

QUANTITATIVE ABILITY.

Practice Tests

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Calculation Techniques

PRACTICE TEST I

- Find the product of 117 and 88.
(1) 10704 (2) 10396 (3) 10359 (4) 10296 (5) None of these
- Find the product of 997 and 983.
(1) 980001 (2) 780051 (3) 980051 (4) 370021 (5) 782391
- Find the product of 1013 and 981.
(1) 982753 (2) 992863 (3) 995673 (4) 992753 (5) 993753
- Find 22345×11 .
(1) 245795 (2) 223935 (3) 237795 (4) 235995 (5) 235795
- Find the value of $(16.67\% \text{ of } 32172) + (62.5\% \text{ of } 132000) - (14.28\% \text{ of } 22890)$
(1) 84592 (2) 91132 (3) 89130 (4) 101392 (5) None of these
- Find the value of $\frac{[(24^2) + (3^6) + (21^2) - 18]}{\sqrt[3]{1728}}$
(1) 1 (2) 12 (3) 144 (4) 1746 (5) None of these
- Find the value of 26% of 496.
(1) 139.96 (2) 252.96 (3) 127.96 (4) 173.6 (5) 128.96
- Find 21×23 .
(1) 483 (2) 489 (3) 498 (4) 504 (5) 567
- Find 97×45 .
(1) 4265 (2) 5265 (3) 4355 (4) 4365 (5) 4375
- 457 is what percent of 1382?
(1) 30.03% (2) 31.03% (3) 32.03% (4) 33.03% (5) 34.03%
- Find value of $67812 \div 976$
(1) 60 (2) 69 (3) 55 (4) 75 (5) 62
- Find $36956 + 98297$
(1) 135253 (2) 135247 (3) 135263 (4) 135257 (5) 135273
- Find 27.5% of 792
(1) 215.8 (2) 219.8 (3) 218.8 (4) 217.8 (5) 216.8
- Find product of 143×391
(1) 55963 (2) 55943 (3) 55933 (4) 55923 (5) 55913
- Find $95862 - 46271$
(1) 49571 (2) 49581 (3) 49591 (4) 49561 (5) 49551

PRACTICE TEST I

- The average age of A, B, C and D is 26. The average age of B and D is 28. What is the average age of A & C?
(1) 23 (2) 24 (3) 25 (4) 26 (5) None of these
- The average of 3 numbers A, B and C is 15. If 5 is added to A, then average of A & B becomes 16. What is the value of C?
(1) 12 (2) 15 (3) 18 (4) 21 (5) None of these
- The average age of 3 brothers Akash, Bharat and Chandra is 34. If their sister Dimple is included in the calculation, then the average age becomes 29. What is the age of Dimple?
(1) 14 (2) 15 (3) 16 (4) 17 (5) None of these
- The average age of Priya and her daughter Ruchi is 32 and the average age of Shiv and his son Prem is 36. If Prem and Ruchi are 22 and 18 years old respectively, what is the average age of Shiv and Priya?
(1) 45 (2) 46 (3) 47 (4) 48 (5) None of these
- In a cricket T20 tournament, the 1st 4 matches had the 1st innings score of 141, 147, 162 & 178. If the 1st innings score in the 5th match was 7 less than the average, what was the score in the 5th match?
(1) 151 (2) 152 (3) 153 (4) 154 (5) None of these
- 15 numbers are arranged in a random order. The average of the 15 numbers is 54. The average of the first 8 numbers is 64 and the average of the last 8 numbers is 60. Find the 8th number.
(1) 182 (2) 152 (3) 214 (4) 91 (5) 180
- Two different batches of students of a coaching class with average marks 80 and 90 respectively are combined to form a third batch. The average marks of the classes now changes to 84. Find the ratio of the number of students in the first batch to that in the second batch.
(1) 2 : 3 (2) 4 : 3 (3) 5 : 4 (4) 3 : 2 (5) 5 : 6
- The average age of 40 students and a teacher is 24 years. The average age of only the students is 0.5 years less than the average age of the 40 students and the teacher. Find the age of the teacher in years.
(1) 40 years (2) 42 years (3) 44 years (4) 45 years (5) 46 years
- The average weight of 6 students increases by 2 kg if a student who weighs 48 kg is replaced by another student. What is the weight of the new student?
(1) 36 kg (2) 46 kg (3) 50 kg (4) 12 kg (5) 60 kg
- The average age of a group of friends is 25 years. If four new friends with an average age of 21 years join the group, the average of the entire group becomes 23 years. How many friends were there in the group initially?
(1) 4 (2) 5 (3) 6 (4) 2 (5) 3

-
11. The average of temperatures on Sunday, Monday, Tuesday and Wednesday is 48° and the average of temperatures on Monday, Tuesday, Wednesday and Thursday is 49° . If the ratio of temperatures on Sunday and Thursday is 12 : 13, then find the temperature recorded on Sunday.
(1) 45° (2) 48° (3) 44° (4) 49° (5) 50°
12. The average age of 20 women is 49. The age of the youngest woman is 32 years and that of the oldest woman is 56. If two women with ages 45 and 50 leave the group and three women join the group, the average remains unchanged. What is the average age of the three women who joined the group later?
(1) 32 years (2) 35 years (3) 38 years (4) 49 years (5) 48 years
13. The combined average monthly salary of employees in department A and department B of factory XYZ is Rs.1,200 and the average monthly salary of 200 employees in department A is Rs.900. If the average monthly salary of employees in department B is Rs.1,400, find the number of employees in department B.
(1) 200 (2) 400 (3) 150 (4) 300 (5) 350
14. A group of 15 boys and 12 girls went for a picnic. The average age of the boys was 25 while that of the girls was 20. Find the average age of the group.
(1) 22.87 (2) 22.78 (3) 23 (4) 22 (5) 23.78
15. Ana and Binu study in the same class. The average score of all the students in the class, excluding Binu who was absent, in a Mathematics exam was 26 while the average score of all the students in the class, excluding Ana who was absent, in an English exam was 34. If the total score of the class in Mathematics and English was 1920, how many students were there in the class?
(1) 34 (2) 33 (3) 32 (4) 40 (5) 36

PRACTICE TEST I

- If A had obtained 100% more marks than what he actually obtained, he would still have fallen short of the passing marks by 2% of the total marks. How much did he actually score (in percentage terms) if the passing percentage is 40%?
(1) 9% (2) 19% (3) 38% (4) None of these
- The Indian cricket team won 50% of the matches played in the first two weeks of the NatWest series in Australia. However, at the end of the series its success rate was 75%. If the Indian team had played 6 matches in the first two weeks and they won all the matches they played after the first two weeks, find the total number of matches that they played after the first two weeks.
(1) 6 (2) 4 (3) 5 (4) 10
- There were 5 sections in a test. Out of the total number of students who appeared, 10% students cleared the cut-off in all sections and 10% cleared the cut-off in none of the sections. Of the remaining students, 25% cleared only one section and 10% cleared exactly 4 sections. If 25% of the remaining candidates cleared exactly 2 sections and 27300 students cleared exactly 3 sections, how many students appeared for the test?
(1) 105000 (2) 95000 (3) 85000 (4) 72000 (5) 70000
- The price of sugar has increased by 20%. Sneha has decided to only spend 8% more than she initially did on sugar. Find the percentage by which she needs to reduce the sugar consumption.
(1) 12% (2) 10% (3) 15% (4) 18%
- The price of apples decreases by 15%. As a result, Reena increases her consumption by 20%. The percentage change in expenditure is
(1) -5% (2) 5% (3) -2% (4) 2% (5) 10%
- The price of oil decreases by 30%. What should be the increase in consumption so as to keep the expenditure constant?
(1) 44% (2) 42.86% (3) 48.26% (4) 30% (5) 45%
- The price of a trouser is more than that of a t-shirt by 60%. By what percent is the t-shirt's price less than that of the trouser?
(1) 37% (2) 55% (3) 40% (4) 37.5% (5) 35%
- Since the price of sugar reduced by 20%, Rohan was able to purchase 10 kg more for Rs. 80. What was the original price per kg of sugar?
(1) Rs. 4 (2) Rs. 10 (3) Rs. 3 (4) Rs. 2 (5) Rs. 1.6
- Seema brought some chocolates. She distributed 25% of the chocolates among the students of the first standard and 20% of the remaining chocolates among the students of the second standard. If she still had 240 chocolates, how many did she have initially?
(1) 436 (2) 350 (3) 400 (4) 410 (5) None of these

