrt{3}$ gives $x < y$. Since both directions occur, no relation can be established.

766. Equation I: the left side combines to $\frac{14}{\sqrt{x}} = \sqrt{x}$. Multiplying both sides by $\sqrt{x}$ gives $14 = x$, so $x = 14$. Equation II: put $t = \sqrt{y}$, so $t + \frac{35}{t} = 12$. Multiplying by t gives $t^2 - 12t + 35 = 0$, i.e. $(t - 5)(t - 7) = 0$, so $t = 5$ or $t = 7$. Squaring back, $y = 25$ or $y = 49$ (both positive, so both are valid). Since $14 < 25$ and $14 < 49$, we get $x < y$ in every case.

767. Equation I: the discriminant is $37^2 - 4(342) = 1369 - 1368 = 1$, so $x = \frac{37 \pm 1}{2}$, giving $x = 19$ or $x = 18$. (Check: $18 \times 19 = 342$ and $18 + 19 = 37$.) Equation II: two numbers with sum 15 and product 56 are 7 and 8, so $y = 7$ or $y = 8$. The smallest x is 18 and the largest y is 8; since $18 > 8$, every value of x exceeds every value of y and equality is impossible. Hence $x > y$.

768. Equation I: both signs are positive, so both roots are negative. $(x + 6)(x + 7) = 0$ gives $x = -6$ or $x = -7$. Equation II: $(y + 5)(y + 6) = 0$ gives $y = -5$ or $y = -6$. Remember that with negative numbers the one closer to zero is larger, so the largest x is -6 and the smallest y is -6 . Pairwise: $-6 > -5$? No, $-6 < -5$; $-6 = -6$; $-7 < -5$; $-7 < -6$. So x never exceeds y and equality occurs once, giving $x \leq y$.

769. Equation I: $(x-2)(x-4) = 0$, so $x = 2$ or $x = 4$. Equation II: this is a perfect square, $(y-3)^2 = 0$, so $y = 3$ is a repeated root and that is the only value. Now test each listed option. With $x = 2$ we get $2 < 3$, so $x > y$ is false and $x \geq y$ is false. With $x = 4$ we get $4 > 3$, so $x < y$ is false. The two values of x are never equal to 3, so $x = y$ is false. Every listed relation fails, therefore the answer is None of these (the relationship cannot be established).

770. Equation I: 9261 ends in 1, so its cube root ends in 1; and $20^3 = 8000$ while $22^3 = 10648$, so the cube root lies between them. Indeed $21^3 = 9261$, so $x = 21$. Equation II: the discriminant is $45^2 - 4(506) = 2025 - 2024 = 1$, so $y = \frac{45 \pm 1}{2}$, giving $y = 23$ or $y = 22$. (Check: $22 \times 23 = 506$.) Since $21 < 22$ and $21 < 23$, we get $x < y$ with no equality.

771. Look for roots of the form $a\sqrt{5}$. Equation I: if the roots are $a\sqrt{5}$ and $b\sqrt{5}$, then $a + b = 7$ and $(a\sqrt{5})(b\sqrt{5}) = 5ab = 60$, so $ab = 12$. Thus $a = 4, b = 3$ and $x = 4\sqrt{5} \approx 8.94$ or $x = 3\sqrt{5} \approx 6.71$. Equation II: $a + b = 9$ and $5ab = 100$, so $ab = 20$, giving $a = 5, b = 4$ and $y = 5\sqrt{5} \approx 11.18$ or $y = 4\sqrt{5} \approx 8.94$. The largest x is $4\sqrt{5}$ and the smallest y is $4\sqrt{5}$, so x never exceeds y , and equality occurs for the pair $(4\sqrt{5}, 4\sqrt{5})$. Hence $x \leq y$.

772. Equation I: put $t = \frac{x+2}{x-2}$, so the equation becomes $t + \frac{1}{t} = \frac{34}{15}$. Multiplying by $15t$ gives $15t^2 - 34t + 15 = 0$, whose discriminant is $1156 - 900 = 256$, so $t = \frac{34 \pm 16}{30}$, i.e. $t = \frac{5}{3}$ or $t = \frac{3}{5}$. If $\frac{x+2}{x-2} = \frac{5}{3}$ then $3x + 6 = 5x - 10$, so $x = 8$. If $\frac{x+2}{x-2} = \frac{3}{5}$ then $5x + 10 = 3x - 6$, so $x = -8$. Both keep the denominators non-zero, so $x = 8$ or $x = -8$. Equation II: $(y-7)(y-8) = 0$, so $y = 7$ or $y = 8$. Testing pairs: $x = 8, y = 7$ gives $x > y$, while $x = -8, y = 7$ gives $x < y$. Opposite outcomes occur, so no relation can be established.

773. Equation I: write it as $\sqrt{x+7} = 7 - \sqrt{x}$ and square both sides: $x+7 = 49 - 14\sqrt{x} + x$. The x terms cancel, leaving $14\sqrt{x} = 42$, so $\sqrt{x} = 3$ and $x = 9$. Verify: $\sqrt{16} + \sqrt{9} = 4 + 3 = 7$, so $x = 9$ is genuine. Equation II: $(y-9)(y+1) = 0$, so $y = 9$ or $y = -1$. Compare: $9 = 9$ and $9 > -1$. Since x is never smaller than y but equality does occur, the exact relation is $x \geq y$.

774. For surd quadratics look for roots that are multiples of $\sqrt{7}$. Equation I: if the roots are $a\sqrt{7}$ and $b\sqrt{7}$, then $a + b = 9$ and $(a\sqrt{7})(b\sqrt{7}) = 7ab = 126$, so $ab = 18$. Two numbers with sum 9 and product 18 are 3 and 6, so $x = 3\sqrt{7} \approx 7.94$ or $x = 6\sqrt{7} \approx 15.87$. Equation II: $a + b = 17$ and $7ab = 490$, so $ab = 70$; two numbers with sum 17 and product 70 are 7 and 10, giving $y = 7\sqrt{7} \approx 18.52$ or $y = 10\sqrt{7} \approx 26.46$. The largest value of x is $6\sqrt{7}$ and the smallest value of y is $7\sqrt{7}$. Since $6\sqrt{7} < 7\sqrt{7}$, every value of x is strictly less than every value of y and equality never occurs, so $x < y$.

775. Equation I: multiply throughout by x (note $x \neq 0$): $x^2 + 24 = 10x$, i.e. $x^2 - 10x + 24 = 0$. Two numbers with sum 10 and product 24 are 4 and 6, so $x = 4$ or $x = 6$. Equation II: multiply by y : $y^2 + 48 = 14y$, i.e. $y^2 - 14y + 48 = 0$. Two numbers with sum 14 and product 48 are 6 and 8, so $y = 6$ or $y = 8$. The largest x is 6 and the smallest y is 6, so x never exceeds y ; equality occurs for the pair $(6, 6)$. Hence $x \leq y$.

776. Equation I: the discriminant is $21^2 - 4(2)(54) = 441 - 432 = 9$, so $x = \frac{21 \pm 3}{4}$, giving $x = 6$ or $x = \frac{18}{4} = 4.5$. (Check at $x = 4.5$: $2(20.25) - 21(4.5) + 54 = 40.5 - 94.5 + 54 = 0$.) Equation II: the discriminant is $11^2 - 4(3)(6) = 121 - 72 = 49$, so $y = \frac{11 \pm 7}{6}$, giving $y = 3$ or $y = \frac{4}{6} = \frac{2}{3} \approx 0.67$. The smallest value of x is 4.5 and the largest value of y is 3; since $4.5 > 3$, every value of x exceeds every value of y . Equality is impossible, so the strict relation $x > y$ holds.

777. Equation I: split $-4x$ as $2x - 6x$: $4x^2 + 2x - 6x - 3 = 0$, i.e. $2x(2x+1) - 3(2x+1) = 0$, so $(2x-3)(2x+1) = 0$ and $x = \frac{3}{2}$ or $x = -\frac{1}{2}$. Equation II: split $8y$ as $2y + 6y$: $4y^2 + 2y + 6y + 3 = 0$, i.e. $2y(2y+1) + 3(2y+1) = 0$, so $(2y+1)(2y+3) = 0$ and $y = -\frac{1}{2}$ or $y = -\frac{3}{2}$. The smallest x is $-\frac{1}{2}$ and

the largest y is $-\frac{1}{2}$, so x is never less than y ; equality occurs for the pair $\left(-\frac{1}{2}, -\frac{1}{2}\right)$. Hence $x \geq y$.

Subtopic 1.7.4

778. Use the identity $(a+b)^2 = a^2 + b^2 + 2ab$. Substituting the given values, $12^2 = a^2 + b^2 + 2 \times 27$, i.e. $144 = a^2 + b^2 + 54$. Therefore $a^2 + b^2 = 144 - 54 = 90$. (As a check, a and b are the roots of $t^2 - 12t + 27 = 0$, namely $t = 9$ and $t = 3$; indeed $9^2 + 3^2 = 81 + 9 = 90$.)

779. Apply the difference-of-squares identity $x^2 - y^2 = (x-y)(x+y)$ to the numerator: $(127)^2 - (23)^2 = (127 - 23)(127 + 23) = 104 \times 150$. The expression therefore becomes $\frac{104 \times 150}{104} = 150$. Recognising the identity avoids squaring 127 and 23 separately.

780. Square both sides of the given relation. $\left(x - \frac{1}{x}\right)^2 = x^2 - 2 \cdot x \cdot \frac{1}{x} + \frac{1}{x^2} = x^2 + \frac{1}{x^2} - 2$. So $x^2 + \frac{1}{x^2} - 2 = 5^2 = 25$, giving $x^2 + \frac{1}{x^2} = 25 + 2 = 27$. Note the sign: with a minus sign inside we ADD 2, whereas from $x + \frac{1}{x} = 5$ we would subtract 2 and get 23.

781. The two expansions are $(a+b)^2 = a^2 + b^2 + 2ab$ and $(a-b)^2 = a^2 + b^2 - 2ab$. Subtracting the second from the first eliminates $a^2 + b^2$ and leaves $(a+b)^2 - (a-b)^2 = 4ab$. Hence $4ab = 169 - 25 = 144$, so $ab = \frac{144}{4} = 36$. (Consistently, $a + b = 13$ and $a - b = 5$ give $a = 9$, $b = 4$ and $ab = 36$.)

782. Rather than squaring both numbers, use $x^2 - y^2 = (x-y)(x+y)$ with $x = 305$ and $y = 295$. Then $x - y = 305 - 295 = 10$ and $x + y = 305 + 295 = 600$. So the value is $10 \times 600 = 6,000$. (Direct computation confirms this: $93,025 - 87,025 = 6,000$.)

783. Use the identity $x^3 + \frac{1}{x^3} = \left(x + \frac{1}{x}\right)^3 - 3\left(x + \frac{1}{x}\right)$, which follows from $(p+q)^3 = p^3 + q^3 + 3pq(p+q)$ with $p = x$, $q = \frac{1}{x}$ and $pq = 1$. Substituting $x + \frac{1}{x} = 4$ gives $4^3 - 3 \times 4 = 64 - 12 = 52$. The option 64 is the trap of forgetting the $-3\left(x + \frac{1}{x}\right)$ correction term.

784. Recall the identity $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$. Taking $a = 0.87$ and $b = 0.13$, the numerator equals $(a+b)(a^2 - ab + b^2)$, and the denominator is exactly the factor $a^2 - ab + b^2$. Cancelling it leaves $a + b = 0.87 + 0.13 = 1$. No decimal arithmetic is actually needed.

785. Square the given relation once: $\left(x + \frac{1}{x}\right)^2 = x^2 + \frac{1}{x^2} + 2$, so $x^2 + \frac{1}{x^2} = 3^2 - 2 = 7$. Square again: $\left(x^2 + \frac{1}{x^2}\right)^2 = x^4 + \frac{1}{x^4} + 2$, so $x^4 + \frac{1}{x^4} = 7^2 - 2 = 49 - 2 = 47$. The option 49 is the trap of stopping before subtracting 2 the second time.

786. Use the three-variable identity $(a+b+c)^2 = a^2 + b^2 + c^2 + 2(ab+bc+ca)$. Substituting, $12^2 = 64 + 2(ab+bc+ca)$, i.e. $144 = 64 + 2(ab+bc+ca)$. Hence $2(ab+bc+ca) = 144 - 64 = 80$, and so $ab+bc+ca = \frac{80}{2} = 40$. The option 80 is the trap of forgetting to divide by 2.

787. Use $a^3 + b^3 = (a+b)^3 - 3ab(a+b)$. Substituting, $a^3 + b^3 = 10^3 - 3 \times 21 \times 10 = 1000 - 630 = 370$. Since 370 is not listed among the first four options, the correct choice is "None of these". (Verification: a and b are the roots of $t^2 - 10t + 21 = 0$, i.e. 7 and 3; then $7^3 + 3^3 = 343 + 27 = 370$.)

788. Factorise every part. The numerator $x^2 - 9 = (x-3)(x+3)$ by the difference of squares. The denominator $x^2 + x - 12$ splits as $x^2 + 4x - 3x - 12 = (x+4)(x-3)$. So the first fraction is $\frac{(x-3)(x+3)}{(x+4)(x-3)} = \frac{x+3}{x+4}$ after cancelling $(x-3)$. Multiplying by $\frac{x+4}{x+3}$ cancels both remaining factors and leaves 1.

789. First rationalise $\frac{1}{x} = \frac{1}{2 + \sqrt{3}} \times \frac{2 - \sqrt{3}}{2 - \sqrt{3}} = \frac{2 - \sqrt{3}}{4 - 3} = 2 - \sqrt{3}$. Then $x + \frac{1}{x} = (2 + \sqrt{3}) + (2 - \sqrt{3}) = 4$, the surds cancelling. Now square: $x^2 + \frac{1}{x^2} = \left(x + \frac{1}{x}\right)^2 - 2 = 16 - 2 = 14$.

790. We are given $x + y = 2400$ and $x^2 - y^2 = 192000$. Since $x^2 - y^2 = (x - y)(x + y)$, we get $(x - y) \times 2400 = 192000$, so $x - y = \frac{192000}{2400} = 80$. Now add the two linear equations: $(x + y) + (x - y) = 2400 + 80$, i.e. $2x = 2480$, so $x = 1240$ and $y = 2400 - 1240 = 1160$. The larger deposit is Rs. 1,240; the value Rs. 1,160 is the smaller deposit, offered as a trap.

791. Since $x \neq 0$, divide the whole equation by x : $x - 6 + \frac{1}{x} = 0$, which gives $x + \frac{1}{x} = 6$. Now apply $x^3 + \frac{1}{x^3} = \left(x + \frac{1}{x}\right)^3 - 3\left(x + \frac{1}{x}\right) = 6^3 - 3 \times 6 = 216 - 18 = 198$. The value 216 is the trap of stopping at 6^3 without subtracting the correction term.

792. Take abc as the common denominator. Then $\frac{a^2}{bc} + \frac{b^2}{ca} + \frac{c^2}{ab} = \frac{a^3 + b^3 + c^3}{abc}$. Now use the identity $a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$. Since $a + b + c = 0$, the right side is 0, so $a^3 + b^3 + c^3 = 3abc$. The expression therefore equals $\frac{3abc}{abc} = 3$. (Check with $a = 1, b = 1, c = -2$: $\frac{1}{-2} + \frac{1}{-2} + \frac{4}{1} = -0.5 - 0.5 + 4 = 3$.)

793. Use the identity $a^2 + b^2 + c^2 - ab - bc - ca = \frac{1}{2}[(a - b)^2 + (b - c)^2 + (c - a)^2]$, which avoids squaring the large numbers. Here $a - b = 2023 - 2024 = -1$, $b - c = 2024 - 2025 = -1$ and $c - a = 2025 - 2023 = 2$. So the bracket is $(-1)^2 + (-1)^2 + 2^2 = 1 + 1 + 4 = 6$, and half of it is $\frac{6}{2} = 3$. The value 6 is the trap of forgetting the factor $\frac{1}{2}$.

794. Step 1: since $\left(x - \frac{1}{x}\right)^2 = x^2 + \frac{1}{x^2} - 2 = 27 - 2 = 25$, and $x > 1$ makes $x - \frac{1}{x}$ positive, we get $x - \frac{1}{x} = 5$. Step 2: use $p^3 - q^3 = (p - q)^3 + 3pq(p - q)$ with $p = x, q = \frac{1}{x}$, so $pq = 1$. Then $x^3 - \frac{1}{x^3} = 5^3 + 3 \times 1 \times 5 = 125 + 15 = 140$. Note the sign difference from the sum case, where the correction term is subtracted.

795. Combine the terms two at a time, each step being a difference of squares. First, $\frac{1}{a - b} + \frac{1}{a + b} = \frac{(a + b) + (a - b)}{a^2 - b^2} = \frac{2a}{a^2 - b^2}$. Adding the third term: $\frac{2a}{a^2 - b^2} + \frac{2a}{a^2 + b^2} = \frac{2a[(a^2 + b^2) + (a^2 - b^2)]}{a^4 - b^4} = \frac{2a \times 2a^2}{a^4 - b^4} = \frac{4a^3}{a^4 - b^4}$. Adding the fourth term: $\frac{4a^3}{a^4 - b^4} + \frac{4a^3}{a^4 + b^4} = \frac{4a^3[(a^4 + b^4) + (a^4 - b^4)]}{a^8 - b^8} = \frac{4a^3 \times 2a^4}{a^8 - b^8} = \frac{8a^7}{a^8 - b^8}$. The expression $\frac{4a^3}{a^4 - b^4}$ is the value after only the first three terms, offered as a trap.

796. Step 1: from $a^3 + b^3 = (a + b)^3 - 3ab(a + b)$ we get $133 = 7^3 - 3ab \times 7 = 343 - 21ab$. Hence $21ab = 343 - 133 = 210$, so $ab = 10$. Step 2: $(a - b)^2 = (a + b)^2 - 4ab = 49 - 40 = 9$, and since $a > b$, $a - b = 3$. (Verification: $a = 5, b = 2$ give $a + b = 7$ and $125 + 8 = 133$, as required.)

797. Use the identity $p^3 + q^3 + r^3 - 3pqr = (p + q + r)(p^2 + q^2 + r^2 - pq - qr - rp)$. First find $p^2 + q^2 + r^2$ from $(p + q + r)^2 = p^2 + q^2 + r^2 + 2(pq + qr + rp)$: $225 = p^2 + q^2 + r^2 + 2 \times 71$, so $p^2 + q^2 + r^2 = 225 - 142 = 83$. Then the second bracket is $83 - 71 = 12$, and the required value is $15 \times 12 = 180$. Note that pqr itself is never needed.

798. Rationalise each. $x = \frac{(\sqrt{5} + 1)^2}{(\sqrt{5} - 1)(\sqrt{5} + 1)} = \frac{5 + 2\sqrt{5} + 1}{5 - 1} = \frac{6 + 2\sqrt{5}}{4} = \frac{3 + \sqrt{5}}{2}$, and similarly

$y = \frac{3 - \sqrt{5}}{2}$. Then $x + y = \frac{(3 + \sqrt{5}) + (3 - \sqrt{5})}{2} = 3$ and $xy = \frac{9 - 5}{4} = 1$. Now $x^2 + y^2 = (x + y)^2 - 2xy = 9 - 2 = 7$, so $x^2 + xy + y^2 = 7 + 1 = 8$. (Equivalently, $x^2 + xy + y^2 = (x + y)^2 - xy = 9 - 1 = 8$.)

Subtopic 1.7.5

799. The monthly deposits form an AP with first term $a = 1200$ and common difference $d = 150$. The n th term of an AP is $a_n = a + (n - 1)d$. For the 12th month, $n = 12$, so $a_{12} = 1200 + (12 - 1) \times 150 = 1200 + 11 \times 150 = 1200 + 1650 = 2850$. Hence the deposit in the 12th month is Rs. 2,850.

800. The n th term of a GP is $a_n = ar^{n-1}$, where a is the first term and r the common ratio. Here $a = 7$, $r = 3$ and $n = 5$, so $a_5 = 7 \times 3^4 = 7 \times 81 = 567$. (Note $189 = 7 \times 27$ is the 4th term and $1701 = 7 \times 243$ is the 6th term, so those are traps.)

801. Here $a = 5$ and $d = 9 - 5 = 4$. The sum of the first n terms is $S_n = \frac{n}{2}[2a + (n - 1)d]$. With $n = 20$: $S_{20} = \frac{20}{2}[2 \times 5 + 19 \times 4] = 10[10 + 76] = 10 \times 86 = 860$.

802. The odd numbers $1, 3, 5, \dots, 59$ form an AP with $a = 1$, $d = 2$ and last term $l = 59$. Number of terms: $59 = 1 + (n - 1) \times 2 \Rightarrow (n - 1) = 29 \Rightarrow n = 30$. Sum $= \frac{n}{2}(a + l) = \frac{30}{2}(1 + 59) = 15 \times 60 = 900$. (Equivalently, the sum of the first n odd numbers is $n^2 = 30^2 = 900$.)

803. If three quantities are in AP, the middle one is the arithmetic mean of the other two. So the second instalment $= \frac{8000 + 20000}{2} = \frac{28000}{2} = 14000$. Check: 8000, 14000, 20000 has a constant difference of Rs. 6,000, so it is indeed an AP. The second instalment is Rs. 14,000.

804. Here $a = 2$ and $r = \frac{6}{2} = 3$. For $r > 1$, $S_n = \frac{a(r^n - 1)}{r - 1}$. With $n = 6$: $S_6 = \frac{2(3^6 - 1)}{3 - 1} = \frac{2(729 - 1)}{2} = 728$. (Direct check: $2 + 6 + 18 + 54 + 162 + 486 = 728$.)

805. Here $a = 7$, $d = 13 - 7 = 6$ and the last term is $l = 205$. Using $l = a + (n - 1)d$: $205 = 7 + (n - 1) \times 6 \Rightarrow 198 = 6(n - 1) \Rightarrow n - 1 = 33 \Rightarrow n = 34$. Since 34 does not appear among the first four options, the answer is 'None of these'.

806. The commissions form an AP with $a = 3200$ and $d = 250$. We need n such that $a_n = 9200$. $a + (n - 1)d = 9200 \Rightarrow 3200 + (n - 1) \times 250 = 9200$. So $(n - 1) \times 250 = 6000 \Rightarrow n - 1 = \frac{6000}{250} = 24 \Rightarrow n = 25$. Her commission reaches Rs. 9,200 in the 25th month.

807. Let the first term be a and the common difference d . Then $a + 6d = 34$ and $a + 12d = 64$. Subtracting the first from the second: $6d = 30 \Rightarrow d = 5$. Substituting back: $a + 6 \times 5 = 34 \Rightarrow a = 34 - 30 = 4$. Hence $a_{20} = a + 19d = 4 + 19 \times 5 = 4 + 95 = 99$.

808. Let the first term be a and common ratio r . Then $ar^2 = 20$ and $ar^5 = 160$. Dividing: $\frac{ar^5}{ar^2} = \frac{160}{20} = 8 \Rightarrow r = 2$. From $ar^2 = 20$: $a \times 4 = 20 \Rightarrow a = 5$. Then $S_8 = \frac{a(r^8 - 1)}{r - 1} = \frac{5(256 - 1)}{2 - 1} = 5 \times 255 = 1275$.

809. Using $S_n = \frac{n}{2}[2a + (n - 1)d]$ with $n = 15$, $a = 12$, $S_{15} = 600$: $600 = \frac{15}{2}[24 + 14d]$. Multiplying both sides by $\frac{2}{15}$: $80 = 24 + 14d \Rightarrow 14d = 56 \Rightarrow d = 4$. Since 4 is not listed in options A to D, the correct choice is 'None of these'.

810. Each year the value becomes 90% of the previous year's value, so the yearly values form a GP with $a = 200000$ and $r = 0.9$. Value after 3 years $= 200000 \times (0.9)^3 = 200000 \times 0.729 = 145800$. Step by step: $200000 \rightarrow 180000 \rightarrow 162000 \rightarrow 145800$. The value at the end of 3 years is Rs. 1,45,800. (Rs. 1,40,000 is the trap from wrongly deducting a flat 10% of the original cost each year.)

811. Here $a = 9$ and $d = 8$. Using $S_n = \frac{n}{2} [2a + (n-1)d] = 636$: $\frac{n}{2} [18 + 8(n-1)] = 636 \Rightarrow n[8n + 10] = 1272$. So $8n^2 + 10n - 1272 = 0$, i.e. $4n^2 + 5n - 636 = 0$. The discriminant is $25 + 4 \times 4 \times 636 = 25 + 10176 = 10201 = 101^2$, so $n = \frac{-5 + 101}{8} = \frac{96}{8} = 12$ (the negative root is rejected). Hence 12 terms are needed.

812. Let the first term be a and common difference d . Given $a_5 = 3a_2$: $a + 4d = 3(a + d) \Rightarrow a + 4d = 3a + 3d \Rightarrow d = 2a$. Then $a_8 = a + 7d = a + 14a = 15a$ and $a_4 = a + 3d = a + 6a = 7a$. Therefore $\frac{a_8}{a_4} = \frac{15a}{7a} = \frac{15}{7}$, i.e. the ratio is $15 : 7$.

813. Let the three numbers be $a - d$, a , $a + d$. Sum: $(a - d) + a + (a + d) = 3a = 36 \Rightarrow a = 12$. Sum of squares: $(a - d)^2 + a^2 + (a + d)^2 = 3a^2 + 2d^2 = 482$. So $3(144) + 2d^2 = 482 \Rightarrow 432 + 2d^2 = 482 \Rightarrow d^2 = 25 \Rightarrow d = \pm 5$. The numbers are 7, 12, 17, and the largest is 17. (Check: $49 + 144 + 289 = 482$.)

814. Let the AP have first term a and common difference $d \neq 0$. The three terms are $a + d$, $a + 4d$, $a + 8d$. For a GP the middle term squared equals the product of the outer terms: $(a + 4d)^2 = (a + d)(a + 8d)$. Expanding: $a^2 + 8ad + 16d^2 = a^2 + 9ad + 8d^2$, so $8d^2 = ad$, and since $d \neq 0$ we get $a = 8d$. The three terms become $9d$, $12d$, $16d$. Common ratio $= \frac{12d}{9d} = \frac{4}{3}$ (and $\frac{16d}{12d} = \frac{4}{3}$ confirms it).

815. For an AP, $\frac{a_k}{b_k} = \frac{S_{2k-1}}{T_{2k-1}}$, because $S_{2k-1} = \frac{2k-1}{2} [2a + (2k-2)d] = (2k-1)[a + (k-1)d] = (2k-1)a_k$, and similarly for the second AP; the factor $(2k-1)$ cancels in the ratio. For the 11th terms take $k = 11$, so $2k - 1 = 21$. Then the ratio $= \frac{7(21) + 1}{4(21) + 27} = \frac{147 + 1}{84 + 27} = \frac{148}{111} = \frac{4}{3}$ (dividing numerator and denominator by 37). Hence the ratio is $4 : 3$.

816. Let the first term be a and common ratio r with $|r| < 1$. Then $\frac{a}{1-r} = 15 \dots$ (i). The squares form a GP with first term a^2 and ratio r^2 , so $\frac{a^2}{1-r^2} = 45 \dots$ (ii). Write (ii) as $\frac{a}{1-r} \times \frac{a}{1+r} = 45$. Using (i), $15 \times \frac{a}{1+r} = 45$, so $a = 3(1+r)$. From (i), $a = 15(1-r)$. Equating: $15 - 15r = 3 + 3r \Rightarrow 12 = 18r \Rightarrow r = \frac{2}{3}$. Then $a = 15 \left(1 - \frac{2}{3}\right) = 15 \times \frac{1}{3} = 5$.

817. The payments form an AP with $a = 1000$ and $d = 100$, and the total must be 118000. $\frac{n}{2} [2000 + (n-1)100] = 118000 \Rightarrow n[2000 + 100n - 100] = 236000$. So $100n^2 + 1900n - 236000 = 0$, i.e. $n^2 + 19n - 2360 = 0$. Discriminant $= 361 + 9440 = 9801 = 99^2$, so $n = \frac{-19 + 99}{2} = \frac{80}{2} = 40$. The loan is cleared in 40 months.

818. Let the first year's profit be a and the common ratio r . Then $ar^2 = 216000$ and $ar^5 = 729000$. Dividing: $r^3 = \frac{729000}{216000} = \frac{27}{8} \Rightarrow r = \frac{3}{2}$. From $ar^2 = 216000$: $a \times \frac{9}{4} = 216000 \Rightarrow a = 96000$. Total for 4 years $= S_4 = \frac{a(r^4 - 1)}{r - 1} = \frac{96000 \left(\frac{81}{16} - 1\right)}{\frac{1}{2}} = 96000 \times \frac{65}{16} \times 2 = 96000 \times 8.125 = 780000$. (Check: $96000 + 144000 + 216000 + 324000 = 780000$.) The total is Rs. 7,80,000.

819. The n th term is $a_n = S_n - S_{n-1}$ for $n \geq 2$. $S_{n-1} = 3(n-1)^2 + 5(n-1) = 3n^2 - 6n + 3 + 5n - 5 = 3n^2 - n - 2$. So $a_n = (3n^2 + 5n) - (3n^2 - n - 2) = 6n + 2$ (this also holds for $n = 1$, since $a_1 = S_1 = 8 = 6 + 2$). Setting $6n + 2 = 152$ gives $6n = 150 \Rightarrow n = 25$. Hence the 25th term equals 152.

Subtopic 1.8.1

820. Area of the floor $= \text{length} \times \text{breadth} = 24 \times 18 = 432$ sq m. Cost $= \text{area} \times \text{rate} = 432 \times 45$. Now $432 \times 45 = 432 \times 40 + 432 \times 5 = 17280 + 2160 = 19440$. Hence the tiling cost is Rs. 19,440.

821. For a square, perimeter = $4 \times \text{side}$, so side = $\frac{96}{4} = 24$ m. Area of a square = $(\text{side})^2 = 24 \times 24 = 576$ sq m.

822. Area of a triangle = $\frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 34 \times 18$. First, $\frac{1}{2} \times 34 = 17$, then $17 \times 18 = 306$. So the area is 306 sq cm.

823. Area of a parallelogram = base $\times$ height, where the height is the perpendicular distance between the two parallel sides. So $216 = 18 \times h$, giving $h = \frac{216}{18} = 12$ cm.

824. Area of a rhombus = $\frac{1}{2} \times d_1 \times d_2$, where d_1 and d_2 are the diagonals. So area = $\frac{1}{2} \times 24 \times 10 = 12 \times 10 = 120$ sq cm.

825. Area of a trapezium = $\frac{1}{2} \times (\text{sum of parallel sides}) \times (\text{distance between them}) = \frac{1}{2} \times (18+12) \times 9 = \frac{1}{2} \times 30 \times 9 = 15 \times 9 = 135$ sq m.

826. Perimeter of a rectangle = $2 \times (\text{length} + \text{breadth}) = 2 \times (45 + 30) = 2 \times 75 = 150$ m. Cost of fencing = $150 \times 28 = \text{Rs. } 4,200$.

827. Let the length be $5x$ m and the breadth be $3x$ m. Perimeter = $2(5x + 3x) = 16x$. Given $16x = 256$, so $x = 16$. Therefore length = $5 \times 16 = 80$ m and breadth = $3 \times 16 = 48$ m. Area = $80 \times 48 = 3840$ sq m.

828. Area of the rectangle = $40 \times 10 = 400$ sq cm. The square has the same area, so $(\text{side})^2 = 400$, giving side = $\sqrt{400} = 20$ cm. Perimeter of the square = $4 \times 20 = 80$ cm.

829. For an equilateral triangle, perimeter = $3a$, so $a = \frac{72}{3} = 24$ cm. Area = $\frac{\sqrt{3}}{4}a^2 = \frac{\sqrt{3}}{4} \times 24^2 = \frac{\sqrt{3}}{4} \times 576 = 144\sqrt{3}$ sq cm.

830. The diagonals of a rhombus bisect each other at right angles. Half of the given diagonal = $\frac{16}{2} = 8$ m. Let half of the other diagonal be x . In the right triangle formed, $8^2 + x^2 = 10^2$, so $x^2 = 100 - 64 = 36$ and $x = 6$ m. Hence the other diagonal = 12 m. Area = $\frac{1}{2} \times 16 \times 12 = 96$ sq m.