10. A family dines at a restaurant and one of the family members gives Rs. 400 to pay the bill and doesn't take back the change leaving the change as tip to waiter. The bill comprised the actual cost of food and a service tax of 12.5%. The service tax was Rs. 40. How much tip did the waiter receive?
- (1) Rs. 10 (2) Rs. 20 (3) Rs. 30 (4) Rs. 40 (5) Rs. 50
11. In a certain test, Ajay was able to correctly solve 3 out of the 5 questions asked. In the second test, there were 7 questions out of which he got 6 correct. In both the tests, each question carried 10 marks with no negative marking. What is the percentage change in the marks obtained by Ajay in the two tests?
- (1) 43% (2) 48.26% (3) 42.86% (4) 46.86% (5) 42%
12. A shopkeeper reduces the price of a product by 12.5%. Thinking that this is not enough, he then reduces it by 10%. When selling the product to a customer, he further gives a discount of 7%. What single discount would have been equivalent to the successive discounts?
- (1) 12.5% (2) 21.25% (3) 29.5% (4) 26.76%
13. The hourly wages of a labourer have increased by 15%. Since the increase, the number of hours he works daily has reduced by 12.5%. If, before the increase, he was earning Rs.80 everyday, find the amount he is earning after the increase.
- (1) 78 (2) 90 (3) 80.5 (4) 92.5 (5) 92
14. 80% of the weight of fresh dates is constituted by water. They are kept in a drying room and after drying them sufficiently, it turns out that only 20% of the weight is constituted by water. Find the weight of dried dates obtained from 500 kg of fresh dates.
- (1) 175 kg (2) 180 kg (3) 75 kg (4) 125 kg
15. An art aficionado, Mr. Karat, conducts his business in a unique style. Every once in a while he raises the prices by $x\%$ then a while later he reduces all the new prices by $x\%$. After one such up-down cycle, the price of a painting decreased by Rs. 1000. After a second up-down cycle, the painting was sold for Rs. 23,040. What was the original price of the painting?
- (1) Rs. 15,000 (2) Rs. 20,000 (3) Rs. 25,000 (4) Rs. 30,000 (5) Rs. 35,000

4

Interest and Growth Rates

PRACTICE TEST I

- If a certain principal amount increases to Rs. 6,500 in 3 years at a certain fixed rate of simple interest and Rs. 7,500 in 5 years at the same rate of interest, then what is the rate of simple interest?
(1) 5% (2) 10% (3) 15% (4) 20%
- Chintamani took a loan of Rs. 50,000 at a rate of 10% per annum at simple interest for 3 years and invested the money at the rate of 10% per annum for the same period, compounded annually. How much money did he gain or lose in the entire transaction?
(1) Gained Rs. 16,550 (2) Gained Rs. 5,000
(3) Gained Rs. 1,550 (4) Neither gained nor lost.
- A building worth Rs. 13,31,000 is constructed on land worth Rs. 7,29,000. After how many years will the value of both be the same, if the worth of the land appreciates at 10% per annum and that of the building depreciates at the rate of 10% per annum?
(1) 1.5 (2) 2 (3) 2.5 (4) 4 (5) 3
- A bank lent Rs. 4,000 to Manoj at a certain rate of simple interest and Rs. 5,000 to Aditi at simple interest at a rate which is 0.5 percentage points more than that of Manoj. After two years, the bank received Rs. 860 as interest from both of them combined. Find the rate of interest per annum at which the amount was lent to Aditi?
(1) 4.5% (2) 4% (3) 5.5% (4) 5% (5) 8%
- If the principal is increased by Rs. 250, the simple interest increases by Rs. 150. If the time period is doubled, the simple interest increases by Rs. 1,500. Find the compound interest on the original principal, for half of the original time period at the same rate.
(1) Rs. 500 (2) Rs. 600 (3) Rs. 650 (4) Rs. 800 (5) Data Insufficient
- It takes n years, for Rs. 62,500 to amount to Rs. 1,08,000, at 20% per annum compounded annually. Find the value of n .
(1) 7 (2) 5 (3) 4 (4) 3 (5) 2
- A sum of Rs. 5000 deposited by Mr. A at compound interest doubles after 6 years. What will be its value after 18 years?
(1) Rs. 20,000 (2) Rs. 60,000 (3) Rs. 25,000 (4) Rs. 30,000 (5) Rs. 40,000
- The compound interest on a certain amount for two years is Rs. 2,912 and the simple interest on the same amount is Rs. 2,800. Find the principal amount.
(1) Rs. 12,000 (2) Rs. 12,750 (3) Rs. 14,250 (4) Rs. 15,000 (5) Rs. 17,500
- The difference between the compound interest and the simple interest for 2 years on a certain sum at 10% rate of interest is Rs. 850. Find the principal.
(1) Rs. 8,50,000 (2) Rs. 8,500 (3) Rs. 85,000
(4) Rs. 70,250 (5) None of these

10. A certain amount of money is lent out at compound interest at the rate of 20% per annum for two years, compounded annually. It would give Rs. 241 more if the amount is compounded half yearly. Find the principal.
 (1) Rs. 5,000 (2) Rs. 10,000 (3) Rs. 15,000 (4) Rs. 20,000
11. A sum of Rs. 12,615 is divided between a brother and sister who are 12 and 10 years old respectively, in such a way that if their portions are invested at the rate of 5% per annum compound interest, they shall receive equal amounts on reaching 21 years of age. How much money does the brother get initially?
 (1) Rs. 6,615 (2) Rs. 6000 (3) Rs. 16,165 (4) Rs. 7,612 (5) Rs. 7,600
12. A sum of money was borrowed such that the rate of simple interest was 10% per annum. At the end of the first year, Rs. 6,500 was paid off and the rate of interest on the balance was increased to 12% per annum. If the interest for the second year was $(\frac{3}{4})^{\text{th}}$ of the interest for the first year, what was the original sum borrowed?
 (1) Rs. 13,684 (2) Rs. 15,888 (3) Rs. 15,000 (4) Rs. 23,698 (5) Rs. 25,000
13. After how many years approximately would the amount payable on a loan be twice the principal, if the principal is lent at the rate of 20% per annum, compounded quarterly?
 (1) 5 (2) 6.5 (3) 8 (4) 3.5 (5) 4.5
14. The population of country A on 1st Jan, 2008 was 1 billion and it grows at the rate of 10% per year. The population of country B on the same date was 1.5 billion and it decreases at the rate of 10% per year. On 1st January of which year will country A's population become more than that of country B?
 (1) 2008 (2) 2009 (3) 2010 (4) 2011 (5) 2012
15. Out of a world population of approximately 6.6 billion, 1.2 billion people live in the richer countries of Europe, America, Japan and this figure is growing at the rate of 25% per year, while the other 5.4 billion people live in the less developed countries and this figure is growing at the rate of 15%. What will be the world population in 5 years if we assume that these growth rates will stay constant for the next 5 years? (round answer to 3 significant digits)
 (1) 11.53 billion (2) 12.53 billion (3) 12.03 billion
 (4) 14.03 billion (5) 14.52 billion

5

Profit, Loss and Discount

PRACTICE TEST I

- Find the profit or loss percentage when a shopkeeper marks his goods 20% above the cost price and then allows a discount of 20% on the marked price?
(1) 2% loss (2) 3% profit (3) 4% loss (4) 2% profit
- A shopkeeper sold an article at a loss of 8%. Had he sold it for Rs. 540 more, he would have made a profit of 10%. Find the cost price of the article?
(1) 1800 (2) 2000 (3) 2500 (4) 3000 (5) 3600
- During a special sale, the shop assistant was supposed to reduce the marked price of each article by 15%. For a particular item, he made a mistake and increased the marked price by 15%. Consequently for that item, the customer had to pay Rs. 540 more than what he would have paid if the price was correctly reduced by 15%. What was the price paid by the customer?
(1) 1800 (2) 2070 (3) 2340 (4) 2000 (5) Cannot be determined
- A trader gives a discount of 10% on the marked price and in the process still makes a profit of 20% on his cost price. By what percentage did he mark the product over his cost price?
(1) 15% (2) 20% (3) 26.66% (4) 33.33%
- If a selling price of Rs. 2,500 results in a 20% discount off the marked price, then the selling price that would result in a 40% discount off the marked price (in Rs.) will be equal to:
(1) 1875 (2) 2000 (3) 2025 (4) 2075
- A businessman buys two different kinds of rice which cost him Rs. 30 per kg and Rs. 42 per kg. He mixes them in the ratio 3 : 2 and sells the mixture at the rate Rs. 38 per kg. Find the profit or loss percentage (approximately)?
(1) 7% profit (2) 9% profit (3) 13% profit (4) 7% loss (5) 9% loss
- Amit sold a bike to Sumit at 20% profit. Sumit spent Rs. 1,000 to get it painted and sold it to Rohit at 10% profit. If Rohit paid Rs. 15,000 to Sumit for the bike, how much did Amit pay for the bike?
(1) Rs. 10,350 (2) Rs. 10,000 (3) Rs. 10,530 (4) Rs. 10,050 (5) Rs. 10,005
- A shopkeeper sells 150 bags for Rs. 7500. By doing so, he gains the cost of 250 bags. Find his percentage gain.
(1) 40% (2) 50% (3) 67% (4) 16.67% (5) 66.67%
- When a plot is sold for Rs. 18,700, the owner loses 15%. At what price must that plot be sold in order to gain 15%?
(1) Rs. 25,100 (2) Rs. 24,700 (3) Rs. 25,300 (4) Rs. 25,500 (5) Rs. 25,700
- At Vijay stores there are some good offers on the purchase of a laptop.
Offer 1: Purchase a laptop for Rs. 35,000 and get a discount of 30%.
Offer 2: Purchase a laptop for Rs. 35,000 and get successive discounts of 20% and 10%.
Which offer is better for the customer?

6

Ratio and Proportion

PRACTICE TEST I

- What number should be added to each term in the ratio $19 : 43$, so that it becomes equal to $2 : 3$?
(1) 20 (2) 29 (3) -91 (4) -30
- A construction company is planning to invest in a road and railway line construction in the ratio $4 : 5$. If the amount invested in the railway line construction is 6 million, then how much money did the company invest in the road construction?
(1) 14 million (2) 10.8 million (3) 4.8 million (4) 2.6 million (5) 7.5 million
- If the incomes of A and B are in the ratio $3 : 4$ and their expenditures are in the ratio $2 : 3$, then find the ratio of their savings.
(1) $1 : 1$ (2) $1 : 9$ (3) $1 : 2$ (4) Cannot be determined
- The total money collected for New Year celebrations in a certain building was Rs. 20,500. The ratio of the amount contributed by the people of the A wing to that contributed by the people of the B wing was $8 : 5$. Also, the ratio of the amount contributed by the people of the B wing to that contributed by the people of the C wing was $2 : 3$. Find the amount contributed by the people of B wing.
(1) Rs. 5,000 (2) Rs. 2,000 (3) Rs. 2,500 (4) Rs. 3,000 (5) Rs. 500
- 78 is divided into two parts such that the ratio between those two parts is $7 : 6$. Find the product of those two parts.
(1) 1215 (2) 2808 (3) 1512 (4) 3276 (5) 1014
- Seats for Mathematics, Physics and Biology in a school are in the ratio $5 : 7 : 8$. There is a proposal to increase these seats by 40%, 50% and 75% respectively. What will be the ratio of increased seats?
(1) $2 : 3 : 4$ (2) $2 : 4 : 5$ (3) $2 : 3 : 5$ (4) $3 : 4 : 2$ (5) $4 : 5 : 3$
- During the elections for the post of a building society chairman, the ratio of the number of members with Mr. Shah to that with Mr. Raheja was $6 : 5$. But 24 members from Mr. Shah's side defected and joined Mr. Raheja. Now the ratio of members with Mr. Shah to that with Mr. Raheja is $2 : 3$. Find the number of members siding with Mr. Shah initially.
(1) 90 (2) 15 (3) 75 (4) 240 (5) 30
- Vessel 1 contains 38 litres of milk and vessel 2 contains 24 litres of water. 8 litres of milk is taken from vessel 1 and placed in vessel 2. Then, 20 litres of the mixture is taken from vessel 2 and placed in vessel 1. Find the ratio of milk in vessel 1 to water in vessel 2?
(1) $4 : 9$ (2) $15 : 35$ (3) $15 : 4$ (4) $35 : 9$ (5) $35 : 3$
- The sum of three numbers is 98. If the ratio of the first to second is $2 : 3$ and that of the second to the third is $5 : 8$, then the second number is:
(1) 25 (2) 35 (3) 30 (4) 45 (5) 40

10. Aakash has coins of 50 paise, 25 paise and Rs. 1.50 in the ratio 1 : 2 : 3 (Aakash stays in a country where all are valid currency coins. Also, in his country, 1 Rupee equals 100 paise). How many coins of 25 paise does Aakash have, if he has got Rs.6,600 in all?
- (1) 2000 (2) 2200 (3) 2400 (4) 2600 (5) 2800