831. Let the parallel sides be $3x$ and $5x$. Area = $\frac{1}{2}(3x + 5x) \times 12 = \frac{1}{2} \times 8x \times 12 = 48x$. Given $48x = 192$, so $x = 4$. The longer parallel side = $5x = 5 \times 4 = 20$ cm.

832. Let the original length be l and breadth b , so original area = lb . New length = $1.2l$ and new breadth = $0.9b$. New area = $1.2l \times 0.9b = 1.08lb$. The change = $1.08lb - lb = 0.08lb$, which is 8% of the original area. So the area increases by 8%.

833. Hypotenuse = $\sqrt{9^2 + 12^2} = \sqrt{81 + 144} = \sqrt{225} = 15$ cm. Taking the two perpendicular sides as base and height, area = $\frac{1}{2} \times 9 \times 12 = 54$ sq cm. Taking the hypotenuse as base with the required perpendicular h as height, area = $\frac{1}{2} \times 15 \times h$. So $\frac{1}{2} \times 15 \times h = 54$, giving $h = \frac{108}{15} = 7.2$ cm.

834. The outer rectangle formed by the garden together with the path has length $60 + 2 \times 3 = 66$ m and breadth $40 + 2 \times 3 = 46$ m. Outer area = $66 \times 46 = 3036$ sq m. Garden area = $60 \times 40 = 2400$ sq m. Area of the path = $3036 - 2400 = 636$ sq m. Cost = $636 \times 55 = 636 \times 50 + 636 \times 5 = 31800 + 3180 = \text{Rs. } 34,980$.

835. Each road is a rectangle of 80 m by 4 m, so each has area $80 \times 4 = 320$ sq m, and the two together give $2 \times 320 = 640$ sq m. However, the roads cross each other, and the common square patch of side 4 m has been counted twice. Its area is $4 \times 4 = 16$ sq m. Required area = $640 - 16 = 624$ sq m.

836. Drop perpendiculars from the ends of the shorter parallel side to the longer one. These cut off two equal segments on the longer side, each of length $\frac{25-13}{2} = 6$ cm. In the right triangle so formed, the slant side is 10 cm and the base is 6 cm, so the height $= \sqrt{10^2 - 6^2} = \sqrt{100 - 36} = \sqrt{64} = 8$ cm. Area $= \frac{1}{2}(25 + 13) \times 8 = \frac{1}{2} \times 38 \times 8 = 152$ sq cm. Since 152 is not listed among the first four options, the answer is None of these.

837. Area of a rhombus $= \frac{1}{2} \times d_1 \times d_2$. Here $216 = \frac{1}{2} \times 24 \times d_2 = 12d_2$, so the other diagonal $d_2 = \frac{216}{12} = 18$ m. The diagonals bisect each other at right angles, so the half-diagonals are $\frac{24}{2} = 12$ m and $\frac{18}{2} = 9$ m. Each side of the rhombus is the hypotenuse of a right triangle with legs 12 m and 9 m, so side $= \sqrt{12^2 + 9^2} = \sqrt{144 + 81} = \sqrt{225} = 15$ m. Perimeter $= 4 \times 15 = 60$ m. Fencing cost $= 60 \times 35 = \text{Rs. } 2,100$.

838. Let the length be l and the breadth be b . From the first condition, $(l + 5)(b - 3) = lb$, which expands to $lb - 3l + 5b - 15 = lb$, i.e. $5b - 3l = 15$. From the second condition, $(l - 5)(b + 5) = lb$, which expands to $lb + 5l - 5b - 25 = lb$, i.e. $5l - 5b = 25$, so $l - b = 5$ and $l = b + 5$. Substituting in the first relation: $5b - 3(b + 5) = 15$, so $2b - 15 = 15$, giving $b = 15$ m and $l = 20$ m. Area $= 20 \times 15 = 300$ sq m.

839. Semi-perimeter $s = \frac{13 + 14 + 15}{2} = 21$. By Heron's formula, area $= \sqrt{s(s-a)(s-b)(s-c)} = \sqrt{21 \times 8 \times 7 \times 6} = \sqrt{7056} = 84$ sq m. The longest side is 15 m. Taking it as the base with the required perpendicular h , area $= \frac{1}{2} \times 15 \times h = 84$, so $h = \frac{168}{15} = 11.2$ m.

840. Let the breadth of the rectangle be b ; then its length is $3b$ and its perimeter is $2(3b + b) = 8b$. The square has the same perimeter, so $4 \times \text{side} = 8b$, giving side $= 2b$. Area of the square $= (2b)^2 = 4b^2$. Area of the rectangle $= 3b \times b = 3b^2$. Required ratio $= 4b^2 : 3b^2 = 4 : 3$.

Subtopic 1.8.2

841. Circumference of a circle $= 2\pi r$. Here $r = 14$ m, so circumference $= 2 \times \frac{22}{7} \times 14$. Since $\frac{14}{7} = 2$, this becomes $2 \times 22 \times 2 = 88$ m. Hence the circumference is 88 m.

842. Diameter $= 28$ cm, so radius $r = \frac{28}{2} = 14$ cm. Area $= \pi r^2 = \frac{22}{7} \times 14 \times 14$. Now $\frac{22}{7} \times 14 = 44$, and $44 \times 14 = 616$. Hence the area is 616 sq cm.

843. We use $2\pi r = 176$, i.e. $2 \times \frac{22}{7} \times r = 176$, so $\frac{44r}{7} = 176$. Therefore $r = \frac{176 \times 7}{44} = 4 \times 7 = 28$ m. Hence the radius is 28 m.

844. We use $\pi r^2 = 1386$, i.e. $\frac{22}{7} \times r^2 = 1386$. Therefore $r^2 = \frac{1386 \times 7}{22} = 63 \times 7 = 441$. Taking the square root, $r = \sqrt{441} = 21$ m. Hence the radius is 21 m.

845. Area of the whole circle $= \pi r^2 = \frac{22}{7} \times 14 \times 14 = 616$ sq cm. A quadrant is a sector of angle 90° , i.e. one-fourth of the circle. So its area $= \frac{616}{4} = 154$ sq cm.

846. Area of a ring $= \pi(R^2 - r^2)$ where $R = 21$ m and $r = 14$ m. Now $R^2 - r^2 = 441 - 196 = 245$. So the area $= \frac{22}{7} \times 245 = 22 \times 35 = 770$ sq m.

847. Full circumference $= 2\pi r = 2 \times \frac{22}{7} \times 21 = 132$ cm. An arc of 60° is $\frac{60}{360} = \frac{1}{6}$ of the full circumference. So arc length $= \frac{132}{6} = 22$ cm.

848. First find the radius: $\pi r^2 = 3850$ gives $r^2 = \frac{3850 \times 7}{22} = 175 \times 7 = 1225$, so $r = 35$ m. Next the boundary length: $2\pi r = 2 \times \frac{22}{7} \times 35 = 220$ m. Finally the cost $= 220 \times 45 = \text{Rs. } 9,900$.

849. Distance covered in one revolution equals the circumference $= \pi d = \frac{22}{7} \times 70 = 220$ cm. Total distance $= 1.1 \text{ km} = 1.1 \times 1,00,000 = 1,10,000$ cm. Number of revolutions $= \frac{110000}{220} = 500$.

850. Inner radius $r = 35$ m; outer radius $R = 35 + 7 = 42$ m. Area of the path $= \pi(R^2 - r^2) = \frac{22}{7}(1764 - 1225) = \frac{22}{7} \times 539$. Since $\frac{539}{7} = 77$, this is $22 \times 77 = 1694$ sq m. Cost $= 1694 \times 25 = \text{Rs. } 42,350$.

851. Let the radius be r . Then $2\pi r - 2r = 30$, i.e. $2r(\pi - 1) = 30$. With $\pi = \frac{22}{7}$ we get $\pi - 1 = \frac{15}{7}$, so $2r \times \frac{15}{7} = 30$, giving $2r = \frac{30 \times 7}{15} = 14$, hence $r = 7$ cm. Area $= \frac{22}{7} \times 49 = 154$ sq cm.

852. The largest circle inside a square of side 28 m has diameter 28 m, so radius 14 m. Area of the square $= 28 \times 28 = 784$ sq m. Area of the circle $= \frac{22}{7} \times 14 \times 14 = 616$ sq m. Area to be gravelled $= 784 - 616 = 168$ sq m. Since 168 is not listed among the first four options, the answer is None of these.

853. The perimeter of a sector is the arc plus the two bounding radii. Full circumference $= 2 \times \frac{22}{7} \times 21 = 132$ cm. Arc for $120^\circ = \frac{120}{360} \times 132 = \frac{132}{3} = 44$ cm. The two radii contribute $2 \times 21 = 42$ cm. Perimeter $= 44 + 42 = 86$ cm.

854. Areas are in ratio 16 : 25, so the radii are in ratio $\sqrt{16} : \sqrt{25} = 4 : 5$. Let the radii be $4k$ and $5k$. Difference of circumferences $= 2\pi(5k - 4k) = 2\pi k = 44$, so $2 \times \frac{22}{7} \times k = 44$, giving $k = 7$. The larger radius is $5k = 35$ cm, and its area $= \frac{22}{7} \times 35 \times 35 = 22 \times 5 \times 35 = 3850$ sq cm.

855. Length of wire $=$ circumference of the circle $= 2 \times \frac{22}{7} \times 28 = 176$ cm. Area of the circle $= \frac{22}{7} \times 28 \times 28 = 2464$ sq cm. When bent into a square, the perimeter is 176 cm, so the side $= \frac{176}{4} = 44$ cm and the area $= 44 \times 44 = 1936$ sq cm. Required excess $= 2464 - 1936 = 528$ sq cm.

856. Let the radius be r . The perimeter of a semicircle is the curved arc πr plus the diameter $2r$, so $\pi r + 2r = 72$, i.e. $r(\pi + 2) = 72$. With $\pi = \frac{22}{7}$ we get $\pi + 2 = \frac{22}{7} + 2 = \frac{36}{7}$, so $r \times \frac{36}{7} = 72$, giving $r = \frac{72 \times 7}{36} = 14$ cm. Check: arc $= \frac{22}{7} \times 14 = 44$ cm and diameter $= 28$ cm, and $44 + 28 = 72$ cm. Area of the semicircle $= \frac{1}{2}\pi r^2 = \frac{1}{2} \times \frac{22}{7} \times 14 \times 14 = \frac{616}{2} = 308$ sq cm.

857. Each semicircle stands on a side of length 14 m, so each has diameter 14 m and radius 7 m. The two semicircles together make one full circle of radius 7 m, whose area $= \frac{22}{7} \times 49 = 154$ sq m. Area of the rectangle $= 28 \times 14 = 392$ sq m. Total area $= 392 + 154 = 546$ sq m.

858. Circumference is directly proportional to the radius, so a 25% rise in circumference means the radius also rises by 25%: the new radius is $1.25r$. Area is proportional to the square of the radius, so the new area is $(1.25)^2 = 1.5625$ times the old area. The increase is $1.5625 - 1 = 0.5625$, i.e. 56.25%.

859. At each corner the cow grazes a quarter-circle of radius 7 m, because the corner angle of a square is 90° . The four quarter-circles together make one complete circle of radius 7 m, whose area $= \frac{22}{7} \times 7 \times 7 = 154$ sq m. Area of the square $= 28 \times 28 = 784$ sq m. Ungrazed area $= 784 - 154 = 630$ sq m.

860. Area of the full circle = $\frac{22}{7} \times 42 \times 42 = 22 \times 6 \times 42 = 5544$ sq cm. The sector is $\frac{462}{5544} = \frac{1}{12}$ of the circle, so its angle is $\frac{360^\circ}{12} = 30^\circ$. Full circumference = $2 \times \frac{22}{7} \times 42 = 264$ cm, so the arc = $\frac{264}{12} = 22$ cm. Perimeter = arc + two radii = $22 + 2 \times 42 = 22 + 84 = 106$ cm.

861. Let the outer and inner radii be $5k$ and $3k$. Area of the ring = $\pi(25k^2 - 9k^2) = 16\pi k^2 = 2464$. So $k^2 = \frac{2464 \times 7}{22 \times 16} = \frac{784}{16} = 49$, giving $k = 7$. The inner radius is $3k = 21$ cm, so the inner circumference = $2 \times \frac{22}{7} \times 21 = 132$ cm.

Subtopic 1.8.3

862. For a cube of edge a , volume = a^3 . So $a^3 = 512 \Rightarrow a = 8$ cm. Total surface area of a cube = $6a^2 = 6 \times 8^2 = 6 \times 64 = 384$ sq cm.

863. Volume of a cuboid = $l \times b \times h = 8 \times 6 \times 2.5 = 120$ cu m. Since 1 cu m = 1000 litres, capacity = $120 \times 1000 = 1,20,000$ litres.

864. Curved surface area of a cylinder = $2\pi rh = 2 \times \frac{22}{7} \times 7 \times 10$. The 7 cancels with the denominator, giving $2 \times 22 \times 10 = 440$ sq cm.

865. Surface area of a sphere = $4\pi r^2 = 4 \times \frac{22}{7} \times (10.5)^2 = 4 \times \frac{22}{7} \times 110.25$. Now $\frac{110.25}{7} = 15.75$, so the value is $4 \times 22 \times 15.75 = 88 \times 15.75 = 1386$ sq cm.

866. Curved surface area of a cone = $\pi rl = \frac{22}{7} \times 7 \times 25 = 22 \times 25 = 550$ sq m.

867. A solid hemisphere has a curved part and a flat circular face. Total surface area = $2\pi r^2 + \pi r^2 = 3\pi r^2 = 3 \times \frac{22}{7} \times 49 = 3 \times 22 \times 7 = 462$ sq cm. (The value 308 is only the curved part and 154 only the flat face.)

868. Total surface area = $6a^2 = 294 \Rightarrow a^2 = 49 \Rightarrow a = 7$ cm. Volume = $a^3 = 7^3 = 343$ cu cm.

869. Volume = $\pi r^2 h = \frac{22}{7} \times (3.5)^2 \times 4 = \frac{22}{7} \times 12.25 \times 4 = \frac{22}{7} \times 49 = 154$ cu m. In litres this is $154 \times 1000 = 1,54,000$ litres. Time = $\frac{154000}{350} = 440$ seconds = 7 minutes 20 seconds.

870. Volume of the sphere = $\frac{4}{3}\pi r^3 = \frac{4}{3}\pi \times 9^3 = \frac{4}{3}\pi \times 729 = 972\pi$ cu cm. Volume of one cone = $\frac{1}{3}\pi r^2 h = \frac{1}{3}\pi \times 9 \times 3 = 9\pi$ cu cm. Number of cones = $\frac{972\pi}{9\pi} = 108$.

871. Slant height $l = \sqrt{r^2 + h^2} = \sqrt{21^2 + 28^2} = \sqrt{441 + 784} = \sqrt{1225} = 35$ m. Curved surface area = $\pi rl = \frac{22}{7} \times 21 \times 35 = 22 \times 3 \times 35 = 2310$ sq m. Base area = $\pi r^2 = \frac{22}{7} \times 441 = 22 \times 63 = 1386$ sq m. Total surface area = $2310 + 1386 = 3696$ sq m. (Option B is only the slanting surface and option A only the base.)

872. The rolled side becomes the circumference: $2\pi r = 44 \Rightarrow 2 \times \frac{22}{7} \times r = 44 \Rightarrow r = 7$ cm. The other side becomes the height, so $h = 20$ cm. Volume = $\pi r^2 h = \frac{22}{7} \times 49 \times 20 = 22 \times 7 \times 20 = 3080$ cu cm.

873. The edge of the largest cube that divides the block exactly is the HCF of 30, 24 and 18, which is 6 cm. Volume of block = $30 \times 24 \times 18 = 12960$ cu cm. Volume of one cube = $6^3 = 216$ cu cm. Number of cubes = $\frac{12960}{216} = 60$.

874. Volume of milk = $\frac{2}{3}\pi r^3 = \frac{2}{3}\pi (10.5)^3 = \frac{2}{3}\pi \times 1157.625 = 771.75\pi$ cu cm. Volume of one bottle = $\pi r^2 h = \pi \times (3.5)^2 \times 3.5 = \pi \times 42.875$ cu cm. Number of bottles = $\frac{771.75}{42.875} = 18$.

875. Radius = 25 cm = 0.25 m and height = 3.5 m. Curved surface area = $2\pi rh = 2 \times \frac{22}{7} \times 0.25 \times 3.5 = 2 \times 22 \times 0.25 \times 0.5 = 5.5$ sq m. Cost = $5.5 \times 12 = \text{Rs. } 66$.

876. The exposed surfaces are: the curved surface of the cylinder, the flat circular base of the cylinder, and the curved surface of the hemisphere (the top face of the cylinder is covered by the hemisphere).
Curved surface of cylinder = $2\pi rh = 2 \times \frac{22}{7} \times 7 \times 20 = 880$ sq cm. Base = $\pi r^2 = \frac{22}{7} \times 49 = 154$ sq cm. Curved surface of hemisphere = $2\pi r^2 = 2 \times 154 = 308$ sq cm. Total = $880 + 154 + 308 = 1342$ sq cm.

877. Small cone : frustum = 1 : 26, so small cone : whole cone = 1 : 27. The small cone is similar to the whole cone, and volumes of similar solids vary as the cube of corresponding lengths:
 $\left(\frac{h}{24}\right)^3 = \frac{1}{27} \Rightarrow \frac{h}{24} = \frac{1}{3} \Rightarrow h = 8$ cm. This 8 cm is measured from the apex, so the distance of the cut from the base is $24 - 8 = 16$ cm.

878. Volume = $\pi r^2 h$, so volume varies as $r^2 h$. New radius factor = 1.2, so r^2 becomes $(1.2)^2 = 1.44$ times. New height factor = 0.75. New volume = $1.44 \times 0.75 = 1.08$ times the original, i.e. 108% of it. Hence the volume increases by 8%.

879. Radius of well = 7 m. Volume of earth dug out = $\pi r^2 h = \frac{22}{7} \times 49 \times 10.5 = 22 \times 7 \times 10.5 = 1617$ cu m. The embankment is a ring of inner radius 7 m and outer radius $7 + 7 = 14$ m. Its base area = $\pi(14^2 - 7^2) = \frac{22}{7} \times (196 - 49) = \frac{22}{7} \times 147 = 462$ sq m. Height = $\frac{1617}{462} = 3.5$ m.

880. The largest sphere inside the cube has diameter equal to the edge, so radius = 7 cm. Volume of cube = $14^3 = 2744$ cu cm. Volume of sphere = $\frac{4}{3}\pi r^3 = \frac{4}{3} \times \frac{22}{7} \times 343 = \frac{4 \times 22 \times 49}{3} = \frac{4312}{3} = 1437\frac{1}{3}$ cu cm. Wood wasted = $2744 - 1437\frac{1}{3} = 1306\frac{2}{3}$ cu cm. This value is not among options A to D (option A is the volume of the sphere itself), so the answer is None of these.

881. Let the radii be $2k$ and $3k$ and the heights be h_1 and h_2 . Curved surface area = $2\pi rh$, so $\frac{2k \cdot h_1}{3k \cdot h_2} = \frac{8}{9} \Rightarrow \frac{h_1}{h_2} = \frac{8}{9} \times \frac{3}{2} = \frac{4}{3}$. Volumes are in the ratio $r_1^2 h_1 : r_2^2 h_2 = (2)^2 \times 4 : (3)^2 \times 3 = 16 : 27$.

882. External radius $R = \frac{14}{2} = 7$ cm. Internal radius $r = 7 - 3.5 = 3.5$ cm. Volume of metal = $\pi(R^2 - r^2)h = \frac{22}{7}(49 - 12.25) \times 20 = \frac{22}{7} \times 36.75 \times 20$. Now $\frac{36.75}{7} = 5.25$, so the volume = $22 \times 5.25 \times 20 = 22 \times 105 = 2310$ cu cm.

Subtopic 1.8.4

883. Complementary angles add up to 90° . Let the two angles be $4x$ and $5x$. Then $4x + 5x = 90$, so $9x = 90$ and $x = 10$. The angles are $4 \times 10 = 40^\circ$ and $5 \times 10 = 50^\circ$. The larger one is 50° . (Check: $40 + 50 = 90$, and $40 : 50 = 4 : 5$.)

884. The angle sum of a triangle is 180° . Let the angles be $2x$, $3x$ and $4x$. Then $2x + 3x + 4x = 180$, i.e. $9x = 180$, so $x = 20$. The angles are 40° , 60° and 80° . The largest is $4x = 80^\circ$.

885. By the exterior angle theorem, an exterior angle of a triangle equals the sum of the two interior opposite angles. So $110^\circ = 45^\circ + x$, giving $x = 110 - 45 = 65^\circ$. Since 65° does not appear among options A to D, the correct choice is 'None of these'.

886. Interior angles on the same side of a transversal (co-interior or allied angles) between two parallel lines are supplementary, i.e. they add up to 180° . Hence the required angle = $180^\circ - 65^\circ = 115^\circ$.

887. In an isosceles triangle the angles opposite the two equal sides (the base angles) are equal. Let each base angle be x . Then $40 + x + x = 180$, so $2x = 140$ and $x = 70$. Each base angle measures 70° .

888. Let the angle be x . Its supplement is $180 - x$ and its complement is $90 - x$. Given $180 - x = 4(90 - x)$, i.e. $180 - x = 360 - 4x$. Bringing terms together, $4x - x = 360 - 180$, so $3x = 180$ and $x = 60$. Check: supplement = 120, complement = 30, and $4 \times 30 = 120$. Correct.

889. By the triangle inequality, the third side must be greater than the difference of the other two and less than their sum. Here the difference is $15 - 8 = 7$ and the sum is $15 + 8 = 23$, so the third side x must satisfy $7 < x < 23$. The values 9, 12, 20 and 22 all lie strictly inside this range, but 7 does not (it equals the difference, which would make the three points collinear, not a triangle). Hence 7 m is impossible.

890. Angle sum = 180° , so $2x + (3x - 15) + (4x + 15) = 180$. The constants cancel: $9x = 180$, hence $x = 20$. The three angles are $2x = 40^\circ$, $3x - 15 = 45^\circ$ and $4x + 15 = 95^\circ$. All are positive and they total $40 + 45 + 95 = 180$. The largest angle is 95° .

891. Since $\angle A = 70^\circ$, we get $\angle B + \angle C = 180 - 70 = 110^\circ$. In triangle BIC , the angles at B and C are half of $\angle B$ and $\angle C$ respectively, so their sum is $\frac{110}{2} = 55^\circ$. Therefore $\angle BIC = 180 - 55 = 125^\circ$. (This matches the standard result $\angle BIC = 90^\circ + \frac{\angle A}{2} = 90 + 35 = 125^\circ$.)

892. Draw a line through E parallel to both AB and CD ; call it EF , with F on the same side as B and D . Since $EF \parallel AB$, the angle between EA and EF equals the alternate angle $\angle BAE = 55^\circ$. Since $EF \parallel CD$, the angle between EC and EF equals the alternate angle $\angle DCE = 40^\circ$. The line EF lies inside $\angle AEC$, so $\angle AEC = 55^\circ + 40^\circ = 95^\circ$.

893. The centroid of a triangle divides each median in the ratio $2 : 1$, measured from the vertex. So $PG : GD = 2 : 1$, which means PG is $\frac{2}{3}$ of the whole median PD . Therefore $PG = \frac{2}{3} \times 21 = 14$ cm. (The remaining part $GD = \frac{1}{3} \times 21 = 7$ cm, and $14 : 7 = 2 : 1$ as required.)

894. First, $\angle C = 180 - 60 - 80 = 40^\circ$. Since CD bisects $\angle C$, we have $\angle ACD = \frac{40}{2} = 20^\circ$. Now apply the angle sum to triangle ACD : $\angle A + \angle ACD + \angle ADC = 180$, i.e. $60 + 20 + \angle ADC = 180$, so $\angle ADC = 100^\circ$. As 100° is not listed in options A to D, the answer is 'None of these'.

895. At the same instant the sun's rays make equal angles with the ground, so the pole with its shadow and the building with its shadow form two similar right triangles. Hence $\frac{\text{height of pole}}{\text{shadow of pole}} = \frac{\text{height of building}}{\text{shadow of building}}$. That is $\frac{12}{8} = \frac{h}{30}$, so $h = \frac{12 \times 30}{8} = \frac{360}{8} = 45$ m.

896. First find the hypotenuse: $AC = \sqrt{9^2 + 12^2} = \sqrt{81 + 144} = \sqrt{225} = 15$ cm. Now compute the area of triangle ABC in two ways. Using the legs as base and height, area = $\frac{1}{2} \times 9 \times 12 = 54$ sq cm. Using AC as base and BD as the corresponding height, area = $\frac{1}{2} \times 15 \times BD$. Equating, $\frac{1}{2} \times 15 \times BD = 54$, so $BD = \frac{108}{15} = 7.2$ cm.

897. Here $\angle A = 180 - 76 - 34 = 70^\circ$. Let AE be the altitude to BC and AD the bisector of $\angle A$. In right triangle ABE (right angle at E), $\angle BAE = 90 - \angle B = 90 - 76 = 14^\circ$. The bisector makes $\angle BAD = \frac{\angle A}{2} = \frac{70}{2} = 35^\circ$ with AB . Since $\angle B > \angle C$, the altitude foot lies nearer B than the bisector foot, so the required angle = $\angle BAD - \angle BAE = 35 - 14 = 21^\circ$. (This agrees with the standard formula $\frac{\angle B - \angle C}{2} = \frac{76 - 34}{2} = 21^\circ$.)

898. Let $\angle B = B$ and $\angle C = C$, so $B + C = 180 - 40 = 140^\circ$. The exterior angle at B is $180 - B$, and its bisector makes $\angle OBC = \frac{180 - B}{2} = 90 - \frac{B}{2}$ with BC . Similarly $\angle OCB = 90 - \frac{C}{2}$. In triangle OBC , $\angle BOC = 180 - \left(90 - \frac{B}{2}\right) - \left(90 - \frac{C}{2}\right) = \frac{B + C}{2} = \frac{140}{2} = 70^\circ$. (Equivalently,

$$\angle BOC = 90^\circ - \frac{\angle A}{2} = 90 - 20 = 70^\circ.)$$

899. Use Apollonius' theorem: for a median AD to side BC , $AB^2 + AC^2 = 2(AD^2 + BD^2)$, where $BD = \frac{BC}{2} = 7$ cm. Substituting, $10^2 + 12^2 = 2(AD^2 + 7^2)$, i.e. $100 + 144 = 2AD^2 + 98$. So $244 - 98 = 2AD^2$, giving $2AD^2 = 146$ and $AD^2 = 73$. Therefore $AD = \sqrt{73}$ cm (approximately 8.54 cm).

900. The hypotenuse is $\sqrt{12^2 + 16^2} = \sqrt{144 + 256} = \sqrt{400} = 20$ m. For a right-angled triangle the circumcentre is the midpoint of the hypotenuse, so the circumradius $R = \frac{20}{2} = 10$ m. The inradius of a right triangle is $r = \frac{a+b-c}{2}$ where a, b are the legs and c the hypotenuse, so $r = \frac{12+16-20}{2} = \frac{8}{2} = 4$ m. (Check by $r = \frac{\text{Area}}{s}$: area $= \frac{1}{2} \times 12 \times 16 = 96$, $s = \frac{12+16+20}{2} = 24$, so $r = \frac{96}{24} = 4$.) Hence $r + R = 4 + 10 = 14$ m.

901. Let $\angle A = a$. In triangle ABD , $AD = BD$, so the angles opposite them are equal: $\angle ABD = \angle BAD = a$. Then $\angle BDC$, being an exterior angle of triangle ABD at D , equals $a + a = 2a$. In triangle BDC , $BD = BC$, so $\angle BCD = \angle BDC = 2a$. But $\angle BCD$ is the same as $\angle ACB$, and since $AB = AC$ we also have $\angle ABC = \angle ACB = 2a$. Applying the angle sum to triangle ABC : $a + 2a + 2a = 180$, so $5a = 180$ and $a = 36^\circ$. Since 36° is not listed in options A to D, the answer is 'None of these'.

902. Write $\angle B = B$ and $\angle C = C$, so $B + C = 180 - 80 = 100^\circ$. The internal bisector of $\angle B$ gives $\angle PBC = \frac{B}{2}$. The exterior angle at C (between side CA and BC produced beyond C) is $180 - C$, so its bisector makes an angle $\frac{180 - C}{2} = 90 - \frac{C}{2}$ with BC produced. Measured from the ray CB instead, this gives $\angle PCB = 180 - \left(90 - \frac{C}{2}\right) = 90 + \frac{C}{2}$. Applying the angle sum to triangle BPC : $\angle BPC = 180 - \frac{B}{2} - \left(90 + \frac{C}{2}\right) = 90 - \frac{B+C}{2} = 90 - \frac{100}{2} = 40^\circ$. (Equivalently, the standard result here is $\angle BPC = \frac{\angle A}{2} = \frac{80}{2} = 40^\circ$.)

903. Let the poles be $AB = 15$ m and $CD = 30$ m standing at B and D , with $BD = k$ metres apart. Let the wires AD and CB cross at P , at height h above a point Q on BD . Triangle PQD is similar to triangle ABD (both right angled, sharing angle at D), so $\frac{h}{15} = \frac{QD}{k}$. Triangle PQB is similar to triangle CDB , so $\frac{h}{30} = \frac{BQ}{k}$. Adding the two relations gives $\frac{h}{15} + \frac{h}{30} = \frac{QD + BQ}{k} = \frac{k}{k} = 1$. Hence $h \left(\frac{1}{15} + \frac{1}{30} \right) = 1$, i.e. $h \times \frac{3}{30} = 1$, so $h = 10$ m. Note the answer is independent of the distance between the poles.

Subtopic 1.8.5

904. Use the distance formula $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$. Here $x_2 - x_1 = 6 - 2 = 4$ and $y_2 - y_1 = 6 - 3 = 3$. So $d = \sqrt{4^2 + 3^2} = \sqrt{16 + 9} = \sqrt{25} = 5$. The distance is 5 km.

905. The midpoint of the join of (x_1, y_1) and (x_2, y_2) is $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$. Here the x -coordinate is $\frac{-3 + 9}{2} = \frac{6}{2} = 3$ and the y -coordinate is $\frac{7 + 1}{2} = \frac{8}{2} = 4$. Hence the ATM is at $(3, 4)$.

906. Slope $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{13 - 5}{6 - 2} = \frac{8}{4} = 2$. So the slope is 2, i.e. the deposit rises by 2 units for every 1 unit of time.

907. The distance of a point (x, y) from the origin is $\sqrt{x^2 + y^2}$. Here it is $\sqrt{9^2 + 12^2} = \sqrt{81 + 144} = \sqrt{225} = 15$ units. (Note 21 is the sum $9 + 12$, which is not the straight-line distance.)

908. Every point on the x -axis has $y = 0$. Putting $y = 0$ in $3x + 4y = 24$ gives $3x = 24$, so $x = 8$. Hence the line meets the x -axis at $(8, 0)$. (Putting $x = 0$ would give the y -intercept $(0, 6)$, which is not what is asked.)

909. Write the equation in the slope-intercept form $y = mx + c$. From $2x + 3y = 12$ we get $3y = -2x + 12$, so $y = -\frac{2}{3}x + 4$. Comparing with $y = mx + c$, the slope $m = -\frac{2}{3}$. (Equivalently, for $ax + by = c$ the slope is $-\frac{a}{b} = -\frac{2}{3}$.)

910. Two sides lie along the axes, so the triangle is right-angled at the origin. The base along the x -axis is 10 m and the height along the y -axis is 7 m. Area = $\frac{1}{2} \times 10 \times 7 = 35$ sq m.

911. By the section formula, the point dividing the join of (x_1, y_1) and (x_2, y_2) internally in the ratio $m : n$ is $\left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n}\right)$. With $m = 2, n = 3$: $x = \frac{2 \times 7 + 3 \times 2}{5} = \frac{14 + 6}{5} = 4$ and $y = \frac{2 \times 12 + 3 \times (-3)}{5} = \frac{24 - 9}{5} = \frac{15}{5} = 3$. The repeater is at $(4, 3)$.