PRACTICE TEST II

1. The annual income of Mr. X and Mr. Y is in the ratio 9 : 8 and their expenditures are in the ratio 5 : 4. If both individually manage to save Rs. 5,000, then B's expenditure is:
- (1) Rs. 1,250 (2) Rs. 5,000 (3) Rs. 6,250 (4) Rs. 11,250 (5) Rs. 10,000
2. If $5x - 13y = 3x - 8y$, find the value of $(2x^2 + 3y^2) : (2x^2 - 3y^2)$
- (1) 50 : 12 (2) 62 : 39 (3) 25 : 4 (4) 31 : 19
3. On the basis of their performance in a test, Professor Shetty distributed Rs. 798 among Vinod, Vinay and Vinit such that 6 times Vinod's share is equal to 10 times Vinay's share or 5 times Vinit's share. How much does Vinod get?
- (1) 228 (2) 238 (3) 240 (4) 275 (5) 285
4. Find the fourth proportional to 3, 5 and 27.
- (1) 45 (2) 16.2 (3) 135 (4) 55
5. If $\frac{x-y}{x^2-y^2} = \frac{x^2-y^2}{k}$, then $k = ?$
- (1) $(x-y)(x^2-y^2)$ (2) $(xy)(x^2-y^2)$ (3) $(x+y)(x^2-y^2)$ (4) $(x-y)^2(x+y)$
6. The cost of manufacturing a circular cast iron plate is directly proportional to the square root of its diameter. A 24 cm (diameter) plate costs Rs. 346. How much more or less will it cost to manufacture 2 plates with diameters 18 cm and 8 cm?
- (1) Rs. 143 more (2) Rs. 153.41 more (3) Rs. 282.31 more
(4) Rs. 282.31 less (5) Rs. 182.3 less
7. If $\frac{x}{y+z-x} = \frac{y}{z+x-y} = \frac{z}{x+y-z} = r$, then r cannot take any value except,
- (1) 1 (2) $-\frac{1}{2}$ (3) -1 or $\frac{1}{2}$ (4) 1 or $-\frac{1}{2}$ (5) -1
8. A precious stone is accidentally broken into 2 pieces whose weights are in the ratio 4:5. The value of the stone is directly proportional to the square of its weight. What is the ratio of the total value of the original (unbroken) stone to the total value of the broken pieces?
- (1) 41 : 81 (2) 81 : 41 (3) 40 : 81 (4) 81 : 40 (5) None of these
9. A and B started a business in partnership investing Rs. 20,000 and Rs. 15,000 respectively. After six months, C joined them with Rs. 20,000. What will be B's share in total profit of Rs. 25,000 earned at the end of 2 years from the starting of the business?
- (1) 7500 (2) 8000 (3) 7750 (4) 7250 (5) 8250
10. A began a business with Rs. 85,000. He was joined afterwards by B with Rs. 42,500. For how much period does B join, if the profits at the end of the year are divided in the ratio of 3 : 1?
- (1) 6 months (2) 9 months (3) 3 months (4) 8 months (5) 5 months

7

Mixtures and Alligations

PRACTICE TEST I

- A shopkeeper mixes two varieties of pulses to get a mixture of pulses. He uses 1 kg and 4 kg of pulses costing Rs. 10 and Rs. 20 per kg respectively. What is the cost of the resultant mixture (in Rs. per kg)?
(1) 11 (2) 15 (3) 17 (4) 25 (5) 18
- A solution containing 20% water is mixed with another solution containing 40% water. In what proportion should the two solutions be mixed to get a solution containing 25% water?
(1) 3 : 1 (2) 1 : 2 (3) 2 : 3 (4) 1 : 5 (5) 3 : 4
- How many litres of water must be added to 20 litres of 24% solution of wine in water to make it a 10% solution of wine in water?
(1) 17 (2) 15 (3) 24 (4) 28
- In what ratio should two alloys with zinc and tin in the ratio 3 : 5 and 5 : 3 respectively, be mixed to get a new alloy containing zinc and tin in the ratio 1 : 1?
(1) 1 : 1 (2) 5 : 4 (3) 2 : 3 (4) 1 : 4
- Mr.Lal mixed coffee powder worth Rs. 2 per kg and Rs. 4 per kg and then sold the mixture at Rs. 3.75 per kg, thereby gaining a profit of 50%. In what proportion did he mix the two types of coffee powder?
(1) 1.5 : 1 (2) 3 : 2 (3) 3 : 1 (4) 1 : 2 (5) 2 : 1
- Milk contained in a vessel of capacity 72 litres is diluted by replacing it with water twice. After the replacement the ratio of milk to water is 25:11. Find the quantity of water added each time.
(1) 24 litres (2) 30 litres (3) 12 litres (4) 42 litres (5) 10 litres
- A teacher teaches two different classes having the same number of students. In one class the ratio of the number of students who passed to the number of students who failed is 3 : 4. In the other class, the same ratio is 4 : 5. The teacher wants to find the total passing percentage of all her students in both classes. The approximate value of this quantity is:
(1) 41% (2) 44% (3) 47% (4) 50%
- The alloy Cuzi contains copper and zinc in the ratio 3 : 4. The alloy Zial contains zinc and aluminium in the ratio 5 : 2. The alloy Alfie contains aluminium and iron in the ratio 1 : 3. Equal amounts of each alloy are melted together and recast into a new alloy. What is the ratio of the amount of copper to the amount of aluminium in this new alloy?
(1) 1 : 2 (2) 2 : 3 (3) 3 : 4 (4) 4 : 5
- Mr.Dayal, a shopkeeper, bought two varieties of orange juice at Rs. 50 per litre and Rs. 42 per litre respectively. He mixed them in some proportion to get a drink he called 'Oranj-La', which he sold at Rs. 54 a litre, thereby making a profit of 20%.
How much of the Rs. 50 variant of juice is present in 40 litres of Oranj-La?
(1) 15 litres (2) 20 litres (3) 30 litres (4) 25 litres (5) 32 litres

10. In Ram's purse, the ratio of 2 rupee coins to 5 rupee coins is 4 : 11, and there are no other types of coins. In Shyam's purse, the ratio of 5 rupee coins to 2 rupee coins is 7 : 3, and there are no other types of coins. Shyam's purse contains twice as many 2 rupee coins as Ram's purse. Now, they put all their coins in a larger purse. They see that the total amount they have is Rs. 744. What portion of this amount (in rupees) is in the form of 2 rupee coins?

- (1) 104 (2) 136 (3) 180 (4) 200

PRACTICE TEST I

- If 200 men are required to construct a road of length 1 km in 5 days, what would be the length of the road constructed by 300 men in 5 days?
(1) 2 km (2) 1.5 km (3) 3 km (4) 4 km
- What is the ratio of the volume of two spheres having their radii in the ratio 1 : 2?
(1) 1 : 2 (2) 1 : 4 (3) 1 : 8 (4) 1 : 16 (5) 1 : 32
- The force between two charges is inversely proportional to the square of the distance between them. If the force is 20 Newtons when the distance between the two charges is 200 m, then what will be the force when the distance between the two charges increases to 2000 m?
(1) 0.2 N (2) 20 N (3) 200 N (4) 2 N
- The volume of a cone is directly proportional to the product of the square of the radius of its base and the height. If the radius and height of the cone are doubled, then what is the percentage change in the volume of the cone?
(1) 100% (2) 800% (3) 300% (4) 400% (5) 700%
- The area S of a trapezoid varies jointly as its height and the sum of its bases. If the area is 285 square metres when the height is 19 metres and the bases are 11 and 19 metres, then what is the area (in square metres) of another trapezoid whose height is 10 metres and whose bases are 10 and 15 metres respectively?
(1) 250 (2) 150 (3) 125 (4) 100 (5) None of these
- It takes 6 workers to lift 8 cars with 4 cranes. Also, the number of cranes (c) it takes for w workers to lift y cars varies directly as the number of cars and inversely as the number of workers. How many workers are required to lift 20 cars with 5 cranes?
(1) 14 (2) 3 (3) 11 (4) 12 (5) 10
- Because of an error in programming logic, a computer program calculates the area of a circle as inversely proportional to the cube of its radius, and the perimeter of the circle as inversely proportional to its area. (Constant of proportionality is the same in both cases). If the radius of the circle is 8 units, then what would be the perimeter of the circle according to the program?
(1) 8 units (2) 16 units (3) 64 units (4) None of these (5) Data Insufficient
- Ram found a relation between the marks of Mahesh, Ramesh and Durgesh. The relation was such that the marks of Mahesh vary jointly (and in direct proportion) with the square of the marks of Ramesh and the fourth power of the marks of Durgesh. By what percentage would the marks of Mahesh increase/decrease if the marks of Ramesh were doubled and those of Durgesh were halved?
(1) 75% Increase (2) 75% Decrease (3) 25% Increase
(4) 25% Decrease (5) None of these

-
9. P varies directly with Q , Z varies inversely with Q and A varies directly with P and inversely with Z . If $P = 27$, then $Q = 9$, $Z = 3$ and $A = 90$. What is A if $P = 81$?
- (1) 100 (2) 120 (3) 270 (4) 810 (5) None of these
10. 8 students working for 5 hours a day can solve a certain number of problems in 9 days. How many boys are needed to solve five times the original number of problems, if they work at 4 hours a day for 15 days?
- (1) 12 (2) 30 (3) 45 (4) 10 (5) 24

9

Time and Distance

PRACTICE TEST I

- A bus travels from City A to City B at a speed of 55 km/hr, from City B to City C at 110 km/hr and from City C to City A at 55 km/hr. What would be the time taken for the bus to travel from City A to City B and then to City C if the distance between each of the cities is 220 km?
(1) 10 (2) 8 (3) 6 (4) 5
- In a particular race, the time durations taken by three contestants to complete the race is in the ratio 8 : 3 : 6. Find the ratio of their speeds.
(1) 6 : 3 : 8 (2) 3 : 8 : 4 (3) 1 : 2 : 3 (4) 4 : 3 : 1 (5) 3 : 8 : 6
- Meher travelled 20% of the time walking at a speed of 10 km/hr, 50% of the time in a bus at 40 km/hr and rest of the journey in a cab at 50 km/hr. What is the average speed of Meher over the entire journey?
(1) 37 km/hr (2) 25.97 km/hr (3) 42 km/hr (4) 40 km/hr (5) 20.68 km/hr
- When Arun drives at a speed of 40 km/hr towards his office, he reaches late by 15 minutes; but if he drives at a speed of 60 km/hr, he reaches early by 10 minutes. Find the usual time he takes to reach his office exactly on time.
(1) 40 min (2) 45 min (3) 50 min (4) 60 min (5) None of these
- Anurag goes to Prabhadevi from Santacruz at a speed of 6 km/hr and returns from Prabhadevi at a speed of y km/hr. Which, among the following, cannot be the average speed of Anurag during the entire journey?
(1) 3 km/hr (2) 6 km/hr (3) 7.5 km/hr (4) 12 km/hr (5) None of these
- Two trains start simultaneously from Mumbai and Ahmedabad towards each other with speeds 80 km/hr and 100 km/hr respectively. When the two trains meet each other, it was observed that one of the trains has covered 320 km more than the other. Find the distance between Mumbai and Ahmedabad?
(1) 2400 (2) 2560 (3) 2880 (4) 2890 (5) 1280
- A bus on its way to Nashik met with an accident 180 km from Mumbai from where it started. It completed the remaining journey at $\frac{5}{6}$ th of the previous speed and reached late to its destination by 30 minutes. Now a passenger calculated that had the accident happened 50 kms further, it would have been late by only 10 minutes. Find the original speed of the bus?
(1) 20 km/hr (2) 18 km/hr (3) 25 km/hr (4) 28 km/hr (5) 30 km/hr
- A car starts for Pune from Mumbai at 8 p.m. The car meets a bus which is moving in the same direction at 10 p.m. and overtakes it. At 12.30 a.m., the car reaches Pune and it starts on its return journey after an hour. At 2 a.m., the car meets the bus which is still on its way to Pune. When will the bus reach Pune?
(1) 4 a.m. (2) 3 a.m. (3) 5 a.m. (4) 6 a.m. (5) 7 a.m.

9. In a 100 m race, Usha beats Parvati by 10 m and Parvati beats Anuja by 5 m in the same race. By how many meters does Usha beat Anuja in the same race?
 (1) 12 m (2) 15 m (3) 14.5 m (4) 14 m (5) 12.5 m
10. Three kids, Shashi, Manohar and Randheer are racing round their neighbourhood. In a 100 meters sprint, Shashi beats Manohar by 15 meters and Manohar beats Randheer by 7 seconds. How fast is Shashi compared to Randheer, if Manohar runs with a speed of 10 m/s?
 (1) 3 times (2) 1.5 times (3) 2 times (4) 2.5 times (5) None of the above

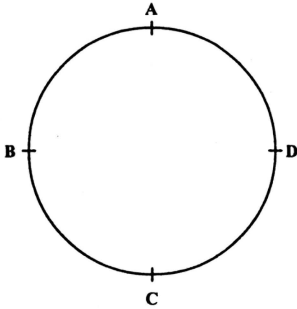
PRACTICE TEST II

1. A particular goods train runs at a speed of 108 km/hr. It crosses a stationary pole on the way in 13 seconds. Find the length of the goods train in meters.
 (1) 390 (2) 290 (3) 216 (4) 324 (5) 130
2. An airplane can travel at a speed of 1100 km/hr when it does not face resistance from air. Air currents are flowing from east to west at a speed of 100 km/hr. How many hours will the airplane take to complete a return journey from Mumbai to Delhi, if the distance between the two cities is approximately 4800 kms? (Mumbai lies in the west, whereas Delhi is in the east.)
 (1) 4.5 (2) 4 (3) 8 (4) 8.8 (5) None of these
3. A ship can cover 40 miles upstream and 90 miles downstream in 10 hours. It can also cover 60 miles upstream and 60 miles downstream in 10 hours. Find the speed of the ship in still water.
 (1) 10 miles/hr (2) 12.5 miles/hr (3) 15 miles/hr (4) 20 miles/hr (5) Data insufficient
4. Two trains are running in opposite directions and they are 120 m and 210 m long respectively. Find the time taken (approximately) for the two trains to cross each other if they are running with speeds 50 km/hr and 70 km/hr respectively?
 (1) 5 sec (2) 8 sec (3) 10 sec (4) 12 sec (5) 20 sec
5. Gurmeet starts walking from point A at an uniform speed of 4 km/hr. Forty-five minutes later, Deepika starts walking in the same direction as Gurmeet from the same point. Deepika overtakes Gurmeet after 36 minutes. Find Deepika's speed.
 (1) 4 km/hr (2) 5 km/hr (3) 4.5 km/hr (4) 6 km/hr (5) 9 km/hr
6. Tom spots Jerry 200 m ahead of him and starts chasing him. Jerry realizes this after 4 minutes and starts running away from him. In one leap, Tom covers 3 m and Jerry covers 2 m. Also in one minute, Tom takes 12 leaps and Jerry takes 16 leaps. In how many minutes would Tom catch up with Jerry after he started chasing him?
 (1) 8 (2) 12 (3) 15 (4) 14 (5) 18
7. Two cyclists start from the same point at the same time in opposite directions on a circular track 1080 m long. The first cyclist travels at a speed of 43.2 km/hr and the second cyclist travels at a speed of 54 km/hr. When they meet at the starting point for the first time, how many times have they met each other including their meeting at the starting point for the first time?
 (1) 4 (2) 5 (3) 8 (4) 9 (5) 10

8. Two sprinters, Anu and Bali, started running from a point on the circular track such that Anu ran in anti-clockwise direction while Bali ran in clockwise direction. Anu meets Bali for the first time at a distance 300 m from the starting point in anti-clockwise direction. When Anu meets Bali for the second time, they are 260 m from the starting point in anti-clockwise direction and Bali is yet to complete a round. Find the circumference of the circular track on which they are running?

(1) 250 m (2) 300 m (3) 360 m (4) 340 m (5) 450 m

9. Points A, B, C and D are equally spaced points on the surface of a circular web of radius $(5/\pi)$ cm. A spider is present at point A. Three beetles are present at points B, C and D. At the initial moment, the spider and the beetles at C and D start crawling anti-clockwise with constant speeds. The beetle at B starts crawling clockwise at a constant speed. The speed of the spider is 1 cm/s. If the spider catches the three insects in 2.083 sec, 12.5 sec and 37.5 sec respectively, then what is the ratio of the speeds of the three insects?