912. Area = $\frac{1}{2} |x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$. Substituting: $x_1(y_2 - y_3) = 1(6 - (-2)) = 8$; $x_2(y_3 - y_1) = 5(-2 - 2) = -20$; $x_3(y_1 - y_2) = 7(2 - 6) = -28$. Sum = $8 - 20 - 28 = -40$. Area = $\frac{1}{2} \times |-40| = 20$ sq units.

913. If three points are collinear, the slope between any two pairs is the same. Slope of the first and third points = $\frac{-3 - 3}{6 - 2} = \frac{-6}{4} = -\frac{3}{2}$. Slope of the first and second points = $\frac{k - 3}{4 - 2} = \frac{k - 3}{2}$. Equating: $\frac{k - 3}{2} = -\frac{3}{2}$, so $k - 3 = -3$ and $k = 0$.

914. The given line $2x + y = 7$ has slope $-\frac{2}{1} = -2$. For perpendicular lines $m_1 m_2 = -1$, so the required slope is $m_2 = \frac{-1}{-2} = \frac{1}{2}$. Using the point-slope form through $(3, 4)$: $y - 4 = \frac{1}{2}(x - 3)$, i.e. $2y - 8 = x - 3$, i.e. $x - 2y + 5 = 0$. Check: $(3, 4)$ gives $3 - 8 + 5 = 0$, so the point lies on it.

915. In parallelogram $ABCD$ the diagonals AC and BD bisect each other, so they share a midpoint. Midpoint of $AC = \left(\frac{1+6}{2}, \frac{2+7}{2}\right) = (3.5, 4.5)$. If $D = (x, y)$, midpoint of $BD = \left(\frac{4+x}{2}, \frac{3+y}{2}\right)$. Equating: $\frac{4+x}{2} = 3.5 \Rightarrow x = 3$, and $\frac{3+y}{2} = 4.5 \Rightarrow y = 6$. So $D = (3, 6)$.

916. Let the point on the x -axis be $(x, 0)$. Equating the squares of the distances: $(x-7)^2 + (0-6)^2 = (x+3)^2 + (0-4)^2$. Expanding: $x^2 - 14x + 49 + 36 = x^2 + 6x + 9 + 16$, i.e. $-14x + 85 = 6x + 25$. So $60 = 20x$ and $x = 3$. The centre should be at $(3, 0)$.

917. For two parallel lines $ax + by = c_1$ and $ax + by = c_2$, the distance is $\frac{|c_2 - c_1|}{\sqrt{a^2 + b^2}}$. Here $a = 3, b = 4$, so $\sqrt{a^2 + b^2} = \sqrt{9 + 16} = 5$, and $|c_2 - c_1| = |30 - 10| = 20$. Distance = $\frac{20}{5} = 4$ units.

918. The centroid is $\left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}\right)$. So $\frac{1 + 5 + x_3}{3} = 3 \Rightarrow 6 + x_3 = 9 \Rightarrow x_3 = 3$, and $\frac{2 + 9 + y_3}{3} = 4 \Rightarrow 11 + y_3 = 12 \Rightarrow y_3 = 1$. Thus $C = (3, 1)$. Now area = $\frac{1}{2} |1(9 - 1) + 5(1 - 2) + 3(2 - 9)| = \frac{1}{2} |8 - 5 - 21| = \frac{1}{2} \times 18 = 9$ sq units.

919. Method 1: put $y = 0$ in the equation to find where the circle meets the x -axis: $x^2 - 10x + 9 = 0$, i.e. $(x-1)(x-9) = 0$, so $x = 1$ and $x = 9$. The intercepted chord runs from $(1, 0)$ to $(9, 0)$ and has length $9 - 1 = 8$ units. Method 2 (check): comparing with $x^2 + y^2 + 2gx + 2fy + c = 0$ gives $g = -5$,

$f = -3$, $c = 9$, so the centre is $(5, 3)$ and radius $= \sqrt{25 + 9 - 9} = 5$. The distance of the centre from the x -axis is 3, so half-chord $= \sqrt{5^2 - 3^2} = 4$ and the chord $= 8$ units.

920. Let the x -axis cut AB in the ratio $k : 1$ (measured from A to B). By the section formula the y -coordinate of the dividing point is $\frac{k(6) + 1(-3)}{k + 1}$. On the x -axis this must be 0, so $6k - 3 = 0$, giving $k = \frac{1}{2}$. Hence the ratio is $\frac{1}{2} : 1 = 1 : 2$. (Check: the point is $x = \frac{1 \times 5 + 2 \times 2}{3} = 3$, i.e. $(3, 0)$, which indeed lies on the x -axis.)

921. Reflect $A(2, 3)$ in the x -axis to get $A'(2, -3)$. For any point P on the x -axis, $AP = A'P$, so $AP + PB = A'P + PB$, which is least when A', P and B are collinear. The least value therefore equals the straight-line distance $A'B = \sqrt{(8 - 2)^2 + (5 - (-3))^2} = \sqrt{36 + 64} = \sqrt{100} = 10$ units.

922. Split the quadrilateral into triangles by the diagonal from $(0, 0)$ to $(10, 6)$. Triangle 1 with vertices $(0, 0), (8, 0), (10, 6)$: area $= \frac{1}{2} |0(0 - 6) + 8(6 - 0) + 10(0 - 0)| = \frac{1}{2} \times 48 = 24$. Triangle 2 with vertices $(0, 0), (10, 6), (2, 9)$: area $= \frac{1}{2} |0(6 - 9) + 10(9 - 0) + 2(0 - 6)| = \frac{1}{2} |90 - 12| = 39$. Total area $= 24 + 39 = 63$ sq units.

923. The line meets the x -axis where $y = 0$: $8x = 120$, so $x = 15$; and the y -axis where $x = 0$: $15y = 120$, so $y = 8$. The triangle has vertices $(0, 0), (15, 0), (0, 8)$ and is right-angled at the origin, with legs 15 and 8 and hypotenuse $\sqrt{15^2 + 8^2} = \sqrt{225 + 64} = \sqrt{289} = 17$. For a right triangle the inradius is $r = \frac{a + b - c}{2} = \frac{15 + 8 - 17}{2} = \frac{6}{2} = 3$ units. (Check by area: $r = \frac{\text{area}}{s} = \frac{60}{20} = 3$.)

924. The line $x - 2y + 4 = 0$ can be written $y = \frac{1}{2}x + 2$, so its slope is $\frac{1}{2}$. The line through A perpendicular to it has slope -2 , giving $y - 1 = -2(x - 3)$, i.e. $2x + y = 7$. Solve this with the expressway: from $x - 2y + 4 = 0$ we get $x = 2y - 4$, and substituting, $2(2y - 4) + y = 7 \Rightarrow 5y = 15 \Rightarrow y = 3$, so $x = 2$. The foot of the perpendicular is $M(2, 3)$. Since M is the midpoint of A and its image $A'(x', y')$: $\frac{3 + y'}{2} = 2 \Rightarrow y' = 1$ and $\frac{1 + x'}{2} = 3 \Rightarrow x' = 5$. So the new branch is at $(1, 5)$. (Check: $M(2, 3)$ satisfies $2 - 6 + 4 = 0$, and the segment from $(3, 1)$ to $(1, 5)$ has slope $\frac{5 - 1}{1 - 3} = -2$, perpendicular to the expressway.)

Subtopic 1.9.1

925. The word BANK has 4 letters and all of them are different. The number of arrangements of 4 distinct objects taken all at a time is $4!$. So the required number $= 4! = 4 \times 3 \times 2 \times 1 = 24$.

926. CLERK has 5 different letters. We must fill 3 places in order, so this is a permutation: ${}^5P_3$. The first place can be filled in 5 ways, the second in 4 ways and the third in 3 ways. Hence the total $= 5 \times 4 \times 3 = 60$. (The answer 10 would be the number of selections, not arrangements, and 125 would apply only if repetition were allowed.)

927. By definition ${}^nP_r = \frac{n!}{(n - r)!}$. So ${}^7P_3 = \frac{7!}{4!} = 7 \times 6 \times 5 = 210$. Note $5040 = 7!$ and $35 = {}^7C_3$, so those are different quantities.

928. The two posts are different, so the order of selection matters and we use permutations. The Cashier's post can be filled by any of the 6 candidates and then the Clerk's post by any of the remaining 5. Required number $= {}^6P_2 = 6 \times 5 = 30$.

929. Five distinct persons arranged in a row can be arranged in $5!$ ways. $5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$. Since 120 does not appear among the first four choices, the correct option is None of these.

930. There are 7 available digits and none of them is 0, so every arrangement gives a valid 4-digit number. The number of ways of filling 4 ordered places from 7 distinct digits without repetition is ${}^7P_4 = 7 \times 6 \times 5 \times 4 = 840$. (If repetition were allowed the answer would be $7^4 = 2401$.)

931. The three prizes are different, so the arrangement matters. The first prize can go to any of 8 employees, the second to any of the remaining 7 and the third to any of the remaining 6. Required number $= {}^8P_3 = 8 \times 7 \times 6 = 336$.

932. BANKING has 7 letters: B, A, N, K, I, N, G. Here the letter N occurs twice and all others occur once. The number of arrangements of n objects of which p are alike is $\frac{n!}{p!}$. So the required number $= \frac{7!}{2!} = \frac{5040}{2} = 2520$.

933. DEPOSIT has 7 distinct letters: D, E, P, O, S, I, T. The first place is fixed as D and the last place is fixed as T, so neither can be changed. The remaining 5 letters E, P, O, S, I have to fill the 5 middle places, which can be done in $5! = 120$ ways. Hence the answer is 120.

934. A number is even when its units digit is even. Among the given digits the even ones are 2 and 4, so the units place can be filled in 2 ways. After fixing the units digit, 4 digits remain for the first three places, which can be arranged in ${}^4P_3 = 4 \times 3 \times 2 = 24$ ways. Total $= 2 \times 24 = 48$. Since 0 is not among the digits, no arrangement is rejected for a leading zero.

935. Total arrangements of 6 persons in a row $= 6! = 720$. Now count the arrangements in which Ramesh and Suresh do sit together: tie them into one block, so we arrange 5 units in $5! = 120$ ways, and the two of them can be ordered within the block in $2! = 2$ ways, giving $120 \times 2 = 240$. Required number $= 720 - 240 = 480$.

936. A 3-digit number formed from these digits exceeds 500 exactly when its hundreds digit is 5, 6, 7 or 9, so the hundreds place can be filled in 4 ways. (A hundreds digit of 2 or 3 gives a number below 400, and 5 itself in the hundreds place always gives a number of at least $523 > 500$.) After that, 5 digits remain for the tens and units places, giving ${}^5P_2 = 5 \times 4 = 20$ ways. Total $= 4 \times 20 = 80$.

937. COMMITTEE has 9 letters: C, O, M, M, I, T, T, E, E. Here M occurs twice, T occurs twice and E occurs twice. The number of distinct arrangements $= \frac{9!}{2!2!2!} = \frac{362880}{8} = 45360$.

938. Treat the three girls as a single block. Then we have 4 boys plus 1 block $= 5$ units, which can be arranged in $5! = 120$ ways. Within the block the three girls can be arranged among themselves in $3! = 6$ ways. Required number $= 120 \times 6 = 720$.

939. The letters in alphabetical order are A, B, K, N. First count the words that come before any word starting with B. Words beginning with A: the remaining letters B, K, N can be arranged in $3! = 6$ ways, so 6 words precede all B-words. Now take words beginning with B. The next letter of BANK is A, which is the smallest remaining letter, so no B-word with a smaller second letter exists. With BA fixed, the remaining letters are K and N, giving BAKN and BANK in that alphabetical order. So BAKN is the 7th word and BANK is the 8th. Rank $= 8$.

940. BANKING has vowels A, I and consonants B, N, K, N, G. Tie the two vowels into a single block. Then the units to be arranged are the block together with B, N, K, N, G, that is 6 units, but among these the letter N occurs twice. So the units can be arranged in $\frac{6!}{2!} = \frac{720}{2} = 360$ ways. Inside the block the two distinct vowels A and I can be ordered in $2! = 2$ ways. Required number $= 360 \times 2 = 720$.

941. First arrange the 5 Hindi books, which can be done in $5! = 120$ ways. These 5 books create 6 gaps (one before the first book, four between consecutive books and one after the last). To keep no two English books together, the 4 English books must occupy 4 different gaps, one book per gap. Since the English books are different and the gaps are distinct positions, this can be done in ${}^6P_4 = 6 \times 5 \times 4 \times 3 = 360$ ways. Total $= 120 \times 360 = 43200$.

942. A number is divisible by 5 when its units digit is 0 or 5; also the leading digit cannot be 0. Case 1, units digit $= 0$: the remaining 4 places are filled from the digits 1, 2, 3, 4, 5 in ${}^5P_4 = 5 \times 4 \times 3 \times 2 = 120$ ways, and none of them is 0, so all are valid. Case 2, units digit $= 5$: the leading digit must be one of 1, 2, 3, 4, giving 4 choices; the remaining 3 middle places are filled from the 4 digits still left (which include 0) in ${}^4P_3 = 4 \times 3 \times 2 = 24$ ways, giving $4 \times 24 = 96$. Total $= 120 + 96 = 216$.

943. In a circular arrangement of n distinct persons the number of ways is $(n - 1)!$, because one seat can be treated as fixed to remove rotations. Tie the two particular managers into one block, so effectively 7 units are to be seated around the table: this can be done in $(7 - 1)! = 6! = 720$ ways. The two managers inside the block can interchange their places in $2! = 2$ ways. Required number $= 720 \times 2 = 1440$.

944. The total number of such numbers is $4! = 24$. Fix any one digit in any one place, say 3 in the tens place; the other three digits can be arranged in the remaining places in $3! = 6$ ways. So each of the four digits appears exactly 6 times in each of the four places. The sum of the digits is $1 + 2 + 3 + 4 = 10$, so the digits contribute $6 \times 10 = 60$ to each place. Required sum $= 60 \times (1000 + 100 + 10 + 1) = 60 \times 1111 = 66660$.

945. Write both sides as products: ${}^nP_4 = n(n - 1)(n - 2)(n - 3)$ and ${}^nP_2 = n(n - 1)$. For ${}^nP_4$ to exist we need $n \geq 4$, so $n(n - 1) \neq 0$ and we may cancel it from both sides. This gives $(n - 2)(n - 3) = 20$, that is $n^2 - 5n + 6 = 20$, so $n^2 - 5n - 14 = 0$. Factorising, $(n - 7)(n + 2) = 0$, giving $n = 7$ or $n = -2$. Since n must be a positive integer with $n \geq 4$, we get $n = 7$. As 7 is not listed, the answer is None of these.

Subtopic 1.9.2

946. Order of selection does not matter, so we use combinations. Required number $= {}^8C_3 = \frac{8 \times 7 \times 6}{3 \times 2 \times 1} = \frac{336}{6} = 56$. (The value 336 is ${}^8P_3$, which would apply only if the three posts were distinct.)

947. A handshake is an unordered pair of employees, so the count is the number of ways of choosing 2 people out of 12. Required number $= {}^{12}C_2 = \frac{12 \times 11}{2} = 66$. (Counting ordered pairs gives $12 \times 11 = 132$, which double-counts each handshake.)

948. The two selections are independent, so multiply them. Clerks: ${}^6C_3 = \frac{6 \times 5 \times 4}{3 \times 2 \times 1} = 20$. Officers: ${}^4C_2 = \frac{4 \times 3}{2} = 6$. Total $= 20 \times 6 = 120$.

949. Use the property ${}^nC_r = {}^nC_{n-r}$, which makes the arithmetic short. ${}^9C_7 = {}^9C_2 = \frac{9 \times 8}{2} = 36$.

950. Joining any 2 of the 8 vertices gives a line segment: ${}^8C_2 = \frac{8 \times 7}{2} = 28$ segments in all. Of these, 8 are the sides of the octagon, and the rest are diagonals. Number of diagonals $= 28 - 8 = 20$.

951. Required number $= {}^{15}C_{11} = {}^{15}C_4 = \frac{15 \times 14 \times 13 \times 12}{4 \times 3 \times 2 \times 1} = \frac{32760}{24} = 1365$.

952. Exactly one straight line passes through any two given points, and since no three points are collinear, different pairs give different lines. Required number $= {}^{10}C_2 = \frac{10 \times 9}{2} = 45$.

953. Exactly 2 women means the remaining $4 - 2 = 2$ members are men. Women: ${}^4C_2 = \frac{4 \times 3}{2} = 6$. Men: ${}^6C_2 = \frac{6 \times 5}{2} = 15$. Total $= 15 \times 6 = 90$.

954. For each of the 7 schemes there are 2 possibilities: chosen or not chosen. Total number of subsets $= 2^7 = 128$. This count includes the single case in which nothing is chosen, which is not allowed. Required number $= 128 - 1 = 127$. Equivalently, ${}^7C_1 + {}^7C_2 + \cdots + {}^7C_7 = 127$.

955. Take the cases separately.

3 males, 2 females: ${}^6C_3 \times {}^4C_2 = 20 \times 6 = 120$.

4 males, 1 female: ${}^6C_4 \times {}^4C_1 = 15 \times 4 = 60$.

5 males, 0 female: ${}^6C_5 \times {}^4C_0 = 6 \times 1 = 6$.

Total $= 120 + 60 + 6 = 186$.

956. Since the Branch Manager is fixed in the panel, only $4 - 1 = 3$ more members are to be chosen, and they must come from the remaining $10 - 1 = 9$ officers. Required number $= {}^9C_3 = \frac{9 \times 8 \times 7}{3 \times 2 \times 1} = \frac{504}{6} = 84$.

957. If there are n trainees, the number of handshakes is ${}^nC_2 = \frac{n(n-1)}{2}$. So $\frac{n(n-1)}{2} = 190$, giving $n(n-1) = 380$. Now $380 = 20 \times 19$, so $n = 20$. (Check: ${}^{20}C_2 = \frac{20 \times 19}{2} = 190$.)

958. Total committees without any restriction $= {}^9C_4 = \frac{9 \times 8 \times 7 \times 6}{4 \times 3 \times 2 \times 1} = 126$.

Committees in which both Ravi and Suresh appear: fix both, then choose the other $4 - 2 = 2$ members from the remaining 7 employees, i.e. ${}^7C_2 = 21$.

Required number $= 126 - 21 = 105$.

959. Choosing 6 employees for one group automatically fixes the other 6, and this can be done in ${}^{12}C_6 = 924$ ways. But since the two groups are not distinguished, each division has been counted twice (once as “group P and group Q” and once as “group Q and group P”). Required number $= \frac{924}{2} = 462$.

960. With 5 seats, “at least 2 men and at least 2 women” allows only two splits: 2 men with 3 women, or 3 men with 2 women.

2 men, 3 women: ${}^5C_2 \times {}^6C_3 = 10 \times 20 = 200$.

3 men, 2 women: ${}^5C_3 \times {}^6C_2 = 10 \times 15 = 150$.

Total $= 200 + 150 = 350$.

961. In a group of 5, girls are in a majority when there are 3, 4 or 5 girls.

3 girls, 2 boys: ${}^5C_3 \times {}^6C_2 = 10 \times 15 = 150$.

4 girls, 1 boy: ${}^5C_4 \times {}^6C_1 = 5 \times 6 = 30$.

5 girls, 0 boys: ${}^5C_5 \times {}^6C_0 = 1 \times 1 = 1$.

Total $= 150 + 30 + 1 = 181$.

962. BANKING has 7 letters: B, A, N, K, I, N, G, i.e. 6 distinct letters B, A, N, K, I, G with N occurring twice.

Case 1 — all 4 letters distinct: choose 4 of the 6 distinct letters $= {}^6C_4 = 15$.

Case 2 — both N's used, plus 2 distinct letters from the remaining 5 (B, A, K, I, G) $= {}^5C_2 = 10$.

Total $= 15 + 10 = 25$, which is not listed. Hence the answer is None of these.

963. If ${}^nC_x = {}^nC_y$ with $x \neq y$, then $x + y = n$. Here $r + (r + 2) = 18$, so $2r = 16$ and $r = 8$.

Therefore ${}^rC_5 = {}^8C_5 = {}^8C_3 = \frac{8 \times 7 \times 6}{3 \times 2 \times 1} = 56$.

964. Choose the 4 bowlers from the 5 bowlers: ${}^5C_4 = 5$ ways.

The remaining $11 - 4 = 7$ players must come from the $15 - 5 = 10$ non-bowlers: ${}^{10}C_7 = {}^{10}C_3 = \frac{10 \times 9 \times 8}{3 \times 2 \times 1} = 120$ ways.

Total $= 5 \times 120 = 600$.

965. Let the 3 chosen chairs leave $8 - 3 = 5$ chairs empty. Arrange the 5 empty chairs in the row; they create $5 + 1 = 6$ gaps (including the two ends). To ensure that no two chosen chairs are adjacent, each chosen chair must go into a different gap.

Number of ways $= {}^6C_3 = \frac{6 \times 5 \times 4}{3 \times 2 \times 1} = 20$.

(General rule: choosing r non-adjacent objects from n in a row can be done in ${}^{n-r+1}C_r$ ways, here ${}^6C_3 = 20$.)

966. Any 3 points chosen from 12 give ${}^{12}C_3 = \frac{12 \times 11 \times 10}{3 \times 2 \times 1} = 220$ selections.

But 3 collinear points do not form a triangle, and the only collinear triples come from the 5 points on the line: ${}^5C_3 = 10$.

Number of triangles $= 220 - 10 = 210$.

Subtopic 1.9.3

967. Total number of balls = $5 + 4 + 3 = 12$, so the total number of equally likely outcomes is 12. The balls that are not blue are the red and green ones, i.e. $5 + 4 = 9$ balls. Hence $P(\text{not blue}) = \frac{9}{12}$.

Dividing numerator and denominator by 3 gives $\frac{3}{4}$.

968. When two dice are rolled the total number of outcomes is $6 \times 6 = 36$. The ordered pairs giving a sum of 9 are (3, 6), (4, 5), (5, 4) and (6, 3), which is 4 favourable outcomes. Therefore $P = \frac{4}{36} = \frac{1}{9}$.

969. A pack has 4 kings and 4 queens. Since a card cannot be both a king and a queen, these events are mutually exclusive, so the favourable outcomes are $4 + 4 = 8$. Total outcomes = 52. Hence $P = \frac{8}{52} = \frac{2}{13}$.

970. Each coin has 2 outcomes, so the total number of outcomes is $2 \times 2 \times 2 = 8$. The outcomes with exactly two heads are HHT, HTH and THH, i.e. 3 favourable outcomes. Note that HHH has three heads, not two, so it is not counted. Hence $P = \frac{3}{8}$.

971. The multiples of 4 between 1 and 25 are 4, 8, 12, 16, 20, 24, which is 6 numbers (28 would be next but exceeds 25). Total outcomes = 25. Hence $P = \frac{6}{25}$, which does not reduce further since 6 and 25 have no common factor.

972. Write out the letters: I, N, S, U, R, A, N, C, E. That is 9 letters in all (the letter N occurs twice and both occurrences are separate positions from which a letter may be picked). The vowels present are I, U, A and E, i.e. 4 positions. Hence $P(\text{vowel}) = \frac{4}{9}$.

973. The possible outcomes are 1, 2, 3, 4, 5, 6, giving 6 outcomes in all. The numbers strictly greater than 4 are 5 and 6, i.e. 2 favourable outcomes (note that 4 itself is not greater than 4). Hence $P = \frac{2}{6} = \frac{1}{3}$.

974. Total balls = $4 + 5 + 3 = 12$. The number of ways of choosing any 2 balls is ${}^{12}C_2 = \frac{12 \times 11}{2} = 66$. The number of ways of choosing 2 green balls out of 5 is ${}^5C_2 = \frac{5 \times 4}{2} = 10$. Hence $P = \frac{10}{66} = \frac{5}{33}$.

975. Total envelopes = $6 + 4 = 10$, so the number of ways of picking 2 is ${}^{10}C_2 = \frac{10 \times 9}{2} = 45$. To get one of each colour, choose 1 white from 6 and 1 black from 4: ${}^6C_1 \times {}^4C_1 = 6 \times 4 = 24$ ways. Hence $P = \frac{24}{45}$. Dividing numerator and denominator by 3 gives $\frac{8}{15}$.

976. The number of ways of drawing 2 cards from 52 is ${}^{52}C_2 = \frac{52 \times 51}{2} = 1326$. The pack has 4 aces, so the number of ways of drawing 2 aces is ${}^4C_2 = \frac{4 \times 3}{2} = 6$. Hence $P = \frac{6}{1326}$. Dividing numerator and denominator by 6 gives $\frac{1}{221}$.

977. It is easier to use the complement. The probability that Anil fails to solve it is $1 - \frac{3}{5} = \frac{2}{5}$, and the probability that Bhavna fails is $1 - \frac{2}{3} = \frac{1}{3}$. Since the attempts are independent, $P(\text{neither solves}) = \frac{2}{5} \times \frac{1}{3} = \frac{2}{15}$. Therefore $P(\text{at least one solves}) = 1 - \frac{2}{15} = \frac{13}{15}$.

978. A product of two whole numbers is odd only when both the numbers are odd; in every other case it is even. On one die the odd numbers are 1, 3, 5, so $P(\text{odd on a die}) = \frac{3}{6} = \frac{1}{2}$. The two dice

are independent, so $P(\text{both odd}) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$, which is $P(\text{product odd})$. Hence $P(\text{product even}) = 1 - \frac{1}{4} = \frac{3}{4}$.

979. Total employees = $5 + 4 = 9$. The number of ways of selecting 3 employees is ${}^9C_3 = \frac{9 \times 8 \times 7}{3 \times 2 \times 1} = 84$. For exactly 2 females, choose 2 from the 4 females and 1 from the 5 males: ${}^4C_2 \times {}^5C_1 = 6 \times 5 = 30$ ways. Hence $P = \frac{30}{84} = \frac{5}{14}$.

980. Total ways of picking 2 files from 15 is ${}^{15}C_2 = \frac{15 \times 14}{2} = 105$. The complement of the event (at least one incomplete) is the event (no file incomplete), i.e. both files are from the 10 complete files: ${}^{10}C_2 = \frac{10 \times 9}{2} = 45$ ways. So $P(\text{none incomplete}) = \frac{45}{105} = \frac{3}{7}$, and $P(\text{at least one incomplete}) = 1 - \frac{3}{7} = \frac{4}{7}$.

981. Total balls = $4 + 5 + 6 = 15$. The number of ways of drawing 3 balls is ${}^{15}C_3 = \frac{15 \times 14 \times 13}{3 \times 2 \times 1} = 455$. For one ball of each colour we choose 1 red from 4, 1 green from 5 and 1 blue from 6: $4 \times 5 \times 6 = 120$ ways. Hence $P = \frac{120}{455}$. Dividing numerator and denominator by 5 gives $\frac{24}{91}$.

982. This is a conditional probability, so the sample space shrinks to the outcomes with an even sum. The even sums and their counts are: sum 2: 1 way; sum 4: 3 ways; sum 6: 5 ways; sum 8: 5 ways; sum 10: 3 ways; sum 12: 1 way. Total = $1 + 3 + 5 + 5 + 3 + 1 = 18$ outcomes. The outcomes giving a sum of 8 are (2, 6), (3, 5), (4, 4), (5, 3), (6, 2), i.e. 5 outcomes. Hence the required probability = $\frac{5}{18}$. (The unconditional answer $\frac{5}{36}$ is a trap.)

983. Total staff = $4 + 5 + 3 = 12$, so total selections = ${}^{12}C_4 = \frac{12 \times 11 \times 10 \times 9}{4 \times 3 \times 2 \times 1} = 495$. The non-officers number $5 + 3 = 8$. Now count the favourable cases. Exactly 2 officers: ${}^4C_2 \times {}^8C_2 = 6 \times 28 = 168$. Exactly 3 officers: ${}^4C_3 \times {}^8C_1 = 4 \times 8 = 32$. Exactly 4 officers: ${}^4C_4 = 1$. Total favourable = $168 + 32 + 1 = 201$. Hence $P = \frac{201}{495}$; dividing both by 3 gives $\frac{67}{165}$.

984. The probabilities of not being selected are $\frac{1}{2}$, $\frac{2}{3}$ and $\frac{3}{4}$ respectively. Exactly one selected can happen in three mutually exclusive ways. Only Deepak: $\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} = \frac{6}{24}$. Only Meera: $\frac{1}{2} \times \frac{1}{3} \times \frac{3}{4} = \frac{3}{24}$. Only Farhan: $\frac{1}{2} \times \frac{2}{3} \times \frac{1}{4} = \frac{2}{24}$. Adding, $P = \frac{6 + 3 + 2}{24} = \frac{11}{24}$.

985. Exactly 3 draws are needed means the first two tokens are red and the third is black. There are 8 tokens initially. $P(\text{1st red}) = \frac{5}{8}$. After removing one red, 7 tokens remain of which 4 are red, so $P(\text{2nd red}) = \frac{4}{7}$. Now 6 tokens remain of which 3 are black, so $P(\text{3rd black}) = \frac{3}{6}$. Multiplying, $P = \frac{5}{8} \times \frac{4}{7} \times \frac{3}{6} = \frac{60}{336} = \frac{5}{28}$.

986. Each bag is equally likely, so $P(P) = P(Q) = \frac{1}{2}$. Each bag holds 9 balls, so $P(\text{white} | P) = \frac{4}{9}$ and $P(\text{white} | Q) = \frac{6}{9}$. The total probability of drawing a white ball is $\frac{1}{2} \times \frac{4}{9} + \frac{1}{2} \times \frac{6}{9} = \frac{4}{18} + \frac{6}{18} = \frac{10}{18}$. By Bayes' rule, $P(Q | \text{white}) = \frac{6/18}{10/18} = \frac{6}{10} = \frac{3}{5}$.

987. The word BANKING has 7 letters in which N is repeated twice and B, A, K, I, G occur once each. The total number of distinct arrangements is $\frac{7!}{2!} = \frac{5040}{2} = 2520$. To count arrangements with the two N's together, tie them into a single block; we then arrange this block with the other 5 distinct

letters, giving $6! = 720$ arrangements (the two N's are identical, so the block has only one internal arrangement). Hence $P = \frac{720}{2520} = \frac{2}{7}$.

Subtopic 1.9.4

988. Let S be the set of savings-account holders and C the set of current-account holders. Given $n(S) = 70$, $n(C) = 60$, $n(S \cap C) = 25$. By the addition rule for two sets, $n(S \cup C) = n(S) + n(C) - n(S \cap C)$. So $n(S \cup C) = 70 + 60 - 25 = 130 - 25 = 105$. Hence 105 customers hold at least one of the two accounts. (Note the survey size 120 is not needed here; it only tells us $120 - 105 = 15$ hold neither.)

989. Let R = set clearing Reasoning, Q = set clearing Quantitative. Then $n(R \cup Q) = n(R) + n(Q) - n(R \cap Q) = 130 + 110 - 60 = 180$. These 180 officers cleared at least one module. The officers clearing neither form the complement of $R \cup Q$ inside the batch, so their number is $200 - 180 = 20$.

990. Employees speaking only Hindi $= n(H) - n(H \cap T) = 32 - 12 = 20$. Employees speaking only Tamil $= n(T) - n(H \cap T) = 25 - 12 = 13$. 'Exactly one language' means only Hindi or only Tamil, so the required number is $20 + 13 = 33$. (Equivalently, $n(H \cup T) - n(H \cap T) = 45 - 12 = 33$.)

991. Each selection corresponds to a subset of the 5-element set of riders. For every rider there are exactly 2 independent possibilities: include it or leave it out. So the total number of subsets is $2^5 = 32$. Since choosing none is allowed, the empty subset is counted, giving 32 ways. (If choosing none had been disallowed the answer would have been $32 - 1 = 31$.)

992. From $n(A \cup B) = n(A) + n(B) - n(A \cap B)$ we get $n(A \cap B) = n(A) + n(B) - n(A \cup B)$. Substituting, $n(A \cap B) = 45 + 38 - 70 = 83 - 70 = 13$.

993. Let D = debit-card holders, C = credit-card holders, with $n(C \cap D) = 30$. Customers with a credit card but not a debit card form the set $C - D$, and $n(C - D) = n(C) - n(C \cap D) = 48 - 30 = 18$.

994. If $A \subseteq B$, then every element of A already lies in B . Hence $A \cup B = B$, so $n(A \cup B) = 20$, and $A \cap B = A$, so $n(A \cap B) = 12$. Therefore $n(A \cup B) + n(A \cap B) = 20 + 12 = 32$. (This also agrees with the identity $n(A \cup B) + n(A \cap B) = n(A) + n(B) = 12 + 20 = 32$.)

995. Use the three-set addition rule: $n(Q \cup R \cup E) = n(Q) + n(R) + n(E) - n(Q \cap R) - n(R \cap E) - n(Q \cap E) + n(Q \cap R \cap E)$. Substituting, $= 45 + 52 + 48 - 18 - 20 - 15 + 8 = 145 - 53 + 8 = 100$. So 100 candidates cleared at least one section, and those clearing none number $150 - 100 = 50$.

996. Each pairwise figure such as $n(I \cap II) = 22$ includes the 10 employees who are in all three schemes. So those in Schemes I and II but not III $= 22 - 10 = 12$; in II and III but not I $= 18 - 10 = 8$; in I and III but not II $= 25 - 10 = 15$. Adding, employees in exactly two schemes $= 12 + 8 + 15 = 35$. (Shortcut: exactly two $= \Sigma$ pairwise $- 3 \times$ triple $= 65 - 30 = 35$.)

997. Only Mutual Funds $= 40 - 15 - 10 + 5 = 20$. Only Fixed Deposits $= 35 - 15 - 12 + 5 = 13$. Only Bonds $= 30 - 12 - 10 + 5 = 13$. (Each 'only' figure subtracts the two overlapping pairs and adds back the triple, which was removed twice.) Total holding exactly one instrument $= 20 + 13 + 13 = 46$.

998. Let e_1, e_2, e_3 be the numbers using exactly one, exactly two and all three services. Then $e_1 + e_2 + e_3 = 120$ with $e_2 = 25$, so $e_1 + e_3 = 95$. Counting memberships, a customer using exactly two services is counted twice in the total $65 + 55 + 45 = 165$, and one using all three is counted thrice: $e_1 + 2e_2 + 3e_3 = 165$, i.e. $e_1 + 50 + 3e_3 = 165$, so $e_1 + 3e_3 = 115$. Subtracting $e_1 + e_3 = 95$ gives $2e_3 = 20$, hence $e_3 = 10$.

999. For any two sets, $n(A \cap B) = n(A) + n(B) - n(A \cup B)$. The intersection is smallest when the union is as large as possible, and the union cannot exceed the 100 households surveyed. So the minimum is $72 + 58 - 100 = 130 - 100 = 30$. (This is attainable: 42 use only ATM, 28 only net banking, 30 both, total 100.)

1000. Since 15% failed both, the percentage passing at least one subject is $100\% - 15\% = 85\%$. Using $n(Q \cup R) = n(Q) + n(R) - n(Q \cap R)$ in percentage terms, $85 = 65 + 48 - n(Q \cap R)$, so $n(Q \cap R) = 113 - 85 = 28\%$. Number of candidates = 28% of $800 = \frac{28}{100} \times 800 = 224$.

1001. The union splits into three disjoint parts: $A - B$, $B - A$ and $A \cap B$. So $n(A \cap B) = n(A \cup B) - n(A - B) - n(B - A) = 90 - 35 - 25 = 30$. Now B consists of $B - A$ together with $A \cap B$, so $n(B) = 25 + 30 = 55$.

1002. Let A , B , C be the sets of numbers from 1 to 300 divisible by 2, 3, 5 respectively. Then $n(A) = \lfloor 300/2 \rfloor = 150$, $n(B) = \lfloor 300/3 \rfloor = 100$, $n(C) = \lfloor 300/5 \rfloor = 60$. A number lies in two of the sets exactly when it is divisible by the corresponding product, so $n(A \cap B) = \lfloor 300/6 \rfloor = 50$, $n(A \cap C) = \lfloor 300/10 \rfloor = 30$, $n(B \cap C) = \lfloor 300/15 \rfloor = 20$, and $n(A \cap B \cap C) = \lfloor 300/30 \rfloor = 10$. By the three-set addition rule, $n(A \cup B \cup C) = 150 + 100 + 60 - 50 - 30 - 20 + 10 = 220$. The tokens divisible by none of 2, 3, 5 form the complement, so their number is $300 - 220 = 80$. (Check: $300 \times \frac{1}{2} \times \frac{2}{3} \times \frac{4}{5} = 80$.)

1003. Count failures instead. At most $100 - 78 = 22$ failed Hindi, $100 - 85 = 15$ failed English and $100 - 92 = 8$ failed Computer. The number failing at least one test is at most $22 + 15 + 8 = 45$ (largest when the failure groups are disjoint). Hence the number passing all three is at least $100 - 45 = 55$. This bound is achieved when the three failure groups do not overlap, so the minimum is 55. (General formula: minimum = $n(A) + n(B) + n(C) - 2 \times \text{total} = 255 - 200 = 55$.)

1004. By De Morgan's law, $A' \cap B' = (A \cup B)'$, so $n(A \cup B) = 700 - 180 = 520$. Then $n(A \cap B) = n(A) + n(B) - n(A \cup B) = 350 + 280 - 520 = 630 - 520 = 110$. The required set $A' \cap B = B - A$, so $n(A' \cap B) = n(B) - n(A \cap B) = 280 - 110 = 170$.

1005. Let t be the number knowing all three. Total memberships: $130 + 145 + 100 = 375 = e_1 + 2(95) + 3t = e_1 + 190 + 3t$, so $e_1 + 3t = 185$. Also everyone knows at least one, so $e_1 + 95 + t = 250$, giving $e_1 + t = 155$. Subtracting, $2t = 185 - 155 = 30$, so $t = 15$ and $e_1 = 155 - 15 = 140$. Hence 140 staff members know exactly one language.

1006. Let $n(B) = b$, so $n(A) = b + 2$. The subset counts give $2^{b+2} - 2^b = 96$, i.e. $2^b(4 - 1) = 96$, so $3 \cdot 2^b = 96$ and $2^b = 32$, giving $b = 5$. Then $n(A) = 7$ and $n(B) = 5$ (check: $128 - 32 = 96$). Therefore $n(A) + n(B) = 7 + 5 = 12$.

1007. Let the total be N . Customers holding at least one deposit = $N - 90$. Using the addition rule as counts, $0.63N + 0.44N - 132 = N - 90$, i.e. $1.07N - 132 = N - 90$. So $0.07N = 42$, giving $N = \frac{42}{0.07} = 600$. Verification: fixed deposit = 378, recurring = 264, both = 132, union = $378 + 264 - 132 = 510$, and neither = $600 - 510 = 90$, as required.

1008. Let t be the number clearing all three, so the number clearing exactly two is $2t$. Candidates clearing at least one section = $400 - 40 = 360$, hence $e_1 + 2t + t = 360$, giving $e_1 = 360 - 3t$. Total memberships: $210 + 195 + 175 = 580 = e_1 + 2(2t) + 3t = e_1 + 7t$. Substituting, $580 = (360 - 3t) + 7t = 360 + 4t$, so $4t = 220$ and $t = 55$. (Then exactly two = 110 and exactly one = 195, and $195 + 110 + 55 = 360$, which checks out.)

Subtopic 1.10.1

1009. Compare consecutive terms. $14 \div 7 = 2$, $28 \div 14 = 2$, $56 \div 28 = 2$, so each term is twice the previous one. Hence the missing term = $56 \times 2 = 112$. Check forward: $112 \times 2 = 224$, which matches the last given term. So the answer is 112.

1010. The differences 1, 6, 7, 13 are not constant, so test a sum rule. $6 + 7 = 13$ (the 3rd term), $7 + 13 = 20$ (the 4th term), $13 + 20 = 33$ (the 5th term). Each term is the sum of the two terms before it. Therefore the missing term = $20 + 33 = 53$.

1011. Take differences: $15 - 12 = 3$, $21 - 15 = 6$, $30 - 21 = 9$. The differences increase by 3 each time, so the next difference is 12 and the one after is 15. Missing term = $30 + 12 = 42$. Verify: $42 + 15 = 57$, which is the given last term. So the answer is 42.

- 1012.** Each term is a perfect square: $4 = 2^2$, $9 = 3^2$, $16 = 4^2$, $25 = 5^2$. The bases run 2, 3, 4, 5, 6, 7, so the missing term is $6^2 = 36$, and the term after it is $7^2 = 49$, which matches. Hence the answer is 36.
- 1013.** Differences are $11 - 8 = 3$, $17 - 11 = 6$, $29 - 17 = 12$, $53 - 29 = 24$. These differences themselves double: 3, 6, 12, 24, so the next difference is 48. Missing term $= 53 + 48 = 101$.
- 1014.** Each term is one-third of the previous term: $972 \div 3 = 324$, $324 \div 3 = 108$, $108 \div 3 = 36$. So the missing term $= 36 \div 3 = 12$, and indeed $12 \div 3 = 4$, the given last term. Since 12 does not appear among options A to D, the correct choice is None of these.
- 1015.** Test the rule multiply by 2 then add 2. $3 \times 2 + 2 = 8$, $8 \times 2 + 2 = 18$, $18 \times 2 + 2 = 38$. Continuing, missing term $= 38 \times 2 + 2 = 78$. Check: $78 \times 2 + 2 = 158$, matching the last term. So the answer is 78.
- 1016.** The jumps are too large for a simple difference rule, so test a multiply-and-add rule with changing multipliers. $2 \times 1 + 1^2 = 3$; $3 \times 2 + 2^2 = 6 + 4 = 10$; $10 \times 3 + 3^2 = 30 + 9 = 39$. The pattern is multiply by n and add n^2 , with $n = 1, 2, 3, \dots$. So the missing term $= 39 \times 4 + 4^2 = 156 + 16 = 172$. Verify the next step: $172 \times 5 + 5^2 = 860 + 25 = 885$, which matches. Hence the answer is 172.
- 1017.** Differences are 2, 5, 10, 17. Look at these: $2 = 1^2 + 1$, $5 = 2^2 + 1$, $10 = 3^2 + 1$, $17 = 4^2 + 1$. So the next difference is $5^2 + 1 = 26$. Missing term $= 49 + 26 = 75$.
- 1018.** The terms fall fast, so test halve-then-subtract. $108 \div 2 = 54$ and $54 - 2 = 52$; $52 \div 2 = 26$ and $26 - 2 = 24$. The rule is divide by 2, then subtract 2. Missing term $= 24 \div 2 - 2 = 12 - 2 = 10$. Check: $10 \div 2 - 2 = 5 - 2 = 3$, the given last term. So the answer is 10.
- 1019.** The terms rise and fall alternately, so split into two series. Terms in odd positions: 3, 12, 21, ? increase by 9 each time, so the missing term $= 21 + 9 = 30$. Terms in even positions: 4, 8, 16, 32 double each time, which is consistent with the given last term. Hence the missing seventh term is 30.
- 1020.** Differences of the known consecutive pairs: $14 - 13 = 1 = 1^3$ and $22 - 14 = 8 = 2^3$. The added amounts are successive cubes, so the next addition is $3^3 = 27$. Missing term $= 22 + 27 = 49$. Verify onward: $49 + 4^3 = 49 + 64 = 113$ and $113 + 5^3 = 113 + 125 = 238$, both matching. So the answer is 49.
- 1021.** Find the ratio: $36 \div 24 = \frac{3}{2}$, $54 \div 36 = \frac{3}{2}$, $81 \div 54 = \frac{3}{2}$. Each term is $\frac{3}{2}$ times the previous one. Missing term $= 81 \times \frac{3}{2} = \frac{243}{2} = 121.5$.
- 1022.** Test multiply by 3 and subtract a constant. $5 \times 3 - 4 = 11$; $11 \times 3 - 4 = 29$; $29 \times 3 - 4 = 83$. So the missing term $= 83 \times 3 - 4 = 249 - 4 = 245$. Check forward: $245 \times 3 - 4 = 735 - 4 = 731$, matching the last term. Note that 249 is the trap value obtained by forgetting to subtract 4.
- 1023.** Compute the ratios: $6 \div 4 = 1.5$, $15 \div 6 = 2.5$, $52.5 \div 15 = 3.5$. The multipliers increase by 1 each time: 1.5, 2.5, 3.5, so the next multiplier is 4.5. Missing term $= 52.5 \times 4.5 = 236.25$.
- 1024.** The series alternates between two patterns, so separate them. Odd-position terms: 5, 12, 27, 58, where $5 \times 2 + 2 = 12$, $12 \times 2 + 3 = 27$, $27 \times 2 + 4 = 58$. Even-position terms: 3, 7, 15, ?, where $3 \times 2 + 1 = 7$ and $7 \times 2 + 1 = 15$, so the rule is multiply by 2 and add 1. Missing term $= 15 \times 2 + 1 = 31$.
- 1025.** Write each term as a sum of two consecutive cubes: $1 = 1^3 + 0^3$, $9 = 2^3 + 1^3 = 8 + 1$, $35 = 3^3 + 2^3 = 27 + 8$, $91 = 4^3 + 3^3 = 64 + 27$. The n th term is $n^3 + (n - 1)^3$. For $n = 5$ the term is $125 + 64 = 189$. Verify: for $n = 6$ it is $216 + 125 = 341$, the given last term. Hence the answer is 189.
- 1026.** Look at numerators and denominators separately. Numerators: 1, 3, 9, 27 multiply by 3 each time, so the next is 81. Denominators: 2, 4, 8, 16 double each time, so the next is 32. Missing term $= \frac{81}{32}$. Equivalently, each term is $\frac{3}{2}$ times the previous one, and $\frac{27}{16} \times \frac{3}{2} = \frac{81}{32}$.
- 1027.** Each term is roughly double the previous one, so test multiply by 2 and add something. $13 \times 2 + 4 = 30$; $30 \times 2 + 6 = 66$; $66 \times 2 + 8 = 140$. The added numbers are consecutive even numbers 4, 6, 8, so the next addition is 10. Missing term $= 140 \times 2 + 10 = 290$. Verify: $290 \times 2 + 12 = 592$, matching the last term.

1028. Find the divisors used at each step: $720 \div 120 = 6$, $120 \div 24 = 5$, $24 \div 6 = 4$, $6 \div 2 = 3$. The divisors decrease by 1 each time, so the next divisor is 2. Missing term $= 2 \div 2 = 1$.

1029. The terms alternately fall and rise, so the operations alternate. $200 \div 2 = 100$; $100 \times 3 = 300$; $300 \div 4 = 75$; $75 \times 5 = 375$. The operations alternate between dividing and multiplying, with the operand increasing by 1 each step: $\div 2, \times 3, \div 4, \times 5$. The next operation is $\div 6$, so the missing term $= 375 \div 6 = 62.5$.

Subtopic 1.10.2

1030. Test the rule “multiply by 2 and add 1”. $5 \times 2 + 1 = 11$ (correct). $11 \times 2 + 1 = 23$ (correct). $23 \times 2 + 1 = 47$ (correct). $47 \times 2 + 1 = 95$, but the series shows 96, so 96 is the odd term. Confirm with the remaining terms using the correct value 95: $95 \times 2 + 1 = 191$ (correct) and $191 \times 2 + 1 = 383$ (correct). Since every other term obeys $\times 2 + 1$, the single wrong number is 96; it should be 95.

1031. The list is meant to be the consecutive prime numbers. Check each entry for divisors other than 1 and itself: 11, 13, 17 and 19 have none, so all four are prime. But $21 = 3 \times 7$, which is composite. Hence 21 does not belong; the prime that should occupy that place is 23. So the wrong number is 21.

1032. The terms are the squares of consecutive natural numbers starting from 2: $2^2 = 4$, $3^2 = 9$, $4^2 = 16$, $5^2 = 25$, $6^2 = 36$, $7^2 = 49$, $8^2 = 64$. Comparing term by term, every value matches except the sixth, where the series shows 48 instead of $7^2 = 49$. The last term $64 = 8^2$ is correct, which confirms the pattern continues normally after the error. Hence the wrong number is 48.

1033. Take successive differences: $15 - 12 = 3$, $21 - 15 = 6$, $30 - 21 = 9$, $42 - 30 = 12$, $57 - 42 = 15$. These differences form the arithmetic pattern 3, 6, 9, 12, 15, ... increasing by 3 each time, so the next difference must be 18. The seventh term should therefore be $57 + 18 = 75$, but the series shows 74. Since all earlier differences are consistent, the single wrong number is 74.

1034. The terms are cubes of consecutive natural numbers: $2^3 = 8$, $3^3 = 27$, $4^3 = 64$, $5^3 = 125$, $6^3 = 216$, $7^3 = 343$. Checking each option: $27 = 3^3$, $64 = 4^3$, $125 = 5^3$ and $343 = 7^3$ are all genuine cubes, so none of them is the error. The fifth term is printed as 218, whereas it should be $6^3 = 216$. As the wrong number 218 is not listed among options A to D, the correct choice is “None of these”.

1035. The intended rule is to add consecutive even numbers: $+2$, $+4$, $+6$, $+8$, $+10$, $+12$. Applying it: $7 + 2 = 9$, $9 + 4 = 13$, $13 + 6 = 19$, $19 + 8 = 27$. The series shows 26 instead of 27, so 26 is suspect. Verify the rest using the correct value 27: $27 + 10 = 37$ (matches) and $37 + 12 = 49$ (matches). Hence exactly one term is wrong, namely 26, which should be 27.

1036. Each term should be half of the term before it. Check: $1024 \div 2 = 512$ (correct), $512 \div 2 = 256$ (correct), $256 \div 2 = 128$ (correct), $128 \div 2 = 64$, but the series shows 60. Continuing with the correct value: $64 \div 2 = 32$ (matches) and $32 \div 2 = 16$ (matches). So the only term breaking the halving rule is 60, which should be 64.

1037. The multipliers increase by 1 each step. Check: $2 \times 2 = 4$, $4 \times 3 = 12$, $12 \times 4 = 48$, $48 \times 5 = 240$, $240 \times 6 = 1440$. The series shows 1450, so this term is suspect. Verify the last term from the correct value: $1440 \times 7 = 10080$, which matches the series. Since the multipliers 2, 3, 4, 5, 6, 7 work everywhere else, the single wrong number is 1450; it should be 1440.

1038. The multipliers rise by 1 each time starting from 0.5, that is $\times 0.5$, $\times 1.5$, $\times 2.5$, $\times 3.5$, $\times 4.5$. Check: $8 \times 0.5 = 4$ (correct), $4 \times 1.5 = 6$ (correct), $6 \times 2.5 = 15$ (correct), $15 \times 3.5 = 52.5$, but the entry is 50. Using the correct value, $52.5 \times 4.5 = 236.25$, which matches the last entry. Hence the wrongly entered figure is 50; it should be 52.5.

1039. Take successive differences: $6 - 5 = 1$, $14 - 6 = 8$, $41 - 14 = 27$, $104 - 41 = 63$, $230 - 104 = 126$. The first three differences are $1^3 = 1$, $2^3 = 8$, $3^3 = 27$, so the differences should be consecutive cubes; the fourth difference must be $4^3 = 64$ and the fifth $5^3 = 125$. Then the fifth term should be $41 + 64 = 105$, not 104. Checking with the corrected value, $105 + 125 = 230$, which matches the last term. Hence the wrong number is 104; it should be 105.

1040. Test the rule “multiply by 3 and subtract 2”. $3 \times 3 - 2 = 7$ (correct), $7 \times 3 - 2 = 19$ (correct), $19 \times 3 - 2 = 55$ (correct), $55 \times 3 - 2 = 163$ (correct), $163 \times 3 - 2 = 487$, but the series shows 484. Using the correct value: $487 \times 3 - 2 = 1459$, which matches the final term. So the only term violating the rule is 484; it should be 487.

1041. Each term looks like a cube increased by 1: $1^3 + 1 = 2$, $2^3 + 1 = 9$, $3^3 + 1 = 28$, $4^3 + 1 = 65$, $5^3 + 1 = 126$, $6^3 + 1 = 217$, $7^3 + 1 = 344$. Comparing with the series, the first four terms and the last two terms all match. Only the fifth term differs: the series prints 124 where the pattern demands 126. Hence the wrong number is 124.

1042. Take successive differences: $15 - 10 = 5$, $24 - 15 = 9$, $41 - 24 = 17$, $75 - 41 = 34$, $139 - 75 = 64$, $268 - 139 = 129$. The differences should follow the rule “double and subtract 1”: from 5 we get $5 \times 2 - 1 = 9$, then $9 \times 2 - 1 = 17$, then $17 \times 2 - 1 = 33$, then $33 \times 2 - 1 = 65$, then $65 \times 2 - 1 = 129$. So the required differences are 5, 9, 17, 33, 65, 129. The fifth term should be $41 + 33 = 74$, not 75. Using 74: $74 + 65 = 139$ and $139 + 129 = 268$, both matching. Hence the wrong number is 75; it should be 74.

1043. Each term has the form $n^3 - n$ for decreasing values of n : $7^3 - 7 = 343 - 7 = 336$, $6^3 - 6 = 216 - 6 = 210$, $5^3 - 5 = 125 - 5 = 120$, $4^3 - 4 = 64 - 4 = 60$, $3^3 - 3 = 27 - 3 = 24$, $2^3 - 2 = 8 - 2 = 6$. Every printed term agrees with this except the fourth, which is shown as 62 instead of 60. So 62 is the wrong term and it is present in the options, which rules out “None of these”.

1044. Take successive differences: $9 - 7 = 2$, $15 - 9 = 6$, $27 - 15 = 12$, $45 - 27 = 18$, $77 - 45 = 32$, $119 - 77 = 42$. The first three differences are $1 \times 2 = 2$, $2 \times 3 = 6$ and $3 \times 4 = 12$, so the differences should be the products of consecutive integers $n(n + 1)$, namely 2, 6, 12, 20, 30, 42. The fourth difference must therefore be $4 \times 5 = 20$, giving the fifth term $27 + 20 = 47$, not 45. Verify the rest from the corrected value: $47 + 5 \times 6 = 47 + 30 = 77$ (matches) and $77 + 6 \times 7 = 77 + 42 = 119$ (matches). Hence exactly one term breaks the pattern, namely 45, which should be 47.

1045. Test the rule “multiply by 3 and subtract 5”. $4 \times 3 - 5 = 7$ (correct), $7 \times 3 - 5 = 16$ (correct), $16 \times 3 - 5 = 43$ (correct), $43 \times 3 - 5 = 124$, but the series shows 122. Confirm using the correct value: $124 \times 3 - 5 = 372 - 5 = 367$, which matches the final term. Hence exactly one term breaks the rule, namely 122, which should be 124.

1046. The multipliers are consecutive prime numbers 2, 3, 5, 7, 11. Check: $3 \times 2 = 6$ (correct), $6 \times 3 = 18$ (correct), $18 \times 5 = 90$, but the series shows 88. Verify the remaining terms from the correct value: $90 \times 7 = 630$ (matches) and $630 \times 11 = 6930$ (matches). Hence the wrong number is 88; it should be 90.

1047. Each term has the form $n^3 + n^2$ for $n = 1, 2, 3, \dots$: $1 + 1 = 2$, $8 + 4 = 12$, $27 + 9 = 36$, $64 + 16 = 80$, $125 + 25 = 150$, $216 + 36 = 252$. Comparing with the printed series, the first four terms and the last term agree exactly. Only the fifth differs: it is shown as 155 where the pattern requires 150. Hence the wrong term is 155.

1048. This is an alternating series formed from two independent sequences. The terms in the odd positions are 5, 10, 20, 41 and the terms in the even positions are 3, 6, 12, 24. The even-position sequence doubles each time: $3 \rightarrow 6 \rightarrow 12 \rightarrow 24$, all correct. The odd-position sequence should also double: $5 \rightarrow 10 \rightarrow 20 \rightarrow 40$, but the fourth of these is printed as 41. Hence the wrong number is 41; it should be 40.

1049. Take successive differences: $10 - 6 = 4$, $19 - 10 = 9$, $44 - 19 = 25$, $95 - 44 = 51$, $214 - 95 = 119$. The first three differences are $2^2 = 4$, $3^2 = 9$, $5^2 = 25$, so the differences are the squares of consecutive primes 2, 3, 5, 7, 11. The next difference must therefore be $7^2 = 49$, giving the fifth term $44 + 49 = 93$, not 95. Verify with the corrected value: $93 + 11^2 = 93 + 121 = 214$, which matches the last term. Hence the wrong number is 95; it should be 93.

1050. The rule is “multiply by n and add n ” with n increasing from 2. Check: $12 \times 2 + 2 = 26$ (correct), $26 \times 3 + 3 = 78 + 3 = 81$, but the series shows 82. Verify the rest from the correct

value 81: $81 \times 4 + 4 = 324 + 4 = 328$ (matches), $328 \times 5 + 5 = 1640 + 5 = 1645$ (matches), $1645 \times 6 + 6 = 9870 + 6 = 9876$ (matches). Hence exactly one term is wrong, namely 82, which should be 81.

Subtopic 1.10.3

1051. Take first differences: $11 - 7 = 4$, $17 - 11 = 6$, $25 - 17 = 8$, $35 - 25 = 10$. The differences are 4, 6, 8, 10, which increase by a constant 2 each time (a double-difference or second-difference pattern with second difference 2). Hence the next difference is $10 + 2 = 12$. Therefore the missing term is $35 + 12 = 47$. Option (C) is correct.

1052. Check the ratio of consecutive terms: $\frac{6}{3} = 2$, $\frac{18}{6} = 3$, $\frac{72}{18} = 4$, $\frac{360}{72} = 5$. So the multipliers are the consecutive integers 2, 3, 4, 5 and the next multiplier is 6. Hence the missing term is $360 \times 6 = 2160$. Option (A) is correct.

1053. Write each term as a perfect square: $4 = 2^2$, $9 = 3^2$, $25 = 5^2$, $49 = 7^2$, $121 = 11^2$. The bases are 2, 3, 5, 7, 11, which are the consecutive prime numbers. The next prime after 11 is 13, so the required term is $13^2 = 169$. Note $144 = 12^2$ and $196 = 14^2$ use composite bases, so they do not fit. Option (B) is correct.

1054. Compare each term with a cube: $9 = 2^3 + 1$, $28 = 3^3 + 1$, $65 = 4^3 + 1$, $126 = 5^3 + 1$, $217 = 6^3 + 1$. So the n th term is (cube of the next integer) + 1. The next term uses 7: $7^3 + 1 = 343 + 1 = 344$. Option (D) is correct.

1055. Take the differences: $12 - 10 = 2$, $15 - 12 = 3$, $20 - 15 = 5$, $27 - 20 = 7$. The differences are 2, 3, 5, 7, which are the consecutive prime numbers. The next prime is 11, so the missing term is $27 + 11 = 38$. Since 38 does not appear among the four numerical options, the answer is 'None of these'. Option (E) is correct.

1056. The operations alternate. From 5 to 10 we multiply by 2; from 10 to 13 we add 3; from 13 to 26 we multiply by 2; from 26 to 29 we add 3; from 29 to 58 we multiply by 2. The next operation in the cycle is 'add 3', giving $58 + 3 = 61$. Option (C) is correct.

1057. Each term should be one less than a perfect square: $3 = 2^2 - 1$, $8 = 3^2 - 1$, $15 = 4^2 - 1$, $24 = 5^2 - 1$. Continuing, the fifth term should be $6^2 - 1 = 35$, but the series shows 34. The sixth term checks out as $7^2 - 1 = 48$. Hence the wrong term is 34 (it should be 35). Option (D) is correct.

1058. First differences: $7 - 6 = 1$, $11 - 7 = 4$, $20 - 11 = 9$, $36 - 20 = 16$. These are 1^2 , 2^2 , 3^2 , 4^2 , i.e. consecutive perfect squares. The next difference is $5^2 = 25$, so the required term is $36 + 25 = 61$. Option (C) is correct.

1059. Examine the ratios: $\frac{240}{480} = \frac{1}{2}$, $\frac{160}{240} = \frac{2}{3}$, $\frac{120}{160} = \frac{3}{4}$, $\frac{96}{120} = \frac{4}{5}$. The multipliers form the pattern $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, so the next multiplier is $\frac{5}{6}$. Hence the required term is $96 \times \frac{5}{6} = 80$. Option (B) is correct.

1060. First differences: $6 - 5 = 1$, $14 - 6 = 8$, $41 - 14 = 27$, $105 - 41 = 64$. These are 1^3 , 2^3 , 3^3 , 4^3 , the consecutive perfect cubes. The next difference is $5^3 = 125$, so the missing term is $105 + 125 = 230$. Since 230 is not listed among the four numerical options, the answer is 'None of these'. Option (E) is correct.

1061. Take successive ratios: $\frac{8}{4} = 2$, $\frac{24}{8} = 3$, $\frac{120}{24} = 5$, $\frac{840}{120} = 7$. The multipliers are 2, 3, 5, 7, the consecutive primes. The next prime is 11, so the required term is $840 \times 11 = 9240$. (The trap $10920 = 840 \times 13$ skips the prime 11.) Option (C) is correct.

1062. Test a mixed rule of the form (multiply, then add). $4 \times 2 + 3 = 11$; $11 \times 2 + 3 = 25$; $25 \times 2 + 3 = 53$; $53 \times 2 + 3 = 109$. The rule 'double and add 3' holds throughout, so the next term is $109 \times 2 + 3 = 218 + 3 = 221$. Option (A) is correct.

1063. First differences: $1596 - 1548 = 48$, $1656 - 1596 = 60$, $1728 - 1656 = 72$, $1812 - 1728 = 84$. Second differences: $60 - 48 = 12$, $72 - 60 = 12$, $84 - 72 = 12$, a constant. So the next first difference is $84 + 12 = 96$, and the required term is $1812 + 96 = 1908$. Option (D) is correct.

1064. Test the rule 'multiply by 2 and subtract 2'. $7 \times 2 - 2 = 12$ (correct); $12 \times 2 - 2 = 22$ (correct); $22 \times 2 - 2 = 42$, but the series shows 40. Continuing from the correct value, $42 \times 2 - 2 = 82$ (matches) and $82 \times 2 - 2 = 162$ (matches). So only 40 breaks the pattern; it should be 42. Option (C) is correct.

1065. Try combining a cube and a square. For $n = 2$: $2^3 - 2^2 = 8 - 4 = 4$. For $n = 3$: $27 - 9 = 18$. For $n = 4$: $64 - 16 = 48$. For $n = 5$: $125 - 25 = 100$. For $n = 6$: $216 - 36 = 180$. All match, so the n th term is $n^3 - n^2$. For $n = 7$: $343 - 49 = 294$. Option (A) is correct.

1066. This is two interleaved series. The terms in the odd positions are 5, 8, 11, 14, increasing by 3. The terms in the even positions are 11, 17, 23, ?, increasing by 6. The question mark occupies the eighth (an even) position, so it belongs to the second series: $23 + 6 = 29$. The value 17 (i.e. $14 + 3$) would be the ninth term, not this one. Option (B) is correct.

1067. The operations alternate between adding a prime and doubling. $6 + 2 = 8$; $8 \times 2 = 16$; $16 + 3 = 19$; $19 \times 2 = 38$; $38 + 5 = 43$; $43 \times 2 = 86$. The primes added so far are 2, 3, 5, so the next addition uses the prime 7: $86 + 7 = 93$. Option (C) is correct.

1068. Factorise each term: $6 = 2 \times 3$, $15 = 3 \times 5$, $35 = 5 \times 7$, $77 = 7 \times 11$, $143 = 11 \times 13$. Each term is the product of two consecutive primes, and each term shares its larger prime with the next term's smaller prime. After 11×13 comes 13×17 (the prime after 13 is 17), giving $13 \times 17 = 221$. The distractors are products of the wrong prime pairs: $187 = 11 \times 17$, $209 = 11 \times 19$, $247 = 13 \times 19$. Option (B) is correct.

1069. Compute the successive multipliers: $\frac{324}{972} = \frac{1}{3}$, $\frac{216}{324} = \frac{2}{3}$, $\frac{216}{216} = 1 = \frac{3}{3}$, $\frac{288}{216} = \frac{4}{3}$. The multipliers are $\frac{1}{3}$, $\frac{2}{3}$, $\frac{3}{3}$, $\frac{4}{3}$, so the next is $\frac{5}{3}$. Hence the required term is $288 \times \frac{5}{3} = 480$. Option (D) is correct.