(1) 1 : 3 : 4 (2) 1 : 2 : 4 (3) 1 : 2 : 5 (4) 2 : 3 : 4 (5) 2 : 3 : 5

10. Two swimmers Chintu and Pintu are swimming in a stream, heading towards each other. When they started swimming the distance between them was 25 kms. The speed of the stream is 5 km/hr, the speed of the each of the swimmer is 10 km/hr. How far will be Chintu from Pintu one minute before they meet?

(1) $1/4$ km (2) $1/3$ km (3) $1/6$ km (4) $1/12$ km (5) $1/9$ km

PRACTICE TEST I

- At what time between 7:30 and 8:00 will the hands of a clock be at right angles to each other?
 (1) $7:55\frac{6}{11}$ (2) $7:54\frac{6}{11}$ (3) $7:54\frac{5}{11}$ (4) $7:55\frac{5}{11}$ (5) Cannot be determined
- At what time between 1 O'clock and 2 O'clock do the hands of a clock coincide with each other?
 (1) $1:05\frac{5}{11}$ (2) $1:05\frac{6}{11}$ (3) $1:02\frac{8}{11}$ (4) 1:12 (5) None of these
- If the time in a clock is 7 hours 15 minutes, then what time does it show on a mirror placed to the right of the clock?
 (1) 4 hours 50 minutes (2) 4 hours 40 minutes (3) 4 hours 35 minutes
 (4) 4 hours 45 minutes (5) 11 hours 15 minutes
- What is the angle between the two hands of a clock at 2:35 a.m.?
 (1) $122\frac{1}{2}$ (2) $142\frac{1}{2}$ (3) $132\frac{1}{2}$ (4) $116\frac{1}{2}$ (5) $122\frac{1}{4}$
- At what time between 5 O'clock and 6 O'clock, will the hands of a clock be at an angle of 62?
 (1) 5 hours $17\frac{2}{11}$ minutes (2) 5 hours $38\frac{6}{11}$ minutes (3) 5 hours 16 minutes
 (4) Both (2) and (3) (5) None of these
- At what time between 7 and 8 o'clock will the hands of a clock be in the same straight line but, not together i.e they will be opposite to each other?
 (1) 07:05:45 (2) 07:10:55 (3) 07:16:35 (4) 07:01:25 (5) 07:07:07
- At what time, in minutes, between 3 o'clock and 4 o'clock, do both the hands coincide with each other?
 (1) $15\frac{4}{11}$ (2) $14\frac{4}{11}$ (3) $17\frac{4}{11}$ (4) $16\frac{4}{11}$ (5) $13\frac{4}{11}$
- At what time between 5.30 and 6 will the hands of a clock be at right angles?
 (1) $41\frac{7}{11}$ min past 5 (2) $44\frac{7}{11}$ min past 5 (3) $45\frac{7}{11}$ min past 5
 (4) $42\frac{7}{11}$ min past 5 (5) $43\frac{7}{11}$ min past 5
- The angle between the minute hand and the hour hand of a clock when the time is 4.20, is:
 (1) 20° (2) 15° (3) 10° (4) 25° (5) 16°
- What is the angle between the hands at 4.40?
 (1) 100° (2) 70° (3) 120° (4) 50° (5) 150°

PRACTICE TEST I

- If A and B can complete a job in 4 and 5 days respectively when working alone, then how many days will they take to complete the job together?
(1) 50/9 (2) 20/9 (3) 1/20 (4) 9/20
- If A and B together complete a job in 10 hours and A takes 25 hours to do the job alone, in how many hours can B alone complete the job?
(1) 30 (2) 15 (3) 16.66 (4) 6.16
- Two outlet pipes together empty a 1300 litre tank in 7.2 minutes. What is the rate at which the tank gets empty?
(1) 325 litres/min (2) 394 litres/min (3) 180.5 litres/min (4) 135.4 litres/min
- If a woman completes $\frac{2}{3}$ rd of a task in 1 day, then find the time taken by a man to complete the task if he is half as efficient as the woman.
(1) 0.75 (2) 1.5 (3) 3.33 (4) 3
- If $\frac{7}{8}$ th of some work is done in 1 day, then how much work will be left after half a day?
(1) $\frac{9}{16}$ (2) $\frac{7}{4}$ (3) $\frac{7}{8}$ (4) $\frac{9}{7}$
- It takes 16 days for 10 workers working 7 hours a day to build a room 60 m long, 5 m high and 14 m wide. How many men will be required to build a room 50 m long, 6 m high and 28 m wide if the number of days is halved but the working hours remain the same?
(1) 25 (2) 30 (3) 40 (4) 20 (5) None of these
- Ajay and Vijay together have to complete a project. Ajay alone can complete it in 8 days while Vijay alone requires 16 days. If both of them decide to work on alternate days, starting with Ajay, then in how many days will they be able to finish the project?
(1) 10.25 days (2) 11 days (3) 10 days (4) 10.5 days (5) 11.5 days
- A can complete a piece of work in 40 days. He worked at it for 5 days and then B completed the remaining work in 21 days. In how many days can A and B complete the work, if they start together?
(1) 7 days (2) 10 days (3) 12 days (4) 15 days (5) 16 days
- Two inlet pipes A and B fill a tank completely in 4 hours and 12 hours respectively. An outlet pipe C empties the tank in 3 hours. The tank is initially full. If all pipes are opened simultaneously, then what happens to the tank after 5 hours?
(1) The tank overflows. (2) The tank remains full. (3) The tank is empty.
(4) The tank empties in 2 hours. (5) None of these
- A tank is initially full. Pipe A can empty it in 3 hours while pipes B and C fill it in 9 and 12 hours respectively. If all the pipes are opened simultaneously, then after how many hours will the tank be empty?
(1) 7.2 (2) 4 (3) 2.7 (4) 9.6 (5) 3.3

PRACTICE TEST II

1. A man is thrice as efficient as a woman and a woman is twice as efficient as a child. If all of them, working together, complete a task in 6 days, then find the number of days that the child will take to complete the task alone.
- (1) 9 (2) 18 (3) 36 (4) 54 (5) 45
2. Four men of equal capacity work with person A to complete a task in 5 days. If 3 men with equal capacity had worked with a man of double capacity than A, they would have finished the task in 3 days. In how many days can one of the men of equal capacity complete the task alone?
- (1) $75/7$ (2) 75 (3) $75/11$ (4) $75/22$
3. A and B together complete a task in 14 days. B and C complete the same task in 8 days while A and C together complete it in 7 days. Who is the most efficient of them all?
- (1) A (2) B (3) C (4) B and C
4. A and B together complete a task in 14 days. B and C together complete the same task in 8 days while A and C together complete it in 7 days. Find the number of days taken by the least efficient person to complete the task.
- (1) 112 (2) $112/3$ (3) $112/5$ (4) $112/7$ (5) $112/13$
5. An inlet pipe fills a tank of capacity 1400 m^3 at the rate of $200 \text{ m}^3/\text{min}$. When an outlet pipe is also opened, the tank gets filled in 20 minutes. Find the time (in minutes) in which the outlet pipe empties a completely filled tank, if the inlet pipe is not open.
- (1) 7.77 min (2) 7 min (3) 70 min (4) $10\frac{10}{13}$ min (5) None of these
6. If 20 men work for 5 hours a day, they can build a 190 feet long wall in 10 days. If after working for 6 days, 4 men leave the job, then how many days will be required to complete the job if the number of working hours per day is the same?
- (1) 25 days (2) 5 days (3) 10 days (4) 15 days (5) 20 days
7. Arjun can do a piece of work in 7 days and Karan can do in 11 days. How long will they take to do the same work working together?
- (1) 3.78 days (2) 4 days (3) 4.28 days (4) 4.5 days (5) 4.78 days
8. Pipe A can fill a tank in 4 minutes whereas pipes A and B together can fill the same tank in 3 minutes. How much time (in minutes) will pipe B take to fill the tank?
- (1) 10 (2) 12 (3) 9 (4) 7 (5) 16
9. X alone can do a piece of work in 15 days and Y alone can do it in 10 days. X and Y undertook to do it for Rs. 720. With the help of Z they finished it in 5 days. How much is paid to Z?
- (1) Rs. 120 (2) Rs. 75 (3) Rs. 240 (4) Rs. 90 (5) Rs. 360
10. A can complete a project in 20 days and B can complete the same project in 30 days. If A and B start working on the project together and A quits 10 days before the project is completed, in how many days will the project be completed?
- (1) 21 (2) 15 (3) 11 (4) 7 (5) 18