1070. Test the mixed rule 'multiply by n and add n^2 ', with $n = 1, 2, 3, \dots$ starting from the first term. $3 \times 1 + 1^2 = 4$ (correct); $4 \times 2 + 2^2 = 8 + 4 = 12$ (correct); $12 \times 3 + 3^2 = 36 + 9 = 45$ (correct); $45 \times 4 + 4^2 = 180 + 16 = 196$, but the series shows 200. Continuing from the correct value 196: $196 \times 5 + 5^2 = 980 + 25 = 1005$ (matches) and $1005 \times 6 + 6^2 = 6030 + 36 = 6066$ (matches). So the single wrong term is 200, which should be 196. Option (C) is correct.

1071. The differences grow irregularly, so test ratios: $\frac{12}{8} = 1.5$, $\frac{24}{12} = 2$, $\frac{60}{24} = 2.5$, $\frac{180}{60} = 3$, $\frac{630}{180} = 3.5$. The multipliers increase by 0.5 each time, so the next multiplier is 4. Hence the required term is $630 \times 4 = 2520$. (The trap $2205 = 630 \times 3.5$ repeats the previous multiplier.) Option (A) is correct.

Subtopic 1.11.1

1072. At Chembur the table shows 275 savings accounts and 145 current accounts. Total new accounts = $275 + 145 = 420$. The value 420 does not appear among options A to D (they read 400, 410, 430 and 440), so the correct choice is "None of these". Hence option E.

1073. Read down the 2020 column: Ranchi 60, Patna 50, Bhopal 70, Indore 45. Total = $60 + 50 + 70 + 45$. Adding step by step: $60 + 50 = 110$, $110 + 70 = 180$, $180 + 45 = 225$. So the total loan disbursed in 2020 is Rs. 225 lakh. Hence option A.

1074. At Saket there are 65 male and 39 female employees, so the required ratio is 65 : 39. Both numbers are divisible by 13: $65 \div 13 = 5$ and $39 \div 13 = 3$. Hence $65 : 39 = 5 : 3$. (Note $3 : 2$ would need $65 \times 2 = 39 \times 3$, i.e. $130 = 117$, which is false.) Hence option C.

1075. Required percentage = $\frac{\text{approved}}{\text{received}} \times 100 = \frac{520}{800} \times 100$. Simplify $\frac{520}{800} = \frac{13}{20}$, and $\frac{13}{20} \times 100 = 13 \times 5 = 65$. So 65% of the applications received at Aurangabad were approved. Hence option D.

1076. Suman's monthly figures are 40, 35, 25, 45, 30. Their sum = $40 + 35 = 75$; $75 + 25 = 100$; $100 + 45 = 145$; $145 + 30 = 175$. There are 5 months, so the average = $\frac{175}{5} = 35$ policies per month. Hence option A.

1077. Compare the two entries day by day. Monday: $42 > 35$, yes. Tuesday: $38 < 44$, no. Wednesday: $50 > 41$, yes. Thursday: $46 = 46$, the deposits are equal, not greater, so no. Friday: $55 > 39$, yes. The condition holds on Monday, Wednesday and Friday, i.e. on 3 days. Hence option B.

1078. Compute achievement as a percentage of target for each branch. Alwar: $\frac{200}{250} \times 100 = 80\%$. Bikaner: $\frac{264}{300} \times 100 = 88\%$. Churu: $\frac{153}{180} \times 100 = 85\%$. Dausa: $\frac{320}{400} \times 100 = 80\%$. Erode: $\frac{240}{320} \times 100 = 75\%$. The largest of these is 88%, at Bikaner. Hence option B.

1079. First find the missing entry. Qualified at the three known centres = $1350 + 1026 + 1320 = 3696$. Since all four centres together give 5256, the number qualified at Trichy = $5256 - 3696 = 1560$. Now the required percentage = $\frac{1560}{5200} \times 100$. Cancelling, $\frac{1560}{5200} = \frac{156}{520} = \frac{3}{10}$, so the percentage = $\frac{3}{10} \times 100 = 30\%$. Hence option D.

1080. If $r\%$ were rejected then $(100 - r)\%$ were accepted. Guwahati: 75% of 1200 = 900. Shillong: 60% of 900 = 540. Imphal: 80% of 1500 = 1200. Agartala: 65% of 800 = 520. Total accepted = $900 + 540 + 1200 + 520 = 3160$. Hence option B.

1081. For a ratio $m : f$ the female share of the staff is $\frac{f}{m+f}$ of the total. Jaipur: $96 \times \frac{3}{8} = 36$. Ajmer: $84 \times \frac{3}{7} = 36$. Kota: $120 \times \frac{5}{12} = 50$. Udaipur: $108 \times \frac{4}{9} = 48$. Total female employees = $36 + 36 + 50 + 48 = 170$. Hence option A.

1082. Profit per unit = selling price - cost price; multiply it by the units sold. Fan: $(1000 - 850) \times 120 = 150 \times 120 = 18000$. Mixer: $(1800 - 1500) \times 80 = 300 \times 80 = 24000$. Iron: $(750 - 600) \times 200 = 150 \times 200 = 30000$. Heater: $(1450 - 1200) \times 60 = 250 \times 60 = 15000$. Total profit = $18000 + 24000 + 30000 + 15000 = \text{Rs. } 87,000$. Hence option D.

1083. Total for 2022 = $120 + 150 + 180 + 200 + 160 = 810$, so the average = $\frac{810}{5} = 162$. Total for 2023 = $138 + 165 + 216 + 230 + 176 = 925$, so the average = $\frac{925}{5} = 185$. Required difference = $185 - 162 = 23$, i.e. Rs. 23 crore. Since Rs. 23 crore is not listed in options A to D, the answer is "None of these". Hence option E.

1084. Total expenditure of Nagpur = $84 + 36 + 12 + 48 = 180$ lakh. Required percentage = $\frac{84}{180} \times 100$. Simplify $\frac{84}{180} = \frac{7}{15}$, so the percentage = $\frac{7}{15} \times 100 = \frac{700}{15} = 46\frac{2}{3}$. Thus salaries account for $46\frac{2}{3}\%$ of Nagpur's total expenditure. Hence option C.

1085. Bank P in Q1 and Q2 = $40 + 45 = 85$ thousand. Bank R in Q3 and Q4 = $50 + 70 = 120$ thousand. Required ratio = 85 : 120. Divide both parts by their HCF 5: $85 \div 5 = 17$ and $120 \div 5 = 24$, giving 17 : 24. (Check that 5 : 7 is different: $17 \times 7 = 119 \neq 120 = 24 \times 5$.) Hence option B.

1086. For a ratio selected : rejected = $s : r$, the selected candidates form $\frac{s}{s+r}$ of the applicants. Bandra: $4500 \times \frac{2}{15} = 600$. Colaba: $3600 \times \frac{1}{6} = 600$. Dadar: $4900 \times \frac{1}{7} = 700$. Worli: $3000 \times \frac{1}{6} = 500$. Total selected = $600 + 600 + 700 + 500 = 2400$. Total applicants = $4500 + 3600 + 4900 + 3000 = 16000$. Overall selection percentage = $\frac{2400}{16000} \times 100 = \frac{3}{20} \times 100 = 15\%$. Hence option A.

1087. Read each customer's method from the "Type of interest" column. Ramesh is marked Compound and Suresh is marked Simple. Ramesh earns compound interest: amount = $24000 \left(1 + \frac{10}{100}\right)^2 = 24000 \times 1.21 = 29040$, so his interest = $29040 - 24000 = 5040$. Suresh earns simple interest: $SI = \frac{P \times R \times T}{100} = \frac{32000 \times 12.5 \times 3}{100} = 12000$. Required difference = $12000 - 5040 = \text{Rs. } 6,960$. (The rows for Mahesh and Dinesh are not needed here.) Hence option D.

1088. The work content of a task is fixed, so (men) $\times$ (days) $\times$ (hours per day) stays constant. From the table, painting requires $12 \times 8 \times 6 = 576$ man-hours. With 16 men working 9 hours a day, the men-hours completed per day = $16 \times 9 = 144$. Therefore days required = $\frac{576}{144} = 4$. Hence option C.

1089. The average is over three sections, so total marks = $3 \times$ average. Bhavna: total = $3 \times 33 = 99$, hence Quantitative = $99 - 35 - 31 = 33$. Deepa: total = $3 \times 35 = 105$, hence English = $105 - 40 - 29 = 36$. Required difference = $36 - 33 = 3$. (The complete rows are consistent: Anil $\frac{32 + 28 + 24}{3} = 28$ and Chetan $\frac{27 + 33 + 30}{3} = 30$.) Hence option B.

1090. Profit is shared in the ratio of (investment $\times$ period). Vikram: $40000 \times 12 = 480000$. Yogesh: $60000 \times 8 = 480000$. Zubin: $50000 \times 9 = 450000$. Ashok: $30000 \times 10 = 300000$. Dividing each by 10000, the ratio is $48 : 48 : 45 : 30$, whose parts total 171. Value of one part = $\frac{85500}{171} = 500$. Zubin's share = $45 \times 500 = \text{Rs. } 22,500$. Hence option A.

1091. Actual profit = revenue $\times$ profit percentage. Anand: 2022 profit = $250 \times 0.12 = 30$; 2023 profit = $300 \times 0.15 = 45$; increase = 15. Bharat: $400 \times 0.10 = 40$ and $480 \times 0.125 = 60$; increase = 20. Chandra: $320 \times 0.15 = 48$ and $352 \times 0.125 = 44$; the profit actually falls by 4. Dinkar: $180 \times 0.20 = 36$ and $216 \times 0.15 = 32.4$; the profit falls by 3.6. The greatest increase is Rs. 20 crore, for Bharat Ltd. Note that a rising revenue need not mean a rising profit. Hence option D.

1092. First find each selling price, then work back to the cost price using $CP = \frac{SP \times 100}{100 + \text{profit}\%}$. Saree: $SP = 4000 \times \frac{80}{100} = 3200$, so $CP = \frac{3200}{1.25} = 2560$. Shirt: $SP = 1500 \times \frac{90}{100} = 1350$, so $CP = \frac{1350}{1.125} = 1200$. Jeans: $SP = 2400 \times \frac{75}{100} = 1800$, so $CP = \frac{1800}{1.20} = 1500$. Total cost price = $2560 + 1200 + 1500 = \text{Rs. } 5,260$. Hence option C.

Subtopic 1.11.2

1093. The bars are read in hundreds, so each unit on the graph stands for 100 applications. For the first three months the bar heights are 24, 30 and 18. Their sum is $24 + 30 + 18 = 72$ units. Converting to actual applications, $72 \times 100 = 7,200$. Hence the total is 7,200 applications.

1094. Here February is the base month, so the base value is 30 and the excess is measured against it. Excess = $45 - 30 = 15$ units. Per cent more = $\frac{15}{30} \times 100 = 50\%$. (Note that the units of hundreds cancel out in the ratio, so no conversion is needed.) Hence June is 50% more than February.

1095. In a grouped bar graph the second bar of every pair belongs to Bank Q. Reading only those bars gives 100, 140, 160 and 220. Adding them, $100 + 140 = 240$; $240 + 160 = 400$; $400 + 220 = 620$. So Bank Q's four-year total is Rs. 620 crore. (Bank P's total, for comparison, is $120 + 150 + 180 + 200 = \text{Rs. } 650$ crore, which is why option D is a trap.)

1096. In a stacked bar only the shaded segment is read, not the whole bar. The female segment of Ambala is 160 and the female segment of Chittoor is 140. Their sum is $160 + 140 = 300$. Hence 300 female employees. (The total heights 400 and 350 are irrelevant here.)

1097. Compare only the male segments: 240, 280, 210, 320 and 250. The largest of these is 320, which belongs to Durgapur. In this particular graph Durgapur also happens to have the tallest overall bar

(600), but that is a coincidence and not a valid reason: in a stacked bar the tallest total can belong to one branch while the largest single segment belongs to another, so the deciding figure must always be the male segment read on its own.

1098. The required ratio is BOB : Canara = 25 : 20. Dividing both terms by their HCF 5 gives 5 : 4. Since the ratio is asked in the order BOB first, the answer is 5 : 4 and not 4 : 5. (The common unit of thousands cancels and does not affect the ratio.)

1099. Scanning the six bars, the tallest is June at 45 units and the shortest is March at 18 units. Difference in units = $45 - 18 = 27$. Since each unit is 100 applications, the actual difference is $27 \times 100 = 2,700$ applications.

1100. Form the fraction $\frac{Q}{P}$ for each year and compare. For 2019, $\frac{100}{120} = 0.833$. For 2020, $\frac{140}{150} = 0.933$. For 2021, $\frac{160}{180} = 0.889$. For 2022, $\frac{220}{200} = 1.10$. The largest value is 1.10, so the ratio peaks in 2022 – the only year in which Bank Q outgrew Bank P. A useful shortcut: 2022 is the only year where $Q > P$, so its ratio must exceed 1 while every other year's ratio is below 1.

1101. First combine the two bars of each year. For 2021, $180 + 160 = 340$; for 2022, $200 + 220 = 420$. The word *of* makes 2022 the base, so the required percentage is $\frac{340}{420} \times 100$. Simplify $\frac{340}{420} = \frac{17}{21} = 0.8095$, giving 80.95%, which is approximately 81%.

1102. Total females = $160 + 220 + 140 + 280 + 200 = 1000$, so the average is $\frac{1000}{5} = 200$. Total males = $240 + 280 + 210 + 320 + 250 = 1300$, so the average is $\frac{1300}{5} = 260$. Required percentage = $\frac{200}{260} \times 100 = \frac{1000}{13} = 76.92\% \approx 77\%$. Note that because both averages are divided by the same 5, one may directly use $\frac{1000}{1300}$ and skip the division.

1103. Add both bars of each quarter. Q2 total = $95 + 55 = 150$ and Q4 total = $120 + 90 = 210$ (in Rs. lakh). Increase = $210 - 150 = 60$. Since Q2 is the earlier year it is the base, so percentage increase = $\frac{60}{150} \times 100 = 40\%$.

1104. Test each quarter by computing 60% of the Home bar and comparing it with the Car bar. Q1: 60% of 80 = 48, and $60 > 48$ – satisfied. Q2: 60% of 95 = 57, and $55 < 57$ – not satisfied. Q3: 60% of 110 = 66, and $70 > 66$ – satisfied. Q4: 60% of 120 = 72, and $90 > 72$ – satisfied. So the condition holds in three quarters (Q1, Q3 and Q4). Since *three* does not appear among options A to D, the correct choice is *None of these*.

1105. Convert the bars to actual numbers first: April = $36 \times 100 = 3600$ and June = $45 \times 100 = 4500$. If 15% of April's applications were rejected then 85% were accepted: $3600 \times \frac{85}{100} = 3060$. If 20% of June's were rejected then 80% were accepted: $4500 \times \frac{80}{100} = 3600$. Total accepted = $3060 + 3600 = 6,660$.

1106. Work in thousands and convert at the end. SBI next year = $45 \times 1.20 = 54$ thousand. Canara next year = $20 \times 0.85 = 17$ thousand. Combined = $54 + 17 = 71$ thousand = 71,000 cards. A common error is to net the two percentages ($20\% - 15\% = 5\%$) and apply it to the combined 65 thousand; that is invalid because the two percentages act on different bases.

1107. Original totals: males = $240 + 280 + 210 + 320 + 250 = 1300$; females = $160 + 220 + 140 + 280 + 200 = 1000$. From Durgapur, males leaving = 20% of 320 = 64 and females leaving = 25% of 280 = 70. New male total = $1300 - 64 + 60 = 1296$ (the 60 joiners at Erode are added back). New female total = $1000 - 70 = 930$. Required ratio = 1296 : 930. Divide both by 6: 216 : 155. Since $155 = 5 \times 31$ and $216 = 2^3 \times 27$ share no factor, this is the lowest form.

1108. Bank P's growth from 2021 to 2022 = $\frac{200 - 180}{180} = \frac{20}{180} = \frac{1}{9}$. Applying this to 2022: $P_{2023} =$

$200 \times \frac{10}{9} = 222.22$. Bank Q's growth from 2020 to 2021 = $\frac{160 - 140}{140} = \frac{20}{140} = \frac{1}{7}$. Applying this to 2022: $Q_{2023} = 220 \times \frac{8}{7} = 251.43$. Combined = $222.22 + 251.43 = 473.65$, i.e. approximately Rs. 474 crore.

1109. Since the margin rate is the same in every quarter for a given product, sum each product first. Home total = $80 + 95 + 110 + 120 = 405$ and Car total = $60 + 55 + 70 + 90 = 275$ (Rs. lakh). Margin on Home = $405 \times \frac{8}{100} = 32.4$. Margin on Car = $275 \times \frac{12}{100} = 33.0$. Total margin = $32.4 + 33.0 =$ Rs. 65.4 lakh. Note that a single blended rate of 10% on the grand total 680 would give 68, which is wrong because the larger revenue carries the smaller rate.

1110. Six-month average = $\frac{24 + 30 + 18 + 36 + 27 + 45}{6} = \frac{180}{6} = 30$ units. Months strictly above 30 are April (36) and June (45); February equals the average and so is *not* above it. Above-average group = $36 + 45 = 81$ units = 8100 applications, split 5 : 4, so housing = $8100 \times \frac{5}{9} = 4500$. Remaining group = $24 + 30 + 18 + 27 = 99$ units = 9900 applications, split 4 : 5, so housing = $9900 \times \frac{4}{9} = 4400$. Total housing = $4500 + 4400 = 8,900$.

1111. Compute $0.40 \times (\text{males}) + 0.25 \times (\text{females})$ for each branch. Ambala: $96 + 40 = 136$. Bhilai: $112 + 55 = 167$. Chittoor: $84 + 35 = 119$. Durgapur: $128 + 70 = 198$. Erode: $100 + 50 = 150$. The maximum is 198, at Durgapur. Option C names the right branch with a wrong count, and option A names the runner-up, so both must be rejected.

1112. First find each year's total from the stacked bar. 2020 total = $12 + 8 + 10 = 30$; 2023 total = $20 + 19 + 15 = 54$. Health share in 2020 = $\frac{8}{30} \times 100 = 26.67\%$. Health share in 2023 = $\frac{19}{54} \times 100 = 35.19\%$. The rise in *percentage points* is the plain difference of these two shares: $35.19 - 26.67 = 8.52$, i.e. about 8.5 percentage points. (This is not the same as the percentage growth in the share, which would be $\frac{8.52}{26.67} \times 100 \approx 32\%$.)

1113. Apply each rate to its own segment of the 2023 bar. Life: $20 \times 1.25 = 25$. Health: $19 \times 1.20 = 22.8$. Motor: $15 \times 0.90 = 13.5$. Projected 2024 total = $25 + 22.8 + 13.5 = 61.3$ thousand. The 2023 total is $20 + 19 + 15 = 54$ thousand. Increase = $61.3 - 54 = 7.3$, so the percentage rise = $\frac{7.3}{54} \times 100 = 13.52\% \approx 13.5\%$.

Subtopic 1.11.3

1114. Read the highest and lowest points of the line. Highest is June = 45 hundred = 4500 accounts. Lowest is March = 18 hundred = 1800 accounts. Difference = $45 - 18 = 27$ hundred = $27 \times 100 = 2700$ accounts.

1115. Total (in hundreds) = $24 + 30 + 18 + 36 + 27 + 45 = 180$. Average per month = $\frac{180}{6} = 30$ hundred. In actual numbers, $30 \times 100 = 3000$ accounts per month.

1116. March = 18 hundred, April = 36 hundred. Increase = $36 - 18 = 18$ hundred. Percentage increase = $\frac{18}{18} \times 100 = 100\%$. (Note that 36 is twice 18, so April is 100% more than March, not 200% more.)

1117. Compare the two lines year by year. 2018: $30 < 40$ (no). 2019: $45 < 55$ (no). 2020: $60 > 50$ (yes). 2021: $55 < 70$ (no). 2022: $80 > 65$ (yes). Branch Q is above branch P in exactly 2 years, namely 2020 and 2022.

1118. Total for P = $40 + 55 + 50 + 70 + 65 = 280$ crore. Total for Q = $30 + 45 + 60 + 55 + 80 = 270$ crore. Difference = $280 - 270 =$ Rs. 10 crore.

1119. In 2021, $P = 70$ crore and $Q = 55$ crore. Required ratio = $70 : 55$. Dividing both terms by 5 gives $14 : 11$. This ratio is not listed among options A to D (note $11 : 14$ is the reverse ratio), so the correct choice is None of these.

1120. Total transactions = $12 + 15 + 9 + 18 + 21 = 75$ thousand. Thursday = 18 thousand. Required percentage = $\frac{18}{75} \times 100 = \frac{1800}{75} = 24\%$.

1121. Percent profit in 2019 is 40, so $\text{Income} = \text{Expenditure} \times \left(1 + \frac{40}{100}\right) = 60 \times 1.4$. Hence $\text{Income} = 60 \times \frac{7}{5} = 84$. The income in 2019 was Rs. 84 lakh.

1122. In 2020 the percent profit is 50, so $\text{Income} = 1.5 \times \text{Expenditure}$. Therefore $\text{Expenditure} = \frac{90}{1.5} = 60$ lakh. Profit = $\text{Income} - \text{Expenditure} = 90 - 60 = \text{Rs. } 30$ lakh. (Rs. 45 lakh is the trap of taking 50% of the income.)

1123. Profit = $\text{Expenditure} \times \frac{\text{percent profit}}{100}$. For 2018: $80 \times \frac{25}{100} = 20$ lakh. For 2021: $80 \times \frac{30}{100} = 24$ lakh. Difference = $24 - 20 = \text{Rs. } 4$ lakh.

1124. First three months = $24 + 30 + 18 = 72$ hundred. Last three months = $36 + 27 + 45 = 108$ hundred. Increase = $108 - 72 = 36$ hundred. Percentage increase = $\frac{36}{72} \times 100 = 50\%$.

1125. January approved = $40000 \times \frac{30}{100} = 12000$. March approved = $45000 \times \frac{20}{100} = 9000$. Total = $12000 + 9000 = 21000$ applications.

1126. For branch Q compute the year-on-year change. 2019: $\frac{45 - 30}{30} \times 100 = 50\%$. 2020: $\frac{60 - 45}{45} \times 100 = 33\frac{1}{3}\%$. 2021: the value falls from 60 to 55, so there is no increase. 2022: $\frac{80 - 55}{55} \times 100 \approx 45.5\%$. The highest percentage increase, 50%, occurs in 2019.

1127. Year-wise gaps: 2019 : $120 - 80 = 40$; 2020 : $150 - 100 = 50$; 2021 : $180 - 90 = 90$; 2022 : $160 - 140 = 20$; 2023 : $200 - 150 = 50$. The widest gap, 90, is in 2021. Total loans in 2021 = $180 + 90 = 270$.

1128. From the definition, $\text{Income} = \text{Expenditure} \times \frac{100 + p}{100}$, so $\text{Expenditure} = \text{Income} \times \frac{100}{100 + p}$. Let the common income be I . For 2018 ($p = 25$): $\text{Expenditure} = I \times \frac{100}{125} = \frac{4I}{5}$. For 2019 ($p = 40$): $\text{Expenditure} = I \times \frac{100}{140} = \frac{5I}{7}$. Required ratio = $\frac{4}{5} : \frac{5}{7}$. Multiplying both terms by 35 gives $28 : 25$. (Note that the ratio of the profit percents, $25 : 40 = 5 : 8$, is a trap.)

1129. Actual April approvals = $60000 \times \frac{50}{100} = 30000$. At March's rate of 20%, April approvals would be $60000 \times \frac{20}{100} = 12000$. Decrease = $30000 - 12000 = 18000$. Required percentage = $\frac{18000}{30000} \times 100 = 60\%$.

1130. Rise of P from 2020 to 2021 = $\frac{70 - 50}{50} \times 100 = 40\%$. Applying a 40% rise to the 2022 figure of 65 crore: $65 \times \frac{140}{100} = 65 \times 1.4 = 91$. So the 2023 disbursement would be Rs. 91 crore.

1131. Total in 2023 = $200 + 150 = 350$. In 2024: two-wheeler = $200 \times 1.15 = 230$; four-wheeler = $150 \times 0.80 = 120$. Total = $230 + 120 = 350$. The gain of 30 on X is exactly cancelled by the loss of 30 on Y, so the 2024 total equals the 2023 total, i.e. no change.

1132. April total = 36 hundred = 3600; regular fraction = $1 - \frac{2}{3} = \frac{1}{3}$, so regular = $3600 \times \frac{1}{3} = 1200$. June total = 45 hundred = 4500; regular fraction = $1 - \frac{5}{6} = \frac{1}{6}$, so regular = $4500 \times \frac{1}{6} = 750$. Together = $1200 + 750 = 1950$.

1133. 75% of 12000 = 9000 accounts. Cumulative totals: end of January = 2400; end of February = 2400 + 3000 = 5400; end of March = 5400 + 1800 = 7200; end of April = 7200 + 3600 = 10800. The running total first crosses 9000 at the end of April.

1134. February: total 50000; approved = $50000 \times 0.40 = 20000$, rejected = 30000. Fee = $20000 \times 800 + 30000 \times 200 = 1,60,00,000 + 60,00,000 = \text{Rs. } 2.2 \text{ crore}$. April: total 60000; approved = $60000 \times 0.50 = 30000$, rejected = 30000. Fee = $30000 \times 800 + 30000 \times 200 = 2,40,00,000 + 60,00,000 = \text{Rs. } 3.0 \text{ crore}$. Total = $2.2 + 3.0 = \text{Rs. } 5.2 \text{ crore}$.

Subtopic 1.11.4

1135. Home loan share is 30% of the total disbursement. Total = Rs. 48 lakh. Home loan amount = $\frac{30}{100} \times 48 = 0.30 \times 48 = 14.4 \text{ lakh}$. Hence the Home loan disbursement is Rs. 14.40 lakh.

1136. The whole circle (360°) stands for all 10,800 employees, so each degree stands for $\frac{10800}{360} = 30$ employees. Mumbai occupies 84° , so employees in Mumbai = $84 \times 30 = 2520$.

1137. A full circle of 360° represents 100%. So a sector of 63° represents $\frac{63}{360} \times 100$. Now $\frac{63}{360} = 0.175$, and $0.175 \times 100 = 17.5$. Hence transportation accounts for 17.5% of the total expenditure.

1138. Instead of computing both numbers separately, use the difference of the percentages. Life – Health = $28\% - 22\% = 6\%$ of the total. Now 6% of 9000 = $\frac{6}{100} \times 9000 = 540$. So 540 more Life policies were sold. (Check: Life = 2520, Health = 1980, difference = 540.)

1139. In a pie chart the amount represented by a sector is directly proportional to its central angle, so the required ratio is simply the ratio of the two angles. Ratio = 96 : 72. Dividing both terms by 24 gives 4 : 3.

1140. Central angle = $\frac{\text{part}}{\text{whole}} \times 360^\circ$. Here $\frac{540000}{3600000} = \frac{54}{360} = 0.15$. So the angle = $0.15 \times 360^\circ = 54^\circ$.

1141. From Chart I, Andheri employees = 22% of 3600 = $\frac{22}{100} \times 3600 = 792$. From Chart II, Officers = $\frac{100}{360} \times 3600 = 1000$. Required difference = $1000 - 792 = 208$.

1142. Since both quantities are shares of the same total, the rupee value cancels and only the percentages matter. Electronics + Furniture = $24\% + 16\% = 40\%$. Apparel + Groceries = $18\% + 30\% = 48\%$. Required percentage = $\frac{40}{48} \times 100 = \frac{5}{6} \times 100 = 83\frac{1}{3}\%$. (In rupees: Rs. 2,16,000 against Rs. 2,59,200, the same ratio.)

1143. One percent of the total corresponds to $\frac{360}{100} = 3.6^\circ$. Equity exceeds Fixed deposits by $27\% - 18\% = 9\%$. So the difference in central angles = $9 \times 3.6^\circ = 32.4^\circ$. (Check: Equity = $27 \times 3.6 = 97.2^\circ$, FD = $18 \times 3.6 = 64.8^\circ$, difference = 32.4° .) Since 32.4° is not listed, the answer is None of these.

1144. Rent is 15% of the total, so total expenditure = $\frac{270000}{15} \times 100 = 18000 \times 100 = \text{Rs. } 18,00,000$. Marketing is 18% of this = $\frac{18}{100} \times 1800000 = \text{Rs. } 3,24,000$. (Shortcut: Marketing = Rent $\times \frac{18}{15} = 270000 \times 1.2 = 324000$.)

1145. Students in College A = 20% of 12000 = 2400. Girls in College A = 25% of 4800 = 1200. Boys in College A = total students – girls = $2400 - 1200 = 1200$.

1146. Fertiliser sales in 2018 = 20% of 60 = Rs. 12 lakh. Fertiliser sales in 2019 = 24% of 75 = $\frac{24}{100} \times 75 = \text{Rs. } 18 \text{ lakh}$. Increase = $18 - 12 = \text{Rs. } 6 \text{ lakh}$. Percentage increase = $\frac{6}{12} \times 100 = 50\%$. Note that the percentage shares alone are not enough here, because the two totals are different.

1147. Let the angles be $2x, 3x, 4x, 5x, 6x$. Their sum is the full circle: $20x = 360^\circ$, so $x = 18^\circ$. The largest sector is $6x = 108^\circ$. Books in it = $\frac{108}{360} \times 7200 = 0.3 \times 7200 = 2160$. (Alternatively, the largest section is $\frac{6}{20} = 30\%$ of $7200 = 2160$.)

1148. There are six categories, so the average deposit per category = $\frac{96}{6} = \text{Rs. } 16$ crore. Fixed deposits = 30% of $96 = \frac{30}{100} \times 96 = \text{Rs. } 28.8$ crore. Required excess = $28.8 - 16 = \text{Rs. } 12.8$ crore.

1149. In 2022, UK + Germany = $13\% + 12\% = 25\%$ of Rs. 4.8 crore = $\frac{25}{100} \times 4.8 = \text{Rs. } 1.2$ crore. In 2023, UAE + Japan = $18\% + 12\% = 30\%$ of Rs. 7.2 crore = $\frac{30}{100} \times 7.2 = \text{Rs. } 2.16$ crore. Required ratio = $1.2 : 2.16 = 120 : 216$. Dividing both terms by 24 gives $5 : 9$.

1150. The angle difference between Food and House rent is $108^\circ - 72^\circ = 36^\circ$, which is $\frac{36}{360} = \frac{1}{10}$ of the total. So $\frac{1}{10}$ of the total = Rs. 10,800, giving total monthly expenditure = Rs. 1,08,000. Education and Transport together occupy $45^\circ + 36^\circ = 81^\circ$, i.e. $\frac{81}{360} = 0.225$ of the total. Required amount = $0.225 \times 108000 = \text{Rs. } 24,300$.

1151. Let the original budget be 100 units. Marketing = 25 units and the other heads together = 75 units. New Marketing = $25 \times 1.2 = 30$ units; the other heads stay at 75 units. New total = $30 + 75 = 105$ units. New share of Marketing = $\frac{30}{105} \times 100 = \frac{2}{7} \times 100 = \frac{200}{7} = 28\frac{4}{7}\%$. Note it is not 30%, because the total itself has grown.

1152. Applicants: North = 7200, South = 6000, East = 5400, West = 7800, Central = 3600. Selected: North = 900, South = 1125, East = 675, West = 1350, Central = 450. Selection rates: North = $\frac{900}{7200} = 12.5\%$; South = $\frac{1125}{6000} = 18.75\%$; East = $\frac{675}{5400} = 12.5\%$; West = $\frac{1350}{7800} \approx 17.31\%$; Central = $\frac{450}{3600} = 12.5\%$. The highest rate is South at 18.75%.

1153. Let the first month's total be T . Transport = $\frac{48}{360}T = \frac{2T}{15}$. In the second month Transport = $\frac{2T}{15} + 6000$ and the total = $T + 6000$, and this Transport share equals $\frac{54}{360} = \frac{3}{20}$. So $\frac{2T}{15} + 6000 = \frac{3}{20}(T + 6000)$. Multiplying by 60: $8T + 360000 = 9(T + 6000) = 9T + 54000$. Hence $T = 360000 - 54000 = 306000$. Check: Transport = $\frac{2}{15} \times 306000 = 40800$; new Transport = 46800, new total = 312000, and $\frac{46800}{312000} = 0.15 = \frac{54}{360}$. The total was Rs. 3,06,000, which is not listed, so the answer is None of these.

1154. Batch P: students = 25% of 1200 = 300; fees = 20% of 3600000 = Rs. 7,20,000; average fee = $\frac{720000}{300} = \text{Rs. } 2,400$. Batch Q: students = 15% of 1200 = 180; fees = 24% of 3600000 = Rs. 8,64,000; average fee = $\frac{864000}{180} = \text{Rs. } 4,800$. Required difference = $4800 - 2400 = \text{Rs. } 2,400$.

1155. Let the four angles be $3k, 4k, 5k, 6k$; their sum is $18k$ and their average is $\frac{18k}{4} = 4.5k$, which is the Miscellaneous angle. All five angles must add to 360° : $18k + 4.5k = 22.5k = 360$, so $k = 16$. Miscellaneous angle = $4.5 \times 16 = 72^\circ$. Amount = $\frac{72}{360} \times 90000 = 0.2 \times 90000 = \text{Rs. } 18,000$.

Subtopic 1.11.5

1156. Savings and current accounts together form $45\% + 30\% = 75\%$ of the total. So fixed deposit accounts form $100\% - 75\% = 25\%$ of the total. Number of fixed deposit accounts = 25% of 480 =

$\frac{25}{100} \times 480 = 120$. (Cross-check: savings = 216, current = 144, and $480 - 216 - 144 = 120$.)

1157. The ratio 3 : 4 : 5 has $3 + 4 + 5 = 12$ parts, and these 12 parts equal Rs. 84,000. So one part = $\frac{84000}{12} = \text{Rs. } 7,000$. Toiletries revenue = 5 parts and stationery revenue = 3 parts, so the excess is $5 - 3 = 2$ parts = $2 \times 7000 = \text{Rs. } 14,000$.

1158. Number of male candidates = 60% of 250 = $\frac{60}{100} \times 250 = 150$. Of these, 40% cleared the prelims, so the number who cleared = $\frac{40}{100} \times 150 = 60$.

1159. Home loans = 40% of 45 = $\frac{40}{100} \times 45 = \text{Rs. } 18$ lakh. The car and personal loans together account for $45 - 18 = \text{Rs. } 27$ lakh. Let the personal loan amount be Rs. x lakh; then the car loan amount is Rs. $2x$ lakh, so $x + 2x = 27$, giving $3x = 27$ and $x = 9$. Hence personal loans = Rs. 9 lakh (and car loans = Rs. 18 lakh).

1160. Accounts opened by Branch Q = $320 + 25\%$ of 320 = $320 + 80 = 400$. Total for the two branches = $320 + 400 = 720$.

1161. Quantity sold through Counter II = $800 - 480 = 320$ litres. Required percent = $\frac{320}{800} \times 100 = \frac{2}{5} \times 100 = 40\%$. (Cross-check: Counter I accounts for $\frac{480}{800} \times 100 = 60\%$, and $60\% + 40\% = 100\%$.)

1162. Sales from Monday to Friday = $5 \times 6400 = \text{Rs. } 32,000$. Adding Saturday, the six-day total = $32000 + 10000 = \text{Rs. } 42,000$. Average daily sales = $\frac{42000}{6} = \text{Rs. } 7,000$. Since Rs. 7,000 is not listed among the first four options, the answer is None of these.

1163. Total parts = $5 + 4 + 3 = 12$, so one part = $\frac{1800}{12} = 150$ customers. Mobile banking users = $5 \times 150 = 750$. Senior citizens among them = 30% of 750 = 225, so those who are not senior citizens = $750 - 225 = 525$. (Directly: 70% of 750 = 525.)

1164. Net banking users = 40% of 4500 = 1800. Account holders who do not use net banking = $4500 - 1800 = 2700$. Of these, mobile-app-only users = $\frac{2}{3} \times 2700 = 1800$. The rest visit only the branch = $2700 - 1800 = 900$ (equivalently $\frac{1}{3} \times 2700 = 900$).

1165. Rent = 25% of 48000 = Rs. 12,000, leaving $48000 - 12000 = \text{Rs. } 36,000$. Food = 30% of this remainder = $\frac{30}{100} \times 36000 = \text{Rs. } 10,800$, leaving $36000 - 10800 = \text{Rs. } 25,200$. Subtracting other expenses, savings = $25200 - 6000 = \text{Rs. } 19,200$. Note that Rs. 25,200 is the amount before other expenses, not the savings.

1166. Profit of Outlet A = $240 \times 150 = \text{Rs. } 36,000$. Profit of Outlet B = $180 \times 175 = \text{Rs. } 31,500$. A and B together = $36000 + 31500 = \text{Rs. } 67,500$. Profit of Outlet C = $67500 - 5500 = \text{Rs. } 62,000$. Total profit = $67500 + 62000 = \text{Rs. } 1,29,500$.

1167. Total parts = $3 + 5 + 2 = 10$, so one part = $\frac{120}{10} = 12$ people. Officers = $3 \times 12 = 36$, clerks = $5 \times 12 = 60$, sub-staff = $2 \times 12 = 24$. Files processed: officers $36 \times 45 = 1620$; clerks $60 \times 30 = 1800$; sub-staff $24 \times 12 = 288$. Total = $1620 + 1800 + 288 = 3708$ files.

1168. Depositors at the end of 2023 = $8000 \times 1.20 = 9600$. Depositors at the end of 2024 = $9600 \times 0.85 = 8160$. Increase over 2022 = $8160 - 8000 = 160$. Required percent = $\frac{160}{8000} \times 100 = 2\%$. (Shortcut: the net factor is $1.20 \times 0.85 = 1.02$, i.e. a 2% rise. Note that the answer is not $20 - 15 = 5\%$, because the two changes act on different bases.)

1169. Total salary bill of Branch X = $150 \times 32000 = \text{Rs. } 48,00,000$. Total salary bill of Branch Y = $100 \times 40000 = \text{Rs. } 40,00,000$. Combined bill = Rs. 88,00,000 for $150 + 100 = 250$ employees.

Combined average = $\frac{8800000}{250} = \text{Rs. } 35,200$. The simple average Rs. 36,000 is wrong because the two branches have unequal numbers of employees.

1170. Let the South region sales be Rs. x lakh. Then North = $x + 4$ and East = $2x - 2$. Since the three regions account for the whole Rs. 30 lakh, $x + (x + 4) + (2x - 2) = 30$, so $4x + 2 = 30$, giving $4x = 28$ and $x = 7$. Hence South = Rs. 7 lakh, North = $7 + 4 = \text{Rs. } 11$ lakh and East = $2(7) - 2 = \text{Rs. } 12$ lakh. Check: $7 + 11 + 12 = 30$. The question asks for the East region, so the answer is Rs. 12 lakh.

1171. Male candidates = 55% of 4000 = 2200; female candidates = $4000 - 2200 = 1800$. Males who cleared = 20% of 2200 = 440. Females who cleared = 25% of 1800 = 450. Total who cleared = $440 + 450 = 890$. Required percent = $\frac{890}{4000} \times 100 = 22.25\%$. The plain average of 20% and 25%, namely 22.5%, is wrong because there are more males than females.

1172. Branch A at the end of 2023 = $60 \times 1.20 = \text{Rs. } 72$ lakh. Therefore Branch B at the end of 2023 = $130.5 - 72 = \text{Rs. } 58.5$ lakh. The rise in Branch B = $58.5 - 45 = \text{Rs. } 13.5$ lakh on a base of Rs. 45 lakh. Percent increase = $\frac{13.5}{45} \times 100 = 30\%$.

1173. Total age of the original 8 officers = $8 \times 42 = 336$ years. After the two transfers there are 10 officers with total age = $10 \times 41 = 410$ years. So the combined age of the two new officers = $410 - 336 = 74$ years, and their average age = $\frac{74}{2} = 37$ years. Since 37 years is not among the first four options, the answer is None of these.

1174. Total cost price = $500 \times 40 = \text{Rs. } 20,000$. First lot: 60% of 500 = 300 kg costing $300 \times 40 = \text{Rs. } 12,000$, sold at 25% profit for $12000 \times 1.25 = \text{Rs. } 15,000$. Second lot: the remaining 200 kg costing Rs. 8,000, sold at 10% loss for $8000 \times 0.90 = \text{Rs. } 7,200$. Total selling price = $15000 + 7200 = \text{Rs. } 22,200$. Profit = $22200 - 20000 = \text{Rs. } 2,200$. Profit percent = $\frac{2200}{20000} \times 100 = 11\%$. The plain average of +25% and -10% (7.5%) is wrong because unequal quantities are involved.

1175. Let the numbers of savings and current accounts be $5x$ and $3x$. After the campaign, $\frac{5x}{3x + 40} = \frac{5}{4}$. Cross-multiplying, $20x = 15x + 200$, so $5x = 200$ and $x = 40$. Hence savings accounts = $5 \times 40 = 200$. Check: current accounts were $3 \times 40 = 120$, which after the campaign became 160, and $200 : 160 = 5 : 4$ as required.

1176. Compute each partner's capital-months. Anil: $40000 \times 12 = 4,80,000$. Bhavna: $60000 \times 9 = 5,40,000$. Chetan: $80000 \times 6 = 4,80,000$. The ratio is $480000 : 540000 : 480000$, which on dividing by 60,000 becomes $8 : 9 : 8$, with $8 + 9 + 8 = 25$ parts. Bhavna's share = $\frac{9}{25} \times 50000 = \text{Rs. } 18,000$. (Anil and Chetan get Rs. 16,000 each, and $16000 + 18000 + 16000 = 50000$.)

Subtopic 1.11.6

1177. The five branch figures must add up to the given total of 750. Add the four known figures: $145 + 132 = 277$, then $277 + 168 = 445$, then $445 + 150 = 595$. The missing Chromepet figure is therefore $750 - 595 = 155$. Check: $595 + 155 = 750$, which matches the stated total. Hence the answer is Rs. 155 lakh.

1178. All sectors of a pie chart together account for 100%. The printed sectors total $35 + 20 + 18 + 15 = 88\%$. So the Loan sector is $100 - 88 = 12\%$. Now take 12% of the 12,000 accounts: $12000 \times \frac{12}{100} = 120 \times 12 = 1440$. Hence there are 1440 Loan accounts.

1179. The ratio $7 : 5$ splits the total into $7 + 5 = 12$ equal parts. One part = $\frac{480}{12} = 40$ employees. Female employees occupy 5 parts, so they number $5 \times 40 = 200$. Verify with the printed figure: males

occupy 7 parts = $7 \times 40 = 280$, which matches the table, and $280 + 200 = 480$. Hence the answer is 200.

1180. If the average over 5 days is 640, the five-day total is $640 \times 5 = 3200$. The four labelled days total $610 + 655 + 700 + 590$. Adding step by step: $610 + 655 = 1265$, $1265 + 700 = 1965$, $1965 + 590 = 2555$. So Friday = $3200 - 2555 = 645$. Hence the answer is 645.

1181. A rise of 15% means the 2023 figure is 115% of the 2022 figure. First find 15% of 2400: $2400 \times \frac{15}{100} = 24 \times 15 = 360$. Add this increase to the base year: $2400 + 360 = 2760$. Hence 2760 accounts were opened in 2023.

1182. Let the number who appeared be x . Then 32% of x equals 1440, that is $\frac{32x}{100} = 1440$. Solving, $x = \frac{1440 \times 100}{32} = \frac{144000}{32} = 4500$. Check: 32% of 4500 = $45 \times 32 = 1440$, which matches. Since 4500 does not appear among options A to D, the correct choice is None of these.

1183. Suman sold 25% more than Rakesh, so Suman's count is 125% of Rakesh's count. Compute 25% of 120 = $\frac{120}{4} = 30$. Therefore Suman sold $120 + 30 = 150$ policies. Equivalently, $120 \times \frac{5}{4} = 150$. Hence the answer is 150.

1184. First fill the two blanks. Deposits at Q = $15000 - 8400 = 6600$. Withdrawals at P = 60% of 8400 = $\frac{8400 \times 60}{100} = 5040$. Now compute net inflows. For P: $8400 - 5040 = 3360$. For Q: $6600 - 5520 = 1080$. The required ratio is 3360 : 1080. Divide both terms by their common factor 120: $3360 \div 120 = 28$ and $1080 \div 120 = 9$. Hence the ratio is 28 : 9.

1185. The blank is the number who appeared at City B. If 7% of that number is 630, then the number = $\frac{630 \times 100}{7} = 90 \times 100 = 9000$. Check: 7% of 9000 = 630, correct. City A already gives 7200 appeared. So the combined total = $7200 + 9000 = 16200$. Hence the answer is 16200. (The 8% selection figure for A is not needed for this particular question.)

1186. First recover the missing 2021 value: it is 20% more than 4500, so $4500 \times \frac{120}{100} = 45 \times 120 = 5400$. Next find the rise from 2021 to 2022: $6912 - 5400 = 1512$. Express this as a percentage of the 2021 base: $\frac{1512}{5400} \times 100$. Simplify $\frac{1512}{5400} = \frac{189}{675} = \frac{7}{25}$, and $\frac{7}{25} \times 100 = 28$. Hence the increase is 28%.

1187. Since the average of five branches is 43, the total staff = $43 \times 5 = 215$. The three known branches total $42 + 38 + 45 = 125$. So $R + T = 215 - 125 = 90$. We are told $T = R + 8$. Substituting, $R + (R + 8) = 90$, so $2R = 82$ and $R = 41$. Then $T = 41 + 8 = 49$. Check: $42 + 38 + 41 + 45 + 49 = 215$, and $\frac{215}{5} = 43$, as required. Hence branch T has 49 staff.

1188. The five categories must total 100%. The printed ones sum to $30 + 25 + 15 + 10 = 80\%$, so Net banking accounts for $100 - 80 = 20\%$. UPI therefore exceeds Net banking by $30 - 20 = 10$ percentage points. Since each 1% of 2400 is 24 customers, 10% corresponds to $10 \times 24 = 240$ customers. Hence 240 more customers use UPI.

1189. First recover the total portfolio. If 35% of the total is 560, the total = $\frac{560 \times 100}{35} = 16 \times 100 = 1600$ crore. Check: 35% of 1600 = 560, correct. Now Vehicle loans are 12% of 1600 = $\frac{1600 \times 12}{100} = 16 \times 12 = 192$ crore. Since Rs. 192 crore is not listed in options A to D, the correct choice is None of these.

1190. The 2023 male figure comes straight from the total: $1220 - 620 = 600$ males. (The 2022 female figure, $480 \times \frac{7}{8} = 420$, is not needed here but confirms the ratio $480 : 420 = 8 : 7$.) The increase in males is $600 - 480 = 120$. As a percentage of the 2022 base: $\frac{120}{480} \times 100 = \frac{1}{4} \times 100 = 25$. Hence males increased by 25%.

1191. Fill the blanks first. For 2022: $Q = 800 - 240 - 300 = 260$. For 2023, the total is $800 \times \frac{115}{100} = 920$, so $P = 920 - 360 - 272 = 288$. Now compute each growth rate. Branch P: $\frac{288 - 240}{240} \times 100 = \frac{48}{240} \times 100 = 20\%$. Branch Q: $\frac{360 - 260}{260} \times 100 = \frac{100}{260} \times 100 \approx 38.5\%$. Branch R: $272 < 300$, so R actually declined, by $\frac{28}{300} \times 100 \approx 9.3\%$. Comparing 20%, 38.5% and a decline, Branch Q shows the highest growth.

1192. The two blanks together account for $1200 - 420 - 300 = 480$ employees. Splitting 480 in the ratio $5 : 3$ gives $5 + 3 = 8$ parts, so one part = 60. Corporate = $5 \times 60 = 300$ and Treasury = $3 \times 60 = 180$. Now apply the transfer: 20% of 300 = 60 employees move from Corporate to Treasury. Corporate becomes $300 - 60 = 240$ and Treasury becomes $180 + 60 = 240$. The new ratio is $240 : 240 = 1 : 1$.

1193. Work backwards for 2021. If 288 is 120% of the 2021 value, then $2021 = \frac{288 \times 100}{120} = \frac{28800}{120} = 240$. Now work forwards for 2023: $12.5\% = \frac{1}{8}$, so the increase is $\frac{288}{8} = 36$, giving $2023 = 288 + 36 = 324$. The three yearly values are 240, 288 and 324. Their sum is $240 + 288 = 528$, then $528 + 324 = 852$. The average is $\frac{852}{3} = 284$ lakh transactions per year.

1194. Compute the profit from Product A first. Profit per unit = 20% of 450 = Rs. 90. Over 200 units the profit is $90 \times 200 = \text{Rs. } 18,000$. Since the combined profit is Rs. 31,500, Product B contributed $31500 - 18000 = \text{Rs. } 13,500$. Profit per unit on B = 15% of 600 = Rs. 90. Therefore the number of B units = $\frac{13500}{90} = 150$. Hence 150 units of Product B were sold.

1195. Convert averages into totals. All candidates together scored $300 \times 58 = 17,400$ marks. The boys scored $180 \times 62 = 11,160$ marks. So the girls scored $17400 - 11160 = 6240$ marks in total. Dividing by the number of girls, the girls' average = $\frac{6240}{120} = 52$. Check by weighted average: $\frac{180 \times 62 + 120 \times 52}{300} = \frac{11160 + 6240}{300} = \frac{17400}{300} = 58$, matching the stated overall average. Hence the girls averaged 52 marks.

1196. The five percentages must total 100. The printed ones give $22 + 18 + 16 + 14 = 70$, so Uttar Pradesh accounts for $100 - 70 = 30\%$. Applications from UP = $45000 \times \frac{30}{100} = 13,500$. Of these, 60% are rural: $13500 \times \frac{60}{100} = 8100$. Of these rural applicants, 25% were shortlisted: $8100 \times \frac{1}{4} = 2025$. Hence 2025 rural UP applicants were shortlisted.

1197. Use $SI = \frac{P \times R \times T}{100}$ on Sunita's row, where the principal is the blank: $10800 = \frac{P \times 9 \times 2}{100}$, so $10800 = \frac{18P}{100}$ and $P = \frac{10800 \times 100}{18} = 600 \times 100 = \text{Rs. } 60,000$. (Ramesh's blank is the period: $9600 = \frac{40000 \times 8 \times T}{100} = 3200T$, giving $T = 3$ years, which confirms the row is consistent but is not needed for the question.) The difference between the principals is $60000 - 40000 = \text{Rs. } 20,000$.

Subtopic 1.11.7

1198. In a pie chart the whole circle = 360° corresponds to the whole loan book of Rs. 7,200 crore. So 1° corresponds to $\frac{7200}{360} = 20$ crore. MSME occupies 108° , hence MSME loans = $108 \times 20 = 2160$ crore. (Check: the five angles $90 + 72 + 54 + 108 + 36 = 360$, so the data is consistent.) Hence the answer is Rs. 2160 crore.

1199. First read the bar for Chembur: 30 hundred = $30 \times 100 = 3000$ accounts. Now read the line value for Chembur, which is 30%. Women's accounts = 30% of 3000 = $\frac{30}{100} \times 3000 = 900$. Since 900 is not listed among the four numerical options (720, 840, 960, 1080), the correct choice is None of these.

1200. Revenue = (number of units sold) $\times$ (price per unit). From the line graph, March sales = 400 units. From the table, March price = Rs. 1150 per unit. Therefore revenue = $400 \times 1150 = \text{Rs. } 4,60,000$.

1201. Step 1 (pie chart): candidates who appeared at Mumbai = 25% of 1800 = $\frac{25}{100} \times 1800 = 450$.

Step 2 (table): 30% of these qualified, so qualified = $\frac{30}{100} \times 450 = 135$. Hence 135 candidates qualified from Mumbai.

1202. Compare the two figures year by year. 2019: $100 < 120$ (no). 2020: $140 < 150$ (no). 2021: $200 > 180$ (yes). 2022: $190 < 210$ (no). 2023: $260 > 240$ (yes). Bank Q exceeds Bank P in exactly two years, namely 2021 and 2023.

1203. From the bar graph, September production = 90 thousand = 90,000 shirts. The pie chart applies only to September, and L-size is 25% of it. So L-size shirts = $\frac{25}{100} \times 90000 = 22,500$.

1204. In April, 800 applications were received and 15% were rejected, so the approved percentage is $100 - 15 = 85\%$. Approved applications = $\frac{85}{100} \times 800 = 680$. (Equivalently, rejected = $0.15 \times 800 = 120$, so approved = $800 - 120 = 680$.)

1205. Credit strength = 20% of 4500 = 900. In Credit the ratio is 3 : 2, so females = $\frac{2}{3+2} \times 900 = \frac{2}{5} \times 900 = 360$. Sales strength = 24% of 4500 = 1080. In Sales the ratio is 5 : 4, so females = $\frac{4}{5+4} \times 1080 = \frac{4}{9} \times 1080 = 480$. Required total = $360 + 480 = 840$.

1206. Total profit = (units sold) $\times$ (profit per unit). Profit in 2021 = $1500 \times 2400 = \text{Rs. } 36,00,000$. Profit in 2023 = $2100 \times 2800 = \text{Rs. } 58,80,000$. Increase = $58,80,000 - 36,00,000 = \text{Rs. } 22,80,000$. Percentage increase = $\frac{2280000}{3600000} \times 100 = \frac{228}{360} \times 100 = \frac{190}{3} = 63\frac{1}{3}\%$.

1207. Present amounts: Salaries = $0.35 \times 1800000 = 630000$; Rent = $0.15 \times 1800000 = 270000$; Technology = $0.20 \times 1800000 = 360000$; Marketing = $0.18 \times 1800000 = 324000$; Miscellaneous = $0.12 \times 1800000 = 216000$. Next year each head is multiplied by its growth factor: Salaries $630000 \times 1.10 = 693000$; Rent $270000 \times 1.20 = 324000$; Technology $360000 \times 1.25 = 450000$; Marketing $324000 \times 1.05 = 340200$; Miscellaneous $216000 \times 1.00 = 216000$. Total = $693000 + 324000 + 450000 + 340200 + 216000 = \text{Rs. } 20,23,200$.

1208. Compute the UPI users year by year (in thousands). 2019 : $0.45 \times 40 = 18$. 2020 : $0.60 \times 55 = 33$. 2021 : $0.68 \times 75 = 51$. 2022 : $0.72 \times 100 = 72$. 2023 : $0.80 \times 130 = 104$. Sum = $18 + 33 + 51 + 72 + 104 = 278$ thousand = 2,78,000 users.

1209. Number of Endowment policies = 30% of 24000 = 7200; premium collected = $7200 \times 15000 = \text{Rs. } 10,80,00,000$. Number of Health policies = 25% of 24000 = 6000; premium collected = $6000 \times 10000 = \text{Rs. } 6,00,00,000$. Difference = $10,80,00,000 - 6,00,00,000 = \text{Rs. } 4,80,00,000$. This value does not appear among the first four options, so the answer is None of these.

1210. Cleared from B2 = 40% of 150 = 60. Cleared from B4 = 80% of 90 = 72. Together cleared = $60 + 72 = 132$. Total enrolment of B2 and B4 = $150 + 90 = 240$. Required fraction = $\frac{132}{240}$. Dividing numerator and denominator by 12 gives $\frac{11}{20}$.

1211. First find each bank's daily withdrawal, then divide by its number of ATMs. SBI: 30% of 1,50,00,000 = 45,00,000; per ATM = $\frac{4500000}{45} = 1,00,000$. PNB: $30,00,000 \div 30 = 1,00,000$. HDFC: 18% = 27,00,000; $\frac{2700000}{25} = 1,08,000$. ICICI: 12% = 18,00,000; $\frac{1800000}{20} = 90,000$. Axis: 20% = 30,00,000; $\frac{3000000}{30} = 1,00,000$. The largest per-ATM figure is Rs. 1,08,000, for HDFC.

1212. Accounts in 2022: Home = $0.25 \times 3600 = 900$; Auto = $0.20 \times 3600 = 720$; Personal = $0.30 \times 3600 = 1080$; Education = $0.15 \times 3600 = 540$; Gold = $0.10 \times 3600 = 360$. Accounts in 2023: Home = $900 \times 1.20 = 1080$; Auto = $720 \times 0.85 = 612$; Personal = $1080 \times 1.10 = 1188$; Education = $540 \times 1.40 = 756$; Gold = $360 \times 0.75 = 270$. Total in 2023 = $1080 + 612 + 1188 + 756 + 270 = 3906$. Increase = $3906 - 3600 = 306$. Percentage increase = $\frac{306}{3600} \times 100 = 8.5\%$.

1213. Split each branch into officers and clerks. Alpha (3 : 5 of 640): officers = $\frac{3}{8} \times 640 = 240$, clerks = 400. Beta (4 : 5 of 900): officers = $\frac{4}{9} \times 900 = 400$, clerks = 500. Gamma (2 : 3 of 750): officers = $\frac{2}{5} \times 750 = 300$, clerks = 450. Women officers = $0.25 \times (240 + 400 + 300) = 0.25 \times 940 = 235$. Women clerks = $0.40 \times 400 + 0.20 \times 500 + 0.50 \times 450 = 160 + 100 + 225 = 485$. Total women = $235 + 485 = 720$.

1214. Step 1: recover the missing March sales. Total sales = $58.8 \times 5 = 294$ lakh. The four known months give $48 + 60 + 72 + 54 = 234$ lakh, so March sales = $294 - 234 = 60$ lakh. Step 2: apply the profit percentages. January = $0.125 \times 48 = 6$; February = $0.15 \times 60 = 9$; March = $0.20 \times 60 = 12$; April = $0.10 \times 72 = 7.2$; May = $0.25 \times 54 = 13.5$. Total profit = $6 + 9 + 12 + 7.2 + 13.5 = 47.7$ lakh.

1215. Brand X sales: Delhi = 25% of 1200 = 300; Mumbai = 20% of 1500 = 300; Pune = 40% of 900 = 360. Their sum = $300 + 300 + 360 = 960$. Total laptops sold in all five cities = $(12 + 15 + 9 + 6 + 8)$ hundred = 50 hundred = 5000. Required percentage = $\frac{960}{5000} \times 100 = 19.2\%$.

1216. Daily transactions = tellers $\times$ transactions per teller per hour $\times$ hours. P = $5 \times 12 \times 8 = 480$. Q = $4 \times 15 \times 7 = 420$. R = $6 \times 10 \times 9 = 540$. S = $3 \times 18 \times 8 = 432$. P and R together = $480 + 540 = 1020$. Q and S together = $420 + 432 = 852$. Ratio = 1020 : 852. Dividing both by 12 gives 85 : 71.

1217. Registered, then appeared, then qualified for each zone. North: registered = $0.24 \times 45000 = 10800$; appeared = $0.75 \times 10800 = 8100$; qualified = $0.08 \times 8100 = 648$. South: $0.20 \times 45000 = 9000$; appeared = $0.80 \times 9000 = 7200$; qualified = $0.10 \times 7200 = 720$. East: $0.16 \times 45000 = 7200$; appeared = $0.60 \times 7200 = 4320$; qualified = $0.10 \times 4320 = 432$. West: $0.28 \times 45000 = 12600$; appeared = $0.90 \times 12600 = 11340$; qualified = $0.05 \times 11340 = 567$. Central: $0.12 \times 45000 = 5400$; appeared = $0.50 \times 5400 = 2700$; qualified = $0.20 \times 2700 = 540$. Total = $648 + 720 + 432 + 567 + 540 = 2907$.

1218. Profit = revenue – expenditure = revenue $\times$ (100 – expenditure %). Profit in 2021 = $250 \times 20\% = 50$ crore = Rs. 50,00,00,000, on 25 lakh = 25,00,000 units, so profit per unit = $\frac{500000000}{2500000} =$ Rs. 200. Profit in 2023 = $400 \times 30\% = 120$ crore = Rs. 120,00,00,000, on 50 lakh = 50,00,000 units, so profit per unit = $\frac{1200000000}{5000000} =$ Rs. 240. Change = $\frac{240 - 200}{200} \times 100 = 20\%$ increase.

Subtopic 1.11.8

1219. On a radar chart each spoke carries one parameter, and the point plotted on that spoke is read off exactly like a value on a number line, so the five scores are simply 72, 65, 80, 58, 85. Total = $72 + 65 + 80 + 58 + 85$. Add in pairs: $72 + 65 = 137$, $80 + 58 = 138$, so $137 + 138 = 275$, and $275 + 85 = 360$. There are 5 parameters, hence the average = $\frac{360}{5} = 72$. Note that the shape of the polygon on the chart is irrelevant to this computation; only the plotted magnitudes matter. Hence the answer is 72.

1220. In a funnel chart the topmost (widest) band is the entry stage and the bottom-most (narrowest) band is the final stage; a conversion asked “from enquiry to disbursal” is therefore bottom stage divided by top stage. Required percentage = $\frac{\text{Disbursed}}{\text{Enquiries}} \times 100 = \frac{2700}{12000} \times 100$. Simplify: $\frac{2700}{12000} = \frac{27}{120} = \frac{9}{40}$. Now $\frac{9}{40} \times 100 = \frac{900}{40} = 22.5$. Hence 22.5% of all enquiries ended in a disbursement. (The intermediate stages 7500, 4800 and 3600 are not needed here.)

1221. Compare the two plotted polygons parameter by parameter, i.e. spoke by spoke. Deposits: $80 > 65$, A higher. Advances: $70 < 75$, B higher. Fee income: $55 = 55$, a tie, and a tie is NOT “strictly higher”. Digital usage: $90 > 72$, A higher. NPA control: $60 < 68$, B higher. Staff productivity: $74 > 70$, A higher. So A is strictly ahead on Deposits, Digital usage and Staff productivity, that is on 3 parameters. The common trap is to count the tie on Fee income and answer 4; the word “strictly” rules it out. Hence the answer is 3.

1222. Drop-off between two consecutive funnel stages is measured with respect to the earlier (wider) stage. Number lost = $16,000 - 9,600 = 6,400$. Percentage drop-off = $\frac{6400}{16000} \times 100$. Cancel 1600 from numerator and denominator: $\frac{6400}{16000} = \frac{4}{10} = 0.4$, so the drop-off is $0.4 \times 100 = 40\%$. A frequent error is to divide by the later stage ($6400/9600 = 66.7\%$) or by the top stage ($6400/25000 = 25.6\%$); neither is a stage-to-stage drop-off. Hence the answer is 40%.

1223. In a bubble chart the coordinates of a point are read like an ordinary scatter plot, so deposits per employee = $\frac{y}{x}$ for each branch, in Rs. crore per employee. Alwar: $\frac{60}{20} = 3$. Bhuj: $\frac{100}{25} = 4$. Cuttack: $\frac{120}{40} = 3$. Dhule: $\frac{54}{15} = 3.6$. Erode: $\frac{105}{30} = 3.5$. The largest ratio is 4, at Bhuj. Note that Cuttack has the highest deposits in absolute terms but not per employee, which is exactly the distinction the question tests. Hence the answer is Bhuj.

1224. A waterfall chart is read cumulatively: each floating bar starts where the previous one ended, rising for a positive item and falling for a negative one. Track the running total. Start: 480. After fee income: $480 + 120 = 600$. After provisions: $600 - 210 = 390$. After operating expenses: $390 - 150 = 240$. After treasury gains: $240 + 90 = 330$. So the final (grounded) bar stands at Rs. 330 crore. Equivalently, $480 + 120 + 90 - 210 - 150 = 690 - 360 = 330$. Hence the answer is Rs. 330 crore.

1225. Read the two required spokes only: Quantitative Aptitude = 45 and General Awareness = 25. The required ratio is 45 : 25. Divide both terms by their HCF, which is 5: $\frac{45}{5} : \frac{25}{5} = 9 : 5$. The order matters here, so 5 : 9 (option B) is the reversed and therefore wrong ratio, while 9 : 4 would correspond to General Awareness = 20, which is not what is plotted. Hence the answer is 9 : 5.