PRACTICE TEST I

1. What is the value of the following?

$$1.5 + 1.8 + 0.9 + (3 - 4) - 1.2 \times 2$$

- (1) 1.2 (2) 2.4 (3) 1.5 (4) 2 (5) None of these

2. What is the value of the following?

$$[3 + (2 - 4) \times 7 + 3 - (8 \times 2 - 12) \div 4]$$

- (1) -9 (2) -21 (3) -32 (4) 1 (5) None of these

3. What is the value of the following?

$$\left(5 + \left[\frac{1}{3} + \frac{1}{4}\right] \times 12 - 3\right) - 3 \times \frac{1}{3}$$

- (1) 8 (2) 3 (3) 6 (4) 5 (5) None of these

4. What is the value of the following?

$$4\frac{1}{3} - \left\{\frac{1}{6} \times \left(3 + 2\frac{1}{5} + 5 - 4\frac{1}{5}\right)\right\}$$

- (1)
- $\frac{11}{3}$
- (2)
- $3\frac{1}{3}$
- (3)
- $\frac{1}{3}$
- (4)
- $4\frac{1}{3}$
- (5) None of these

5. If
- $X = [(3 + 4)y - 24]^{0.5}$
- and
- $X = 5$
- , what is the value of
- y
- ?

- (1) 1 (2) 2 (3) 3 (4) 4 (5) None of these

6.
$$\frac{\sqrt{0.25} \times \sqrt{x}}{\sqrt{1\frac{9}{16}}} + \sqrt{0.0169} = 0.25$$

Find the value of x .

- (1) 0.3 (2) 0.09 (3) 0.25 (4) 0.16 (5) 0.9

7. Solve
$$\frac{\sqrt{p^2q^6r^8} \times \sqrt[3]{p^3q^2r^6}}{(pqr)^2 \times \sqrt{p^5q^4r^7}}$$

- (1)
- $p^{-\frac{5}{2}}q^{\frac{1}{3}}r^{\frac{1}{2}}$
- (2)
- $(p^{-5}r)^{-\frac{1}{2}}q^{-\frac{1}{3}}$
- (3)
- $p^{-\frac{5}{2}}r^{\frac{1}{3}}q^{\frac{1}{2}}$
- (4)
- $(p^{-5}r)^{\frac{1}{2}}q^{-\frac{1}{3}}$
- (5) None of these

8. A certain number when divided by 13 leaves a remainder of 2. What will be the remainder when the square of that number is divided by 13?

- (1) 2 (2) 4 (3) 5 (4) 6 (5) 7

9. A teacher asked a student to multiply a number by
- $\frac{4}{7}$
- . Instead, he multiplied by
- $\frac{7}{4}$
- and obtained an answer greater than the correct answer by 99. What was the original number?

- (1) 42 (2) 77 (3) 63 (4) 84 (5) None of these

10. If
- n
- is a prime number and
- $82(n^3 + 32n)$
- is exactly divisible by 16, what is the value of
- n
- ?

- (1) 2 (2) 3 (3) 5 (4) 7 (5) Cannot be determined

PRACTICE TEST I

- What is the HCF of the following set of numbers?
12, 24, 16, 32, 8
(1) 2 (2) 4 (3) 6 (4) 8 (5) None of these
- Four signals in a straight line turn red in 8s, 12s, 16s and 20s seconds respectively. If at time $t = 0$, all four signals are red, then after how many minutes will all four become red again?
(1) 1 (2) 2 (3) 3 (4) 4 (5) None of these
- Let X be the LCM of 32, 128, 512 & 1024. What is the sum of digits of X ?
(1) 6 (2) 7 (3) 8 (4) 9 (5) None of these
- There are three classes of 91, 143 and 208 students respectively who go out together for physical training. All the students are divided into groups of equal sizes and each group contains students only from one of the classes. What would be the largest possible group size?
(1) 4 (2) 7 (3) 11 (4) 13 (5) 16
- What is the largest number which divides 98, 147, 268 and 365 to leave a remainder of 2, 3, 4 and 5 respectively?
(1) 16 (2) 24 (3) 45 (4) 48 (5) None of these
- The LCM and HCF of two numbers is 18 and 7200 respectively. If one of the numbers is 450, find the other number.
(1) 290 (2) 300 (3) 288 (4) 320 (5) 180
- Find the possible number of ordered pairs of integers x, y such that their LCM is 108 and HCF is 9.
(1) 4 (2) 6 (3) 3 (4) 5 (5) More than 6
- If N is the highest 4 digit number divisible by 12, 40, 32 & 72, what is the value of N ?
(1) 9990 (2) 9020 (3) 8640 (4) 8900 (5) None of these
- The product of two numbers a and b ($a > b$) is 1924. If the H.C.F. of these numbers is 2, then what is the value of a ?
(1) 26 (2) 39 (3) 48 (4) 74 (5) None of these
- What is the smallest number that should be multiplied to 1260 to make it a perfect square?
(1) 14 (2) 70 (3) 35 (4) 45 (5) None of these
- A number $123x$ is divisible by 7. Find out the value of the digit x if the number is also divisible by 3.
(1) 2 (2) 4 (3) 6 (4) 9 (5) More than 1 value of x is possible

12. Which is the greatest number that leaves an equal remainder when 1086, 946 and 995 are divided by it?
(1) 4 (2) 5 (3) 6 (4) 7 (5) Data inadequate
13. The H.C.F. of two numbers is 36 and their LCM is 1950. If one of the numbers is 234, what is the other number?
(1) 250 (2) 300 (3) 350 (4) 275 (5) 325
14. Which is the least number, which when divided by 3, 4 and 5, leaves remainder 1, 2 and 3 respectively?
(1) 58 (2) 59 (3) 67 (4) 116 (5) None of these
15. The least four digit number which is exactly divisible by 3,4,5 or 8 is :-
(1) 9000 (2) 6400 (3) 3600 (4) 4900 (5) None of these