1226. Overall conversion of a funnel = $\frac{\text{last stage}}{\text{first stage}} \times 100$. Personal loans: $\frac{2100}{8000} \times 100 = \frac{21}{80} \times 100 = \frac{2100}{80} = 26.25\%$. Auto loans: $\frac{1960}{7000} \times 100 = \frac{196}{700} \times 100 = \frac{19600}{700} = 28\%$. The question asks for the gap in percentage points, which is a plain subtraction of the two percentages, not a percentage change: $28 - 26.25 = 1.75$ percentage points. (Had the question asked “by what percent is the auto conversion higher”, the answer would have been $\frac{1.75}{26.25} \times 100 \approx 6.67\%$, a different quantity.) Hence the answer is 1.75.

1227. Percentage rise on each spoke is computed on the 2022 value as base. Deposits: $\frac{75 - 60}{60} \times 100 = \frac{15}{60} \times 100 = 25\%$, more than 20%. Advances: $\frac{65 - 50}{50} \times 100 = \frac{15}{50} \times 100 = 30\%$, qualifies. Digital transactions: $\frac{70 - 40}{40} \times 100 = \frac{30}{40} \times 100 = 75\%$, qualifies. Customer satisfaction: $\frac{88 - 70}{70} \times 100 = \frac{18}{70} \times 100 \approx 25.7\%$, qualifies. Recovery: the index fell from 70 to 63, so there is no rise at all. Therefore 4 parameters rose by more than 20%. Note that the largest gain in raw points is Digital transactions (+30), not Customer satisfaction (+18); ranking by raw points is not the same as ranking by percentage rise, so each spoke must be compared against its own 2022 base. Hence the answer is 4.

1228. Work upward through the funnel, reversing each conversion by division. Finally selected = 900 = 50% of mains-cleared, so mains-cleared = $\frac{900}{0.50} = 1800$. Mains-cleared = 30% of prelims-cleared, so prelims-cleared = $\frac{1800}{0.30} = 6000$. Prelims-cleared = 25% of shortlisted, so shortlisted

$= \frac{6000}{0.25} = 24,000$. Shortlisted = 40% of applications, so applications $= \frac{24000}{0.40} = 60,000$. Check by going forward: $60000 \times 0.40 = 24000$; $24000 \times 0.25 = 6000$; $6000 \times 0.30 = 1800$; $1800 \times 0.50 = 900$. Hence the answer is 60,000.

1229. Return-to-risk ratio $= \frac{y}{x}$ for each plotted bubble. P: $\frac{9}{4} = 2.25$, which is below 2.4. Q: $\frac{15}{6} = 2.5$, which is at least 2.4. R: $\frac{11.5}{5} = 2.3$, below 2.4. S: $\frac{18}{8} = 2.25$, below 2.4. T: $\frac{7.5}{3} = 2.5$, qualifies. So only Q and T clear the bar, i.e. 2 schemes. Observe that S has both the highest return and the highest risk, yet fails the efficiency test, which is precisely why bubble/scatter plots are used for such comparisons. Hence the answer is 2.

1230. First build the closing bar cumulatively. $8000 + 1240 = 9240$; $9240 + 2150 = 11390$; $11390 - 1890 = 9500$; $9500 - 1420 = 8080$. So the closing balance is Rs. 8,080 crore. Increase over the opening balance $= 8080 - 8000 = 80$ crore. Percentage increase $= \frac{80}{8000} \times 100 = \frac{1}{100} \times 100 = 1\%$. Since 1% is not among options A to D (0.8%, 1.2%, 1.5%, 2%), the correct choice is "None of these". A quick shortcut: the inflows total $1240 + 2150 = 3390$ and the outflows total $1890 + 1420 = 3310$, so the net accretion is $3390 - 3310 = 80$ crore directly.

1231. The weighted score is $\sum(\text{rating} \times \text{weight})$, with the weights expressed as decimals. Sales: $8 \times 0.30 = 2.40$. Compliance: $6 \times 0.20 = 1.20$. Teamwork: $7 \times 0.15 = 1.05$. Technology: $9 \times 0.25 = 2.25$. Communication: $5 \times 0.10 = 0.50$. Total $= 2.40 + 1.20 + 1.05 + 2.25 + 0.50$. Add stepwise: $2.40 + 1.20 = 3.60$; $3.60 + 1.05 = 4.65$; $4.65 + 2.25 = 6.90$; $6.90 + 0.50 = 7.40$. The weights sum to $30 + 20 + 15 + 25 + 10 = 100\%$, so the result is directly out of 10; no further scaling is needed. The plain (unweighted) average would have been $\frac{35}{5} = 7$, which is option B and the standard trap. Hence the answer is 7.4.

1232. Move down the funnel stage by stage. Interested $= 4500 \times 0.60 = 2700$. Quotations given $= 2700 \times 0.75 = 2025$. Policies issued $= 2025 \times 0.40 = 810$. Premium paid $= 810 \times 0.90 = 729$. Required percentage $= \frac{729}{4500} \times 100$. Simplify: $\frac{729}{4500} = 0.162$, so the answer is 16.2%. Alternatively, multiply the stage rates directly: $0.60 \times 0.75 \times 0.40 \times 0.90 = 0.162$, i.e. 16.2%, which shows that the contacted figure of 4,500 was not even needed. Option C (18%) is the policy-issued conversion before the premium-payment stage, a common stopping-one-stage-early error.

1233. Compute each composite as $\sum(\text{score} \times \text{weight})$. Kolhapur: $72(0.25) = 18$, $64(0.25) = 16$, $80(0.20) = 16$, $56(0.15) = 8.4$, $68(0.15) = 10.2$; total $= 18 + 16 + 16 + 8.4 + 10.2 = 68.6$. Latur: $66(0.25) = 16.5$, $78(0.25) = 19.5$, $62(0.20) = 12.4$, $74(0.15) = 11.1$, $70(0.15) = 10.5$; total $= 16.5 + 19.5 + 12.4 + 11.1 + 10.5 = 70.0$. Mysuru: $80(0.25) = 20$, $60(0.25) = 15$, $74(0.20) = 14.8$, $66(0.15) = 9.9$, $60(0.15) = 9.0$; total $= 20 + 15 + 14.8 + 9.9 + 9.0 = 68.7$. Ranking: Latur 70.0, Mysuru 68.7, Kolhapur 68.6. Lead of the topper over the runner-up $= 70.0 - 68.7 = 1.3$. Note that the raw unweighted totals are Kolhapur 340, Latur 350 and Mysuru 340, so Latur leads on those as well; what the weights actually decide here is second place, breaking the 340–340 tie in favour of Mysuru. Hence the answer is Latur, by 1.3.

1234. Step 1: walk down the funnel. Clicks $= 50,00,000 \times 0.02 = 1,00,000$. Downloads $= 1,00,000 \times 0.15 = 15,000$. Applications $= 15,000 \times 0.20 = 3,000$. Disbursals $= 3,000 \times 0.25 = 750$. Step 2: gross marketing cost per disbursed loan $= \frac{30,00,000}{750} = \text{Rs. } 4,000$. Step 3: processing-fee income per loan $= 4\%$ of Rs. 80,000 $= 0.04 \times 80,000 = \text{Rs. } 3,200$. Step 4: net cost per disbursed loan $= 4000 - 3200 = \text{Rs. } 800$. A common slip is to compute the cost per application ($30,00,000/3000 = \text{Rs. } 1,000$, option C) instead of per disbursed loan. Hence the answer is Rs. 800.

1235. Step 1: total income $= 2400 + 860 = 3260$. Step 2: operating profit $= 3260 - 1320 = 1940$. Step 3: profit before tax $= 1940 - 640 = 1300$. Step 4: tax $= 26\%$ of 1300 $= 0.26 \times 1300 = 338$, so profit after tax $= 1300 - 338 = 962$. (Equivalently PAT $= 1300 \times 0.74 = 962$.) Step 5: required percentage $= \frac{962}{3260} \times 100$. Estimate: $\frac{962}{3260} \approx 0.2951$, so about 29.5%. Cross-check the size: 29% of 3260 is 945.4

and 30% is 978, and 962 lies between them, closer to 29.5%. A common error is to divide the PBT of 1300 by 3260, giving about 39.9%, or to forget the provisions bar. Hence the answer is approximately 29.5%.

1236. Step 1: total time per branch. Ahmednagar = $25 + 10 + 40 + 30 + 15 = 120$. Bhandara = $20 + 12 + 45 + 28 + 18 = 123$. Chandrapur = $30 + 8 + 35 + 25 + 20 = 118$. Dhar = $22 + 14 + 38 + 32 + 12 = 118$. Erandol = $28 + 9 + 42 + 22 + 16 = 117$. Step 2: because lower time is better, the fastest branch is the one with the smallest total, namely Erandol with 117 minutes; its per-service average = $\frac{117}{5} = 23.4$ minutes. Step 3: grand total of all five branches = $120 + 123 + 118 + 118 + 117 = 596$ minutes over $5 \times 5 = 25$ branch-service pairs, so the overall per-service average = $\frac{596}{25} = 23.84$ minutes. Step 4: required difference = $23.84 - 23.4 = 0.44$ minutes. Since 0.44 does not appear in options A to D, the answer is “None of these”. The trap is to treat the largest radar polygon as the best performer, which here would wrongly pick Bhandara.

1237. Step 1: read the 2023 stage rates. Verification rate = $\frac{18000}{24000} = 75\%$. Sanction rate = $\frac{12600}{18000} = 70\%$. Disbursal rate = $\frac{10080}{12600} = 80\%$. Step 2: apply the 2024 changes. Applications = $24000 \times 1.25 = 30,000$. Verification rate = $75\% + 5\% = 80\%$, so verified = $30000 \times 0.80 = 24,000$. Sanction rate unchanged at 70%, so sanctioned = $24000 \times 0.70 = 16,800$. Disbursal rate = $80\% + 4\% = 84\%$, so disbursed = 16800×0.84 . Compute: $16800 \times 0.84 = 16800 \times \frac{84}{100} = 168 \times 84 = 14,112$. Note that “improved by 5 percentage points” means $75 \rightarrow 80$, not a 5% relative rise ($75 \rightarrow 78.75$); mixing these up gives a different, wrong figure. Hence the answer is 14,112.

1238. Step 1: monthly cash dispensed = $x \times y \times 30$. Panvel = $320 \times 2500 \times 30 = 8,00,000 \times 30 = 2,40,00,000$. Ratnagiri = $180 \times 3200 \times 30 = 5,76,000 \times 30 = 1,72,80,000$. Satara = $250 \times 2800 \times 30 = 7,00,000 \times 30 = 2,10,00,000$. Thane = $400 \times 2200 \times 30 = 8,80,000 \times 30 = 2,64,00,000$. Udgir = $150 \times 3600 \times 30 = 5,40,000 \times 30 = 1,62,00,000$. Step 2: divide each by its downtime hours. Panvel = $\frac{2,40,00,000}{6} = 40,00,000$. Ratnagiri = $\frac{1,72,80,000}{10} = 17,28,000$. Satara = $\frac{2,10,00,000}{4} = 52,50,000$. Thane = $\frac{2,64,00,000}{8} = 33,00,000$. Udgir = $\frac{1,62,00,000}{12} = 13,50,000$. Step 3: the highest ratio is Satara’s 52,50,000. Excess over Panvel = $\frac{5250000 - 4000000}{4000000} \times 100 = \frac{1250000}{4000000} \times 100 = \frac{125}{4} = 31.25\%$. Note that Thane dispenses the most cash overall but ranks only third on this efficiency measure. Hence the answer is 31.25%.

1239. A butterfly chart mirrors two bar series about a common central axis, so the two wings of the 36–45 band are read independently: males 55 thousand and females 45 thousand. Step 1: male non-users = $100\% - 40\% = 60\%$ of 55 = $0.60 \times 55 = 33$ thousand. Step 2: female non-users = $100\% - 55\% = 45\%$ of 45 = $0.45 \times 45 = 20.25$ thousand. Step 3: total non-users = $33 + 20.25 = 53.25$ thousand, that is 53,250 customers. A common error is to average the two usage rates as $\frac{40 + 55}{2} = 47.5\%$ and apply it to the combined 100 thousand, giving 52.5 thousand non-users; this is wrong because the male and female bases are unequal. Hence the answer is 53.25 thousand.

Subtopic 1.11.9

1240. Profit of Anand Showroom = Rs. 5,400 – Rs. 4,500 = Rs. 900. Profit percent is always taken on the cost price, so profit % = $\frac{900}{4500} \times 100$. Now $\frac{900}{4500} = \frac{1}{5}$, and $\frac{1}{5} \times 100 = 20$. Hence the profit percent is 20%, which is option C.

1241. Simple interest is given by $SI = \frac{P \times R \times T}{100}$. For Ramesh, $P = 25,000$, $R = 8$ and $T = 3$. So $SI = \frac{25000 \times 8 \times 3}{100}$. First $\frac{25000}{100} = 250$; then $250 \times 8 = 2000$ and $2000 \times 3 = 6000$. Hence Ramesh earns Rs. 6,000, option D.

1242. Arjun's one-day work = $\frac{1}{12}$ and Bindu's one-day work = $\frac{1}{18}$. Taking the LCM of 12 and 18, which is 36, their combined one-day work = $\frac{3}{36} + \frac{2}{36} = \frac{5}{36}$. The time taken is the reciprocal of the combined one-day work, i.e. $\frac{36}{5} = 7.2$ days = $7\frac{1}{5}$ days. Hence option C.

1243. Average speed = $\frac{\text{Total distance}}{\text{Total time}}$. For the Konkan Express the distance is 480 km and the time is 6 hours, so the speed = $\frac{480}{6} = 80$ km/h. Hence option D.

1244. The discount on the shirt is 15% of the marked price Rs. 3,200, that is $\frac{15}{100} \times 3200 = 480$. So the amount payable = $3200 - 480 = 2720$, i.e. Rs. 2,720. Alternatively, the customer pays 85% of Rs. 3,200 = $0.85 \times 3200 = 2720$. Since Rs. 2,720 does not appear among options A to D, the correct choice is E, None of these.

1245. Every partner keeps his capital in the business for the same period of one year, so the profit is divided simply in the ratio of the investments. From the table the investments are 30000 : 40000 : 50000 : 60000 : 20000, which on dividing throughout by 10,000 becomes 3 : 4 : 5 : 6 : 2. The total number of parts = $3 + 4 + 5 + 6 + 2 = 20$, so one part = $\frac{60000}{20} = 3000$. Tarun holds 5 parts, hence his share = $5 \times 3000 = 15,000$. So Tarun receives Rs. 15,000, option D.

1246. The amount under annual compounding is $A = P \left(1 + \frac{R}{100}\right)^T$. For Alka, $P = 10,000$, $R = 10$ and $T = 2$, so $A = 10000 \times \left(\frac{11}{10}\right)^2 = 10000 \times \frac{121}{100} = 12,100$. The compound interest is the amount minus the principal, i.e. $12100 - 10000 = 2100$. Hence Alka earns Rs. 2,100, option C.

1247. Ashok's selling price = $6000 \times \left(1 + \frac{25}{100}\right) = 6000 \times \frac{5}{4} = 7500$. Bimal's selling price = $8000 \times \left(1 + \frac{15}{100}\right) = 8000 \times 1.15 = 9200$. The required excess = $9200 - 7500 = 1700$. Hence Bimal's selling price exceeds Ashok's by Rs. 1,700, option C.

1248. For Bank X the amount after 2 years = $20000 \times \left(1 + \frac{10}{100}\right)^2 = 20000 \times 1.21 = 24200$, so the compound interest = $24200 - 20000 = 4200$. For Bank Y the simple interest = $\frac{20000 \times 12 \times 2}{100} = 4800$. Since $4800 > 4200$, Bank Y gives more, and the excess = $4800 - 4200 = 600$. Hence Bank Y by Rs. 600, option D.

1249. Take one stack as 1 unit. From the table Kiran does $\frac{1}{12}$ per day and Latika does $\frac{1}{18}$ per day. Using the LCM 36, together they do $\frac{3}{36} + \frac{2}{36} = \frac{5}{36}$ per day. In 4 days they complete $4 \times \frac{5}{36} = \frac{20}{36} = \frac{5}{9}$ of the stack. The work left is $1 - \frac{5}{9} = \frac{4}{9}$. Latika alone does $\frac{1}{18}$ per day, so she needs $\frac{4}{9} \div \frac{1}{18} = \frac{4}{9} \times 18 = 8$ days. Hence she must work 8 more days, option C.

1250. Time downstream = $\frac{60}{18} = \frac{10}{3}$ hours = $3\frac{1}{3}$ hours. Time upstream = $\frac{60}{12} = 5$ hours. Total time = $\frac{10}{3} + 5 = \frac{10 + 15}{3} = \frac{25}{3}$ hours. Now $\frac{25}{3} = 8\frac{1}{3}$ hours, and $\frac{1}{3}$ of an hour is 20 minutes. So the total time is 8 hours 20 minutes, option C.

1251. Profit is shared in the ratio of capital multiplied by time. Nitin: $20000 \times 12 = 2,40,000$. Pooja: $30000 \times 8 = 2,40,000$. Rakesh: $40000 \times 9 = 3,60,000$. The ratio is 240000 : 240000 : 360000, which on dividing by 1,20,000 becomes 2 : 2 : 3. Total parts = 7, so one part = $\frac{56000}{7} = 8000$. Rakesh has 3 parts, so his share = $3 \times 8000 = 24000$. Hence Rs. 24,000, option D.

1252. Vessel A holds 60 litres in the ratio 7 : 3, so the number of parts is $7 + 3 = 10$ and one part = 6 litres. Milk = $7 \times 6 = 42$ litres and water = $3 \times 6 = 18$ litres. Adding 15 litres of water makes the water $18 + 15 = 33$ litres while the milk stays at 42 litres. The new ratio is 42 : 33. Dividing both terms by 3 gives 14 : 11. Hence option B.

1253. First convert the speed: $72 \text{ km/h} = 72 \times \frac{5}{18} = 20 \text{ m/s}$. To cross a platform a train must cover its own length plus the length of the platform. Distance covered in 20 seconds = $20 \times 20 = 400 \text{ m}$. So $180 + \text{platform} = 400$, giving platform = $400 - 180 = 220 \text{ m}$. Hence option C.

1254. For each trader, net gain = selling price of the stock – amount repaid to the bank, and the cost of the stock equals the loan taken.

Harish: amount repaid = $50000 \times \left(\frac{11}{10}\right)^2 = 50000 \times 1.21 = 60,500$; selling price = $50000 \times 1.30 = 65,000$; net gain = $65000 - 60500 = 4,500$.

Jaya: amount repaid = $60000 \times \left(\frac{11}{10}\right)^2 = 60000 \times 1.21 = 72,600$; selling price = $60000 \times 1.25 = 75,000$; net gain = $75000 - 72600 = 2,400$.

Required excess = $4500 - 2400 = 2100$. Hence Rs. 2,100, option B.

1255. One day's work: Anil $\frac{1}{20}$, Bhavna $\frac{1}{30}$, Chirag $\frac{1}{60}$. Let the job last T days. Bhavna and Chirag work all T days, while Anil works only $T - 5$ days. Then $\frac{T-5}{20} + \frac{T}{30} + \frac{T}{60} = 1$. Multiplying throughout by the LCM 60 gives $3(T - 5) + 2T + T = 60$, i.e. $3T - 15 + 3T = 60$, so $6T = 75$ and $T = \frac{75}{6} = 12.5$. Hence the work is completed in $12\frac{1}{2}$ days, option C.

1256. Downstream speed = still-water speed + speed of current, upstream speed = still-water speed – speed of current, and the round-trip time = $\frac{90}{\text{downstream speed}} + \frac{90}{\text{upstream speed}}$.

Boat P: speeds 15 and 9, time = $\frac{90}{15} + \frac{90}{9} = 6 + 10 = 16$ hours.

Boat Q: speeds 20 and 10, time = $4.5 + 9 = 13.5$ hours.

Boat R: speeds 12 and 8, time = $7.5 + 11.25 = 18.75$ hours.

Boat S: speeds 24 and 12, time = $3.75 + 7.5 = 11.25$ hours.

Boat T: speeds 30 and 10, time = $3 + 9 = 12$ hours.

The smallest of 16, 13.5, 18.75, 11.25 and 12 hours is 11.25 hours, which belongs to boat S. Hence option D.

1257. Take the cost price of each article as Rs. 100, so the profit in rupees is numerically equal to the profit percent.

Shirt: marked price = 160; after 20% off, $160 \times 0.80 = 128$; after a further 10% off, $128 \times 0.90 = 115.2$. Profit percent = $115.2 - 100 = 15.2\%$.

Shoes: marked price = 140; after 10% off, $140 \times 0.90 = 126$; after a further 5% off, $126 \times 0.95 = 119.7$. Profit percent = $119.7 - 100 = 19.7\%$.

The required excess = $19.7 - 15.2 = 4.5$ percentage points. Hence option C.

1258. Let the amount in Scheme P be Rs. x ; the amount in Scheme Q is then Rs. $(12000 - x)$. From the table Scheme P pays 10% for 3 years, so its interest = $\frac{x \times 10 \times 3}{100} = 0.30x$; Scheme Q pays 12% for 2 years, so its interest = $\frac{(12000 - x) \times 12 \times 2}{100} = 0.24(12000 - x)$. Therefore $0.30x + 0.24(12000 - x) = 3360$, i.e. $0.30x + 2880 - 0.24x = 3360$, giving $0.06x = 480$ and $x = 8000$. Check: $0.30 \times 8000 = 2400$ and $0.24 \times 4000 = 960$, and $2400 + 960 = 3360$, as required. Hence Rs. 8,000, option C.

1259. When two trains move in the same direction the relative speed is the difference of their speeds: $90 - 72 = 18 \text{ km/h}$. Converting, $18 \times \frac{5}{18} = 5 \text{ m/s}$. To overtake completely, train A must cover the sum

of the two lengths relative to train B, that is $150 + 200 = 350$ m. Time = $\frac{350}{5} = 70$ seconds. Hence option C.

1260. Compute each partner's capital-months. Anita: Rs. 40,000 for the first 6 months and Rs. 60,000 for the next 6 months, i.e. $40000 \times 6 + 60000 \times 6 = 240000 + 360000 = 6,00,000$. Baldev: Rs. 60,000 for 6 months and Rs. 50,000 for the next 6 months, i.e. $60000 \times 6 + 50000 \times 6 = 360000 + 300000 = 6,60,000$. The profit-sharing ratio is $600000 : 660000 = 10 : 11$, so the total is 21 parts and one part = $\frac{105000}{21} = 5000$. Anita gets $10 \times 5000 = 50,000$ and Baldev gets $11 \times 5000 = 55,000$. The difference = $55000 - 50000 = 5000$. Hence Rs. 5,000, option B.

Subtopic 1.12.1

1261. Take Statement I alone. It only gives the relation $R = 3S$; with S unknown, R can be 24, 36, 45 or anything else, so I alone is not sufficient. Take Statement II alone. It fixes $S = 12$ but says nothing at all about Ravi, so II alone is not sufficient. Combine the two: $R = 3 \times 12 = 36$ years, a unique value. Since each statement is useless on its own but the pair gives a unique answer, both statements together are necessary. Hence option E.

1262. From Statement I alone the number could be 18, 27, 36, 45, 54, 63, 72, 81 or 90, so I alone is not sufficient. From Statement II alone the number could be 14, 25, 36, 41, 47, 52, 58, 63, ..., so II alone is not sufficient. Combine them: if the digits are a and b with $a + b = 9$ and $|a - b| = 3$, then the digits are 6 and 3. But the number itself may be 63 or 36 – the statements fix the digits, not their order. Two possibilities remain, so even together the data are not sufficient. Hence option D.

1263. Statement I alone: if the sum P doubles, the interest earned equals the principal, so $SI = P$. Using $SI = \frac{P \times R \times T}{100}$ we get $P = \frac{P \times R \times 8}{100}$, so $R = \frac{100}{8} = 12.5\%$. The principal cancels out, so I alone is sufficient. Statement II alone: $\frac{P \times R \times 2}{100} = 2000$ gives $PR = 100000$; with P unknown, R could be 10% (for $P = \text{Rs. } 10,000$) or 5% (for $P = \text{Rs. } 20,000$). So II alone is not sufficient. Hence option A.

1264. Statement I alone gives only $\frac{1}{M} + \frac{1}{N} = \frac{1}{12}$, one equation in two unknowns, so I alone is not sufficient. Statement II alone gives $N = 20$ and says nothing about Mahesh, so II alone is not sufficient. Together: $\frac{1}{M} = \frac{1}{12} - \frac{1}{20} = \frac{5-3}{60} = \frac{2}{60} = \frac{1}{30}$, so Mahesh alone takes 30 days – a unique answer. Hence option E.

1265. Statement I alone: if 60% of the total is 24, then the total = $\frac{24 \times 100}{60} = 40$ students. A unique value, so I alone is sufficient. Statement II alone: a ratio of 3 : 2 is consistent with 15 students, 30 students, 40 students and so on – it fixes only the proportion, never the actual head count. So II alone is not sufficient. Hence option A. Note that II is consistent with I, since 40 students in the ratio 3 : 2 means 24 boys and 16 girls, but consistency is not the same as sufficiency.

1266. Statement I alone: selling price = $900 \times \frac{80}{100} = \text{Rs. } 720$. Knowing only the selling price tells us nothing about the cost price, since no profit or loss figure is attached; I alone is not sufficient. Statement II alone: the profit is 20% of the cost price, so $\frac{20}{100} \times \text{CP} = 120$, giving $\text{CP} = \frac{120 \times 100}{20} = \text{Rs. } 600$, a unique value. So II alone is sufficient. Hence option B.

1267. Statement I alone: average = $\frac{160}{5} = 32$ years, so I alone is sufficient. Statement II alone: the four elder members total $4 \times 38 = 152$ years; adding the youngest gives $152 + 8 = 160$ years, so the average = $\frac{160}{5} = 32$ years. So II alone is also sufficient. Since either statement by itself answers the question, the answer is option C.

1268. Let the number be $10a + b$. Statement I alone: $(10b + a) - (10a + b) = 27$ gives $9(b - a) = 27$, so $b - a = 3$. The candidates are 14, 25, 36, 47, 58, 69 – not unique, so I alone is not sufficient. Statement

II alone: $a + b = 11$ gives 29, 38, 47, 56, 65, 74, 83, 92 – not unique either. Together: $b - a = 3$ and $a + b = 11$ add to give $2b = 14$, so $b = 7$ and $a = 4$, i.e. the number is 47. Unique, so both statements together are necessary. Hence option E.

1269. Statement I alone: $8000 \left(1 + \frac{R}{100}\right)^2 - 8000 = 1680$, so $\left(1 + \frac{R}{100}\right)^2 = \frac{9680}{8000} = 1.21$. Taking the positive root, $1 + \frac{R}{100} = 1.1$, so $R = 10\%$. Sufficient. Statement II alone: for 2 years the standard result is $CI - SI = P \left(\frac{R}{100}\right)^2$. So $8000 \left(\frac{R}{100}\right)^2 = 80$, giving $\left(\frac{R}{100}\right)^2 = 0.01$ and $R = 10\%$. Also sufficient. Either statement alone answers the question, so option C.

1270. Statement I alone: downstream speed $= \frac{36}{3} = 12$ km/h, so $b + s = 12$ where b and s are the speeds of the boat and the stream. One equation in two unknowns, so I alone is not sufficient. Statement II alone: it states $b + s = 12$ directly – exactly the same single equation – so II alone is not sufficient. The key point is that Statement II carries no information beyond Statement I. Putting them together still leaves only $b + s = 12$, which is satisfied by $b = 10, s = 2$ and equally by $b = 9, s = 3$. So even together the data are not sufficient. Hence option D.

1271. Statement I alone: since all the capitals stay in for the same period, profit is divided in the ratio of the investments, 4 : 5 : 6, whose parts total 15. Bhaskar's share $= \frac{5}{15} \times 45000 = \text{Rs. } 15,000$. Unique, so I alone is sufficient. Statement II alone: it gives two of the three capitals but neither Chetan's investment nor the total profit, so Bhaskar's share cannot be computed. Not sufficient. Hence option A.

1272. Statement I alone: taking 3 kg of the cheaper variety at Rs. c per kg and 2 kg of the dearer at Rs. 60 per kg, the total cost is $3c + 120$ for 5 kg, while the mixture costs $5 \times 48 = 240$. So $3c + 120 = 240$, giving $3c = 120$ and $c = \text{Rs. } 40$ per kg. Sufficient. Statement II alone: with equal quantities the mixture price is the simple average of the two prices, so $\frac{c + 60}{2} = 50$, giving $c + 60 = 100$ and $c = \text{Rs. } 40$ per kg. Also sufficient. Either statement alone answers the question, so option C.

1273. Statement I alone: $2(l + b) = 90$ gives $l + b = 45$, but the area is not fixed by this – $l = 30, b = 15$ gives 450 sq m while $l = 25, b = 20$ gives 500 sq m. Not sufficient. Statement II alone: with $l = 2b$, the diagonal gives $l^2 + b^2 = (15\sqrt{5})^2 = 1125$, i.e. $4b^2 + b^2 = 1125$, so $5b^2 = 1125$, $b^2 = 225$ and $b = 15$ m. Then $l = 30$ m and the area $= 30 \times 15 = 450$ sq m. Unique, so II alone is sufficient. Hence option B.

1274. Statement I alone: $B = 1.4G$, a relation with no absolute figure, so the batch could have 10 girls and 14 boys, or 50 girls and 70 boys. Not sufficient. Statement II alone: $\frac{G}{B} = \frac{5}{7}$, i.e. $B = \frac{7}{5}G = 1.4G$ – exactly the same relation restated in ratio form. Not sufficient. Because the second statement repeats the first rather than adding anything new, combining them still gives only $B = 1.4G$, with no total and no difference to pin the numbers down. So even together the data are not sufficient, giving option D.

1275. Statement I alone: the first year's interest is $0.10P$. The second year's interest is charged on the grown-up amount $1.10P$, so it is $0.10 \times 1.10P = 0.11P$. The excess is $0.11P - 0.10P = 0.01P = 250$, giving $P = \text{Rs. } 25,000$. Sufficient. Statement II alone: for two years $CI - SI = P \left(\frac{R}{100}\right)^2 = P(0.1)^2 = 0.01P$. So $0.01P = 250$ and $P = \text{Rs. } 25,000$. Sufficient as well. The two statements are in fact algebraically equivalent – the extra interest of the second year is precisely the interest earned on the first year's interest – so each alone answers the question. Hence option C.

1276. Statement I alone gives only $\frac{R}{F} = \frac{2}{5}$, satisfied by (20, 50), (24, 60) and infinitely many other pairs. Not sufficient. Statement II alone gives $\frac{R + 5}{F + 5} = \frac{5}{11}$, again one equation in two unknowns, satisfied by (20, 50) and by (30, 72) among others. Not sufficient. Together, put $R = 2x$ and $F = 5x$

from I and substitute into II: $\frac{2x+5}{5x+5} = \frac{5}{11}$, so $11(2x+5) = 5(5x+5)$, i.e. $22x+55 = 25x+25$, giving $3x = 30$ and $x = 10$. Hence Ramesh is $2 \times 10 = 20$ years old and his father is 50. A unique answer emerges only when both statements are used, so option E.

1277. Statement I alone: crossing a pole means covering just its own length L , so $v = \frac{L}{9}$. With L unknown the speed is not fixed – $L = 180$ m gives 20 m/s while $L = 225$ m gives 25 m/s. Not sufficient. Statement II alone: crossing a platform means covering the train's length plus the platform's, so $\frac{L+300}{21} = \frac{L+200}{17} = v$. Comparing the two journeys, the extra $300 - 200 = 100$ m of platform costs an extra $21 - 17 = 4$ seconds, so $v = \frac{100}{4} = 25$ m/s, that is $25 \times \frac{18}{5} = 90$ km/h. Unique, so II alone is sufficient. Hence option B. As a check, $v = 25$ gives $L = 25 \times 21 - 300 = 225$ m, which is consistent with Statement I.

1278. Statement I alone: $x^2 - 5x + 6 = (x-2)(x-3) = 0$, so $x = 2$ or $x = 3$ – two values, hence not sufficient. Statement II alone: $x^3 - 5x^2 + 6x = x(x-2)(x-3) = 0$, so $x = 0, 2$ or 3 – three values, hence not sufficient. Taken together, x must satisfy both, and the common solutions are the intersection of $\{2, 3\}$ and $\{0, 2, 3\}$, which is $\{2, 3\}$ – still two values. Statement II adds nothing because it is merely Statement I multiplied through by x . So even both statements together are not sufficient, giving option D.

1279. Let the capacity be C litres. After two such operations the milk left is $C \left(1 - \frac{8}{C}\right)^2$. Statement I alone: milk forms $\frac{9}{9+16} = \frac{9}{25}$ of the whole, so $\left(1 - \frac{8}{C}\right)^2 = \frac{9}{25}$, giving $1 - \frac{8}{C} = \frac{3}{5}$, so $\frac{8}{C} = \frac{2}{5}$ and $C = 20$ litres. Sufficient. Statement II alone: $\frac{(C-8)^2}{C} = 7.2$, so $C^2 - 16C + 64 = 7.2C$, i.e. $C^2 - 23.2C + 64 = 0$. Its roots are $C = \frac{23.2 \pm \sqrt{538.24 - 256}}{2} = \frac{23.2 \pm 16.8}{2}$, that is $C = 20$ or $C = 3.2$. The root 3.2 must be rejected because 8 litres cannot be drawn out of a 3.2-litre container, leaving $C = 20$ litres uniquely. Sufficient. Since either statement alone settles the answer, option C.

1280. Write a, b, c for the one-day work of the three. Statement I alone gives $a+b = \frac{1}{8}$ and $b+c = \frac{1}{12}$ – two equations in three unknowns. Adding them gives $a+2b+c = \frac{5}{24}$, so $a+b+c = \frac{5}{24} - b$, which changes as b changes. Not sufficient. Statement II alone gives only $a+c = \frac{1}{8}$, clearly not sufficient. Together, add all three pair equations: $2(a+b+c) = \frac{1}{8} + \frac{1}{12} + \frac{1}{8} = \frac{3+2+3}{24} = \frac{8}{24} = \frac{1}{3}$. So $a+b+c = \frac{1}{6}$ and the three together finish the work in 6 days. Both statements are needed, so option E.

1281. Statement I alone gives $A+B = 64000$ and $C = 28000$; Deepa's income is untouched, so it is not sufficient. Statement II alone gives $B+C+D = 90000$, which cannot fix a four-person average, so it is not sufficient. Combining, from II together with $C = 28000$ we get $B+D = 62000$. The required total is $A+B+C+D = (A+B) + C + D = 64000 + 28000 + D = 92000 + D$, and D is still free. Taking $B = 20000, D = 42000$ gives a total of Rs. 1,34,000, an average of Rs. 33,500; taking $B = 30000, D = 32000$ gives a total of Rs. 1,24,000, an average of Rs. 31,000. Both sets satisfy every condition, so even together the data are not sufficient. Hence option D.

Subtopic 1.12.2

1282. The area of the four walls of a room is perimeter of floor $\times$ height, i.e. $2(l+b)h$. So the quantity actually required is the perimeter, not the floor area. From III, perimeter = 70 m. From II, height = 5 m, so wall area = $70 \times 5 = 350$ sq m, and at Rs. 25 per sq m the cost = $350 \times 25 =$ Rs. 8,750. Hence II and III alone answer the question. Statement I is a distractor: the floor area $l \times b = 300$ does not

fix $l + b$ by itself (many rectangles have area 300 with different perimeters), so I is neither sufficient nor needed. Checking the other pairs: I and II give area and height but no perimeter, so the wall area cannot be found; I and III give no height or rate. Hence the answer is II and III only.

1283. Let the number be $10a + b$, where a is the ten's digit and b the unit's digit. Statement I says the interchanged number is 27 less than the original, i.e. $(10a + b) - (10b + a) = 27$, so $9(a - b) = 27$ and $a - b = +3$ with the sign fixed: the ten's digit is the larger one. Statement III says only that the difference between the digits is 3, i.e. $|a - b| = 3$, which leaves open which digit is larger. Statement II gives $a + b = 11$. Combining I and II: $a - b = 3$ and $a + b = 11$ give $2a = 14$, so $a = 7$, $b = 4$ and the number is 74 uniquely (check: $47 = 74 - 27$). Combining II and III: $a + b = 11$ with $|a - b| = 3$ admits both $(a, b) = (7, 4)$ and $(a, b) = (4, 7)$, i.e. the number could be 74 or 47, so this pair is *not* sufficient. Hence I and II together are sufficient, while II and III together are not.

1284. Let Rohit's present age be R and his son's be S . Statement I gives $R = 2S$. Statement II gives $R - 5 = 3(S - 5)$, i.e. $R = 3S - 10$. Statement III gives $R + S = 30$. Take the pairs one by one. I and II: $2S = 3S - 10$, so $S = 10$ and $R = 20$. I and III: $2S + S = 30$, so $S = 10$ and $R = 20$. II and III: $(3S - 10) + S = 30$, so $4S = 40$, $S = 10$ and $R = 20$. Each of the three pairs yields a unique value $R = 20$ years, and all three are mutually consistent. Since every pair works but no single statement alone gives a number, any two of the three statements are sufficient.

1285. Let the monthly income be x . Statement I says rent = $\frac{25}{100}x$ and statement II says rent = Rs. 6,000. Equating, $\frac{x}{4} = 6000$, so $x = \text{Rs. } 24,000$. Hence I and II together are sufficient. Now test the other pairs. II and III give two rupee amounts, Rs. 6,000 on rent and Rs. 9,000 saved, but nothing is said about the rest of the expenditure, so the income cannot be found. I and III give rent as 25% of income and savings of Rs. 9,000; the remaining 75% of income covers savings *and* all other expenses in an unknown split, so the income is again undetermined. Only the combination I and II works.

1286. The chain runs Ravi $\rightarrow$ Priya $\rightarrow$ Nisha, so every link is needed. From III, Ravi = Rs. 25,000. From II, Priya = $\frac{80}{100} \times 25000 = \text{Rs. } 20,000$. From I, Nisha = $20000 + 4000 = \text{Rs. } 24,000$. Now check that no pair suffices. I and II relate Nisha to Ravi but give no rupee figure anywhere, so nothing can be computed. I and III give Ravi's salary but no way to reach Priya's, hence none for Nisha. II and III give Priya's salary but no link to Nisha. Since each pair leaves the chain broken, all three statements are necessary.

1287. Average = $\frac{\text{total}}{\text{number of members}}$. The number of members is already stated in the question as 5, and statement I supplies the total, 250 kg. Hence the average = $\frac{250}{5} = 50$ kg from statement I by itself, with no other data required. Statements II and III describe the extreme individual weights; they impose no further constraint on the sum and are therefore redundant here. Since the answer is reached with I alone, no option that insists on a second statement can be correct.

1288. Let the total number of candidates be T . From I, passed = 60% of T and therefore failed = 40% of T . Take the pairs. I and II: 40% of $T = 480$, so $T = \frac{480 \times 100}{40} = 1200$. I and III: 60% of $T = 720$, so $T = \frac{720 \times 100}{60} = 1200$. II and III: passed and failed together make up the whole, so $T = 720 + 480 = 1200$. All three pairs give the same value, 1200, so the data are consistent, and no single statement alone gives a number. Hence any two of the three statements are sufficient.

1289. Statement I: if a sum doubles under simple interest, the interest equals the principal, so the interest is 100% of P in 8 years. Using $SI = \frac{P \times r \times t}{100}$ with $SI = P$ and $t = 8$, we get $P = \frac{P \times r \times 8}{100}$, so $r = \frac{100}{8} = 12.5\%$. The principal cancels, so I alone answers the question. Statements II and III together: $7500 = \frac{15000 \times r \times 4}{100} = 600r$, giving $r = 12.5\%$ as well, so that pair is also sufficient and is consistent with I. Statement II alone gives only a principal and III alone gives an interest without the

principal, so neither works singly. The complete description is therefore that either I alone, or II and III together, will do.

1290. Let the cost price be C and the actual profit be $p\%$. Then $SP = C \left(1 + \frac{p}{100}\right)$. Statement II says that raising the selling price by Rs. 60 raises the profit rate to $(p + 5)\%$, so the new price is $C \left(1 + \frac{p+5}{100}\right)$. Subtracting the two expressions, the increase in price is $C \times \frac{5}{100}$. Hence $\frac{5C}{100} = 60$, giving $C = \frac{60 \times 100}{5} = \text{Rs. } 1,200$. Notice that p cancels completely, so statement II by itself pins down the cost price without any help. The other data merely confirm it: from I and III, $1.20C = 1440$ also gives $C = \text{Rs. } 1,200$. Since one statement alone settles the question, the answer is II alone.

1291. From I, Anil's one-day work is $\frac{1}{15}$. From II, Bhaskar is 50% more efficient, so his one-day work is $1.5 \times \frac{1}{15} = \frac{1}{10}$. Together their one-day work is $\frac{1}{15} + \frac{1}{10} = \frac{2+3}{30} = \frac{5}{30} = \frac{1}{6}$, so they finish in 6 days. Hence I and II are sufficient. Statement III concerns Chetan, a third person who does not appear in the question, so it contributes nothing about Bhaskar: I and III give Anil and Chetan only, and II and III give a relative efficiency plus an unrelated pair's rate with no absolute rate for Anil. The fact that Anil and Chetan also take 6 days is a deliberate coincidence meant to tempt you into reading III as the answer. Only I and II are needed.

1292. The class average is the total marks divided by the class strength, so both groups and the strength must be known. From I the class has 40 students, so with II the remaining group in III has $40 - 25 = 15$ students. Total marks $= 25 \times 76 + 15 \times 58 = 1900 + 870 = 2770$, and the class average $= \frac{2770}{40} = 69.25$. Now test the pairs. II and III give two group averages but not the size of the second group, so the weighted average cannot be formed (weighting 76 and 58 differently changes the answer). I and II leave the marks of 15 students unknown. I and III leave the marks of 25 students unknown. Hence all three statements are necessary.

1293. When all capitals stay invested for the same period, profit is divided in the ratio of the capitals. From I the ratio is 4 : 5 : 6, whose parts total $4 + 5 + 6 = 15$, so Bhavesh takes $\frac{5}{15} = \frac{1}{3}$ of the profit. From II the profit is Rs. 90,000, so Bhavesh's share $= \frac{1}{3} \times 90000 = \text{Rs. } 30,000$. Thus I and II suffice. Statement III fixes the actual rupee capitals (Chirag Rs. 1,20,000 means one part is Rs. 20,000), but the size of the capital is irrelevant once the ratio is known, so III is redundant. Without II no rupee profit exists to divide, so I and III fail; without I there is no ratio, so II and III fail.

1294. Let the still-water speed be b and the stream speed be c km/h, so downstream speed is $b + c$ and upstream speed is $b - c$. Statement I gives $b + c = \frac{24}{2} = 12$. Statement III gives $b = 5c$. Statement II gives $\frac{24}{b-c} - \frac{24}{b+c} = 1$. Now take the pairs. I and III: $5c + c = 12$, so $c = 2$. I and II: downstream time is 2 h, so upstream time is 3 h and $b - c = \frac{24}{3} = 8$; with $b + c = 12$ we get $c = \frac{12-8}{2} = 2$. II and III: substituting $b = 5c$ into II, $\frac{24}{4c} - \frac{24}{6c} = \frac{6}{c} - \frac{4}{c} = \frac{2}{c} = 1$, so $c = 2$. Every pair gives $c = 2$ km/h consistently, and no statement alone fixes it. Hence any two of the three are sufficient.

1295. Statement I says girls are 45% of the total, so boys are 55%, and the boys-to-girls ratio is $55 : 45 = 11 : 9$. That is exactly what statement II says, so I and II carry identical information and neither adds a headcount to the other. Statement III gives only an inequality, girls > 800 , not an exact figure. Putting everything together, the total could be 2000 (girls 900, boys 1100), or 4000 (girls 1800, boys 2200), or any multiple of 20 large enough to make the girls exceed 800; every such total satisfies all three statements. Since more than one value survives, the total number of students cannot be determined even with all three statements.

1296. Let the sum be P and the rate be $r\%$. Under annual compounding the interest of one year exceeds that of the previous year by the factor $\left(1 + \frac{r}{100}\right)$, and the interest of the first year equals

$\frac{Pr}{100}$. From III, the two-year simple interest is $\frac{2Pr}{100} = 4000$, so $\frac{Pr}{100} = 2000$, which is the first year's interest. Now take the pairs. I and II: $\frac{2332.80}{2160} = 1.08$, so $1 + \frac{r}{100} = 1.08$ and $r = 8$; then the second-year interest = $\frac{Pr}{100} \times 1.08 = 0.08P \times 1.08 = 0.0864P = 2160$, giving $P = \text{Rs. } 25,000$. I and III: the first year's interest is 2000, and $2000 \times \left(1 + \frac{r}{100}\right) = 2160$ gives $1 + \frac{r}{100} = 1.08$, so $r = 8$ and $P = \frac{2000 \times 100}{8} = \text{Rs. } 25,000$. II and III: $2000 \times \left(1 + \frac{r}{100}\right)^2 = 2332.80$, so $\left(1 + \frac{r}{100}\right)^2 = 1.1664$, hence $1 + \frac{r}{100} = 1.08$, $r = 8$ and $P = \text{Rs. } 25,000$. All three pairs agree, so any two of the three statements are sufficient.

1297. Let the distance be d km. Statement I: the car takes $\frac{d}{60}$ h and the bus $\frac{d}{45}$ h, and the gap is 20 minutes = $\frac{1}{3}$ h. So $\frac{d}{45} - \frac{d}{60} = \frac{1}{3}$. Taking LCM 180, $\frac{4d - 3d}{180} = \frac{1}{3}$, i.e. $\frac{d}{180} = \frac{1}{3}$, giving $d = 60$ km. So I alone is enough. Statement II: 45 minutes = $\frac{3}{4}$ h, so $d = 80 \times \frac{3}{4} = 60$ km. So II alone is also enough, and it agrees with I. Statement III gives only a time with no speed, so it fixes nothing by itself. Since two independent single statements each settle the question, the complete answer is that either I alone or II alone is sufficient.

1298. From I let the milk be $5k$ and the water $3k$ litres, so the mixture is $8k$ litres. When 16 litres of the mixture is removed, milk and water leave in the ratio $5 : 3$, so milk removed = $16 \times \frac{5}{8} = 10$ litres and water removed = $16 \times \frac{3}{8} = 6$ litres. After adding 16 litres of water, milk = $5k - 10$ and water = $3k - 6 + 16 = 3k + 10$. From II, $\frac{5k - 10}{3k + 10} = \frac{5}{7}$, so $7(5k - 10) = 5(3k + 10)$, i.e. $35k - 70 = 15k + 50$, giving $20k = 120$ and $k = 6$. Hence the milk was $5 \times 6 = 30$ litres (mixture 48 litres; check: milk $30 - 10 = 20$, water $18 - 6 + 16 = 28$, and $20 : 28 = 5 : 7$). So I and II are sufficient. Statement III gives only an upper bound of 60 litres, which every candidate value below it satisfies, so it neither determines nor is needed for the answer; without I no split is known and without II no equation exists.

1299. From I let the numbers of Re. 1, Rs. 2 and Rs. 5 coins be $5k$, $3k$ and $2k$, so the total number of coins is $10k$. Their total value is $5k \times 1 + 3k \times 2 + 2k \times 5 = 5k + 6k + 10k = 21k$ rupees. Using II, $21k = 2100$, so $k = 100$ and the total number of coins is $10 \times 100 = 1000$. Using III instead, $2k = 200$, so $k = 100$ and again the total is 1000; the two routes agree. Now check II and III without I: the 200 five-rupee coins account for Rs. 1,000, leaving Rs. 1,100 to be made up by Re. 1 and Rs. 2 coins in an unknown split (for example 100 one-rupee and 500 two-rupee coins, or 300 and 400), so the count is not fixed. Hence statement I is indispensable and either II or III completes it.

1300. Successive percentage growth is multiplicative, so present population = (population two years ago) $\times \left(1 + \frac{10}{100}\right) \times \left(1 + \frac{20}{100}\right)$. Using all three statements, this is $25000 \times 1.1 \times 1.2$. Step by step: $25000 \times 1.1 = 27500$, and $27500 \times 1.2 = 33000$. Now check the pairs. I and II give only the combined growth factor $1.1 \times 1.2 = 1.32$, i.e. a 32% rise, with no base figure, so no population follows. I and III give $25000 \times 1.1 = 27500$ at the end of the first year but nothing about the second year. II and III give the base and the second year's rate but leave the first year's change unknown. Every pair fails, so all three statements are necessary.

1301. For a closed cylinder of radius r and height h , curved surface area = $2\pi rh$ and total surface area = $2\pi rh + 2\pi r^2$. Subtracting statement I from statement II removes the curved part and leaves the two circular ends: $2\pi r^2 = 748 - 440 = 308$, so $\pi r^2 = 154$, i.e. $\frac{22}{7}r^2 = 154$, giving $r^2 = 49$ and $r = 7$ m. Substituting into I, $2 \times \frac{22}{7} \times 7 \times h = 44h = 440$, so $h = 10$ m. The volume is then $\pi r^2 h = 154 \times 10 = 1540$ cubic m. Statement III is about cost per square metre, which has no bearing on volume, so it is redundant; and either of I or II alone leaves one equation in the two unknowns r and h , which is not enough. Hence I and II only.

1302. Let the cost price be C . Statement II gives marked price $= 1.40C$ and statement III gives selling price $= 0.90 \times 1.40C = 1.26C$, i.e. a profit of 26% – which is precisely what statement I asserts. So the three statements are mutually consistent, but every one of them is a pure ratio or percentage relation; not one of them supplies a single rupee amount. Any value of C whatsoever, say Rs. 1,000 (marked Rs. 1,400, sold Rs. 1,260) or Rs. 2,500 (marked Rs. 3,500, sold Rs. 3,150), satisfies all three statements simultaneously. Since percentages alone can never fix an absolute amount, the cost price cannot be determined even with all three statements together.

Subtopic 1.12.3

1303. Simple interest is given by $SI = \frac{P \times R \times T}{100}$.

Quantity I: $SI = \frac{12000 \times 8 \times 3}{100} = 120 \times 24 = \text{Rs. } 2,880$.

Quantity II: $SI = \frac{15000 \times 6 \times 2}{100} = 150 \times 12 = \text{Rs. } 1,800$.

Since $2880 > 1800$, Quantity I $>$ Quantity II. Note that the larger principal does not automatically give the larger interest, because the product $R \times T$ for Quantity I is 24 against only 12 for Quantity II.

1304. For any set of numbers in arithmetic progression, the average equals the mean of the first and the last term.

Quantity I: The eight numbers are 12, 14, 16, 18, 20, 22, 24, 26. Average $= \frac{12 + 26}{2} = \frac{38}{2} = 19$.

Quantity II: The first nine multiples of 4 are 4, 8, 12, ..., 36. Average $= \frac{4 + 36}{2} = \frac{40}{2} = 20$. (Check: sum $= 4(1 + 2 + \dots + 9) = 4 \times 45 = 180$, and $180 \div 9 = 20$.)

Since $19 < 20$, Quantity I $<$ Quantity II.

1305. Quantity I: The ratio 4 : 5 : 6 has $4 + 5 + 6 = 15$ parts, so one part $= \frac{4500}{15} = \text{Rs. } 300$. Anita gets 4 parts $= 4 \times 300 = \text{Rs. } 1,200$.

Quantity II: The ratio 4 : 3 : 5 has $4 + 3 + 5 = 12$ parts, so one part $= \frac{3600}{12} = \text{Rs. } 300$. Bina gets 4 parts $= 4 \times 300 = \text{Rs. } 1,200$.

Both shares are Rs. 1,200, so Quantity I = Quantity II. The two totals and the two ratios differ, but the value of one part happens to be Rs. 300 in each case and both persons hold 4 parts.

1306. Quantity I: 45% of 720 $= \frac{45}{100} \times 720 = 45 \times 7.2 = 324$.

Quantity II: 60% of 560 $= \frac{3}{5} \times 560 = 3 \times 112 = 336$.

Since $324 < 336$, Quantity I $<$ Quantity II. A quick check without decimals: 45% of 720 $= \frac{9}{20} \times 720 = 9 \times 36 = 324$, and 60% of 560 $= \frac{3}{5} \times 560 = 3 \times 112 = 336$, confirming $324 < 336$. Note that the larger base does not decide the comparison here — the smaller base carries the higher rate and wins.

1307. To cross a pole a train must cover a distance equal to its own length. Convert speeds using $1 \text{ km/h} = \frac{5}{18} \text{ m/s}$.

Quantity I: Speed $= 54 \times \frac{5}{18} = 15 \text{ m/s}$. Time $= \frac{180}{15} = 12 \text{ seconds}$.

Quantity II: Speed $= 72 \times \frac{5}{18} = 20 \text{ m/s}$. Time $= \frac{200}{20} = 10 \text{ seconds}$.

Since $12 > 10$, Quantity I $>$ Quantity II. The second train is longer but fast enough to more than compensate.

1308. Profit percent $= \frac{SP - CP}{CP} \times 100$.

Quantity I: Profit $= 540 - 450 = \text{Rs. } 90$, so profit percent $= \frac{90}{450} \times 100 = \frac{100}{5} = 20\%$.

Quantity II: Profit = $1000 - 800 = \text{Rs. } 200$, so profit percent = $\frac{200}{800} \times 100 = \frac{100}{4} = 25\%$.

Since $20\% < 25\%$, Quantity I < Quantity II. Note the trap: the rupee profit in Quantity II is larger *and* so is the percentage, but the two need not move together — the percentage depends on the ratio of profit to cost price, which here is $\frac{1}{5}$ against $\frac{1}{4}$.

1309. Quantity I: For a square, perimeter = $4 \times \text{side}$, so side = $\frac{48}{4} = 12$ cm. Area = $12^2 = 144$ sq cm.

Quantity II: Area of a triangle = $\frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2} \times 24 \times 10 = 120$ sq cm.

Since $144 > 120$, Quantity I > Quantity II.

1310. Quantity I: Factorise $x^2 - 13x + 42$. We need two numbers with product 42 and sum 13, namely 6 and 7. So $(x - 6)(x - 7) = 0$ and $x = 6$ or $x = 7$. The larger root is 7.

Quantity II: Factorise $y^2 - 15y + 56$. We need two numbers with product 56 and sum 15, namely 7 and 8. So $(y - 7)(y - 8) = 0$ and $y = 7$ or $y = 8$. The smaller root is 7.

Both quantities equal 7, so Quantity I = Quantity II. Since each quantity is a single fixed number (not a set of possible values), the relation is exact equality and not ' $\leq$ '.

1311. Quantity I: Downstream speed = $\frac{48}{3} = 16$ km/h and upstream speed = $\frac{48}{4} = 12$ km/h. If b is the speed in still water and c the speed of the current, then $b + c = 16$ and $b - c = 12$. Adding, $2b = 28$, so $b = 14$ km/h. (Incidentally $c = 2$ km/h.)

Quantity II: Speed = $\frac{65}{5} = 13$ km/h.

Since $14 > 13$, Quantity I > Quantity II. A common error is to average the two *times* rather than the two *speeds*; the still-water speed is the average of the downstream and upstream speeds, i.e. $\frac{16 + 12}{2} = 14$.

1312. Quantity I: Amount = $10000 \left(1 + \frac{10}{100}\right)^2 = 10000 \times 1.21 = \text{Rs. } 12,100$. Compound interest = $12100 - 10000 = \text{Rs. } 2,100$.

(Shortcut: for 2 years the effective rate is $10 + 10 + \frac{10 \times 10}{100} = 21\%$, and 21% of 10,000 is Rs. 2,100.)

Quantity II: $SI = \frac{13000 \times 8 \times 2}{100} = 13000 \times 0.16 = \text{Rs. } 2,080$.

Since $2100 > 2080$, Quantity I > Quantity II. The two are deliberately close, so approximation is not safe here.

1313. Take the total work as the LCM of 12 and 18, i.e. 36 units. Then Ajay does $\frac{36}{12} = 3$ units per day and Vijay does $\frac{36}{18} = 2$ units per day.

Quantity I: Together they do $3 + 2 = 5$ units per day, so the time is $\frac{36}{5} = 7.2$ days.

Quantity II: Sanjay is thrice as efficient as Vijay, so Sanjay does $3 \times 2 = 6$ units per day and finishes in $\frac{36}{6} = 6$ days.

Since $7.2 > 6$, Quantity I > Quantity II. Note that 'thrice as efficient' means three times the daily output, which corresponds to one-third of the time, i.e. $\frac{18}{3} = 6$ days — the same answer.

1314. In the original 60 litres, milk = $\frac{7}{10} \times 60 = 42$ litres and water = $\frac{3}{10} \times 60 = 18$ litres.

Quantity I: Adding water does not change the milk, which stays at 42 litres. If the new ratio is 7 : 5, then $\frac{42}{\text{water}} = \frac{7}{5}$, so water = $\frac{42 \times 5}{7} = 30$ litres. Water added = $30 - 18 = 12$ litres.

Quantity II: Adding milk does not change the water, which stays at 18 litres. If the new ratio is 4 : 1, then milk = $4 \times 18 = 72$ litres. Milk added = $72 - 42 = 30$ litres.

Since $12 < 30$, Quantity I < Quantity II. The key idea in both parts is that the component *not* being added stays constant and should be used as the anchor.

1315. In a partnership with unequal time periods, profit is shared in the ratio of the products (capital $\times$ time).

Rakesh: $40000 \times 12 = 4,80,000$. Mahesh: $75000 \times 8 = 6,00,000$.

Ratio = $480000 : 600000 = 48 : 60 = 4 : 5$.

Total parts = $4 + 5 = 9$, so one part = $\frac{54000}{9} = \text{Rs. } 6,000$.

Quantity I: Rakesh's share = $4 \times 6000 = \text{Rs. } 24,000$.

Quantity II: Mahesh's share = $5 \times 6000 = \text{Rs. } 30,000$.

Since $24000 < 30000$, Quantity I < Quantity II. Comparing capitals alone or months alone would give the wrong answer; only the capital-months product matters.

1316. Total balls = $5 + 4 + 3 = 12$. The number of ways of drawing 2 balls is ${}^{12}C_2 = \frac{12 \times 11}{2} = 66$.

Quantity I: Both red: ${}^5C_2 = \frac{5 \times 4}{2} = 10$ ways, so the probability is $\frac{10}{66} = \frac{5}{33}$.

Quantity II: One green and one blue: ${}^4C_1 \times {}^3C_1 = 4 \times 3 = 12$ ways, so the probability is $\frac{12}{66} = \frac{6}{33} = \frac{2}{11}$.

With the common denominator 33, compare $\frac{5}{33}$ with $\frac{6}{33}$: since $5 < 6$, Quantity I < Quantity II.

1317. Let the cost price be Rs. 100 in each case; the profit percent does not depend on this choice.

Quantity I: Marked price = 140. After a 10% discount the price is $140 \times 0.90 = 126$. After a further 5% discount it is $126 \times 0.95 = 119.70$. Profit = $119.70 - 100 = 19.70$, so the profit percent is 19.7%.

Quantity II: Marked price = 125. After a 4% discount the selling price is $125 \times 0.96 = 120$. Profit = $120 - 100 = 20$, so the profit percent is 20%.

Since $19.7\% < 20\%$, Quantity I < Quantity II. The trap is to add the two discounts to 15% and compute $140 \times 0.85 = 119$; successive discounts are multiplicative, and the true equivalent single discount is $10 + 5 - \frac{10 \times 5}{100} = 14.5\%$, giving $140 \times 0.855 = 119.70$.

1318. Total age of all five members = $5 \times 28 = 140$ years. Excluding the youngest, the total of the four elder members = $140 - 6 = 134$ years, and $\frac{134}{4} = 33.5$ years, which agrees with the data.

Quantity I: The youngest was born 6 years ago, so at that moment each of the four elder members was 6 years younger. Their total was $134 - 4 \times 6 = 134 - 24 = 110$ years, and the average was $\frac{110}{4} = 27.5$ years.

Quantity II: Two years ago every one of the five members was 2 years younger, and all five already existed (the youngest was then 4). So the average was $28 - 2 = 26$ years.

Since $27.5 > 26$, Quantity I > Quantity II. The common error in Quantity I is to subtract only 6 instead of 4×6 from the total, or to subtract 6 from the average of five members rather than of four.

1319. Quantity I: When two trains move in the same direction the relative speed is the difference of their speeds: $72 - 54 = 18 \text{ km/h} = 18 \times \frac{5}{18} = 5 \text{ m/s}$. To overtake completely, the faster train must

cover the sum of the two lengths, $180 + 220 = 400 \text{ m}$. Time = $\frac{400}{5} = 80$ seconds.

Quantity II: The faster train's speed is $72 \times \frac{5}{18} = 20 \text{ m/s}$. To cross a platform it must cover its own

length plus the platform length: $180 + 420 = 600 \text{ m}$. Time = $\frac{600}{20} = 30$ seconds.

Since $80 > 30$, Quantity I > Quantity II. Using the sum of speeds ($126 \text{ km/h} = 35 \text{ m/s}$) in Quantity I would be wrong — that applies only to trains moving in opposite directions.

1320. Take the capacity of the tank as the LCM of 20, 30 and 15, i.e. 60 units. Then A fills $\frac{60}{20} = 3$ units per minute, B fills $\frac{60}{30} = 2$ units per minute and C empties $\frac{60}{15} = 4$ units per minute.

Quantity I: With all three open the net rate is $3 + 2 - 4 = 1$ unit per minute, so the tank fills in $\frac{60}{1} = 60$ minutes.

Quantity II: During the first 30 minutes the net rate is again 1 unit per minute, so 30 units are filled and $60 - 30 = 30$ units remain. After C is closed the rate is $3 + 2 = 5$ units per minute, so the

remaining 30 units take $\frac{30}{5} = 6$ minutes. Total time = $30 + 6 = 36$ minutes.
 Since $60 > 36$, Quantity I $>$ Quantity II.

1321. Using $n(E \cup M) = n(E) + n(M) - n(E \cap M)$, the percentage passing in at least one subject is $52 + 42 - 17 = 77\%$.

Quantity I: Those failing in both are the rest: $100 - 77 = 23\%$ of $6000 = \frac{23}{100} \times 6000 = 23 \times 60 = 1380$ candidates.

Quantity II: Passed in English only = $52\% - 17\% = 35\%$ of $6000 = 35 \times 60 = 2100$ candidates.

Since $1380 < 2100$, Quantity I $<$ Quantity II. A frequent slip is to take 'failed in both' as $100 - 52 - 42 = 6\%$, which double-counts the overlap and ignores that the 17% appears in both the given percentages.

1322. Quantity I: $x^2 - 9x + 20 = (x - 4)(x - 5) = 0$, so $x = 4$ or $x = 5$.

Quantity II: $y^2 - 7y + 12 = (y - 3)(y - 4) = 0$, so $y = 3$ or $y = 4$.

Now compare every pair: $x = 4, y = 3 \Rightarrow x > y$; $x = 4, y = 4 \Rightarrow x = y$; $x = 5, y = 3 \Rightarrow x > y$; $x = 5, y = 4 \Rightarrow x > y$.

In no case is $x < y$, and in one case the two are equal. The smallest root of the first equation (4) equals the largest root of the second (4), which is exactly the condition for the relation $\geq$. Hence Quantity I $\geq$ Quantity II. Choosing the strict ' $>$ ' would be wrong because equality is possible, and 'no relation' would be wrong because $x < y$ never occurs.

1323. Let Rs. a be invested in scheme A, so Rs. $(50000 - a)$ goes into scheme B. For one year the total interest is

$$I = 0.08a + 0.12(50000 - a) = 6000 - 0.04a.$$

This decreases as a increases, so the extreme values of I come from the extreme values of a .

When $a = 15000$: $I = 6000 - 600 =$ Rs. 5,400. When $a = 30000$: $I = 6000 - 1200 =$ Rs. 4,800.

Since a lies strictly between 15,000 and 30,000, the interest I lies strictly between Rs. 4,800 and Rs. 5,400.

Quantity II is Rs. 5,200, which lies inside this range. For example, $a = 20000$ gives $I =$ Rs. 5,200 (equal); $a = 25000$ gives $I =$ Rs. 5,000 (less); $a = 16000$ gives $I =$ Rs. 5,360 (greater). All three relations are possible, so no relation can be established.