PRACTICE TEST I

1. On which day of the week does 17th May, 2003 fall?
(1) Saturday (2) Monday (3) Tuesday (4) Friday (5) Thursday
2. If there are exactly 25 leap years in a period, there must be
(A "century" below represents any year divisible by hundred.)
 1. at least one century in that period.
 2. at least two centuries in that period
 3. at most one century in that period
 4. at most two centuries in that period.(1) 2 and 4 only (2) 1 and 3 only (3) 1 and 4 only (4) 1, 2 and 3 only (5) None of these
3. Which dates of March 2008 will be a Sunday?
(1) 2, 9, 16, 23, 30 (2) 7, 14, 21, 28 (3) 3, 10, 17, 24, 31
(4) 1, 8, 15, 22, 29 (5) 3, 10, 17, 24, 31
4. What day of the week would be 26th March, 2023?
(1) Saturday (2) Monday (3) Tuesday (4) Friday (5) Sunday
5. Imagine that in a calendar year, there were 436 days and 9 days in a week. How many odd days would that year have?
(1) 1 (2) 2 (3) 3 (4) 4 (5) 5
6. If you were born on 28th January 1988, which was a Tuesday, on what day of the week will your birthday fall in 1989?
(1) Friday (2) Thursday (3) Tuesday (4) Wednesday (5) Cannot be determined
7. If 6th November of a year is Monday, then which day of the week would 29th November of that year fall on?
(1) Sunday (2) Monday (3) Tuesday (4) Wednesday (5) Saturday
8. If 25th October, 1993, was a Monday, then 16th November, 2008, will fall on a ...
(1) Sunday (2) Monday (3) Tuesday (4) Friday (5) Saturday
9. If 30th March 1996 was a Friday, then find the day of the week of 9th March 1997.
(1) Monday (2) Saturday (3) Thursday (4) Wednesday (5) Tuesday
10. If January 26, 2003 is a Sunday, then what day of the week was January 26, 1903?
(1) Sunday (2) Monday (3) Tuesday (4) Wednesday (5) Thursday

15

Algebraic Formulae and Operations

PRACTICE TEST I

- Add $(12x^2 - 12xy + 9y^2)$ and $(6xy + 7y^2)$
 - $12x^2 - 6xy + 16y^2$
 - $12x^2 + 6xy - 16y^2$
 - $12x^2 - 6xy - 16y^2$
 - $12x^2 + 6xy + 16y^2$
 - $12x^2 - 16xy + 16y^2$
- Multiply $(5x - 8y + 3z)$ and $(6x^2 - 7y^2)$
 - $30x^3 + 35xy^2 - 48x^2y + 56y^3 + 18x^2z - 21y^2z$
 - $30x^3 - 35xy^2 + 48x^2y + 56y^3 + 18x^2z - 21y^2z$
 - $30x^3 - 35xy^2 - 48x^2y - 56y^3 + 18x^2z - 21y^2z$
 - $30x^3 - 35xy^2 - 48x^2y + 56y^3 + 18x^2z + 21y^2z$
 - $30x^3 - 35xy^2 - 48x^2y + 56y^3 + 18x^2z - 21y^2z$
- If $a + b = 9$ and $ab = 19.25$, then which of these is a possible value of $(a - b)$?
 - +6
 - +7
 - +2
 - +3
 - +1
- Divide $(12a^2 - 12ab - 9b^2)$ by $(6a + 3b)$
 - $(2b - 3a)$
 - $(2a + 3b)$
 - $(2b + 3a)$
 - $(2a - 3b)$
 - None of these
- Factorize $x^2y^2 - 8xy - 48$
 - $(xy + 12)(xy - 4)$
 - $(xy - 12)(xy - 4)$
 - $(xy - 12)(xy + 4)$
 - $(xy + 12)(xy + 4)$
 - None of these
- Factorize $(2x^3 - 5x^2y - 12xy^2)$
 - $x(2x + 3y)(x + 4y)$
 - $x(2x - 3y)(x - 4y)$
 - $x(2x - 3y)(x + 4y)$
 - $x(2x + 3y)(x - 4y)$
 - $y(2x + 3y)(x - 4y)$
- The total marks of all the students in a particular class are $(x^2 + 4x + 3)$. There are $(x + 1)$ students in the class. If the average marks of a student are 49, how many students are there in the class?
 - 46
 - 47
 - 48
 - 49
- Simplify $(x^4 - 11x^2 + 10)$
 - $(x - 1)(x + 1)(x^2 + 10)$
 - $(x - 1)(x - 1)(x^2 - 10)$
 - $(x - 1)(x + 1)(x^2 - 10)$
 - $(x + 1)(x + 1)(x^2 - 10)$
 - $(x + 1)(x + 1)(x^2 + 10)$
- If $a^2 + \frac{1}{a^2} = 7$, then find the value of $(a + \frac{1}{a})$
 - 3
 - +2
 - +4
 - 4
 - 2
- What is one of the divisors of $3x + 4x^4y^4 + 6x^3z + 5x^2y^2z^2$?
 - x
 - x^2
 - $x + z$
 - xy
 - None of the above

PRACTICE TEST I

1. Which one of the following would be the pure surd form of $3\sqrt{13}$?
 (1) $\sqrt{39}$ (2) $\sqrt{13}$ (3) $\sqrt{36}$ (4) $\sqrt{117}$ (5) $6\sqrt{6}$
2. What would be the simplified form of $\frac{\sqrt{9} \times \sqrt{2916}}{2}$?
 (1) 81 (2) 102 (3) 54 (4) 162 (5) 66
3. What would be the result after rationalising the denominator of the surd, $\frac{1}{4 - \sqrt{3}}$?
 (1) $4 + \sqrt{3}$ (2) $4 - \sqrt{3}$ (3) $\frac{1}{4 + \sqrt{3}}$ (4) $\frac{4 + \sqrt{3}}{13}$ (5) $\frac{4 - \sqrt{3}}{13}$
4. If $x = 7 + 4\sqrt{3}$ what is the value of $x + \frac{1}{x}$?
 (1) $\frac{7}{\sqrt{3}}$ (2) $14 + 8\sqrt{3}$ (3) 17 (4) 14 (5) $14\sqrt{3}$
5. What is the value of rational numbers a and b respectively, if $a + b\sqrt{2} = \frac{3 + 2\sqrt{2}}{3 - 2\sqrt{2}}$?
 (1) 17, 12 (2) 12, 17 (3) 3, 2 (4) 1, 0
6. Find A and B respectively if,

$$\frac{\sqrt{11} - 1}{\sqrt{11} + 1} + \frac{\sqrt{11} + 1}{\sqrt{11} - 1} = A + B\sqrt{11}$$
 (1) 20, 0 (2) 0, 2.4 (3) 2, 0 (4) 2.4, 0
7. Simplify $\frac{3^{7a} \times 9^{2a+1} \times 243^{3a-5}}{3^{a-1} \times 81^{3a-4} \times 27^{4a}}$
 (1) 3^{a-2} (2) 3^{2a-4} (3) 3^{4a-5} (4) 3^{2a-6} (5) 3^{a-6}
8. Which of the following is true?
 (1) $\sqrt[3]{16} < \sqrt{12} < \sqrt[6]{320}$ (2) $\sqrt[6]{3} > \sqrt[3]{2}$ (3) $\sqrt[3]{4} > \sqrt[4]{5}$
 (4) Both options 1 and 2 (5) All of the above
9. What is the value of m in terms of x and y ?

$$m = \frac{\sqrt{x^2 - y^2} + x}{\sqrt{x^2 + y^2} + y} \div \frac{\sqrt{x^2 + y^2} - y}{x - \sqrt{x^2 - y^2}}$$
 (1) $\frac{y^2}{x^2}$ (2) $\frac{y}{x}$ (3) $x^2 - y^2$ (4) $x - y$ (5) $x + y$
10. What is the positive square root of $5 + \sqrt{24}$?
 (1) $\sqrt{3} + 2\sqrt{2}$ (2) $\sqrt{5} + 2\sqrt{2}$ (3) $\sqrt{3} + \sqrt{5}$ (4) $\sqrt{2} + \sqrt{3}$

PRACTICE TEST I

1. Find the value of $\log_{27} 3 + \log_{\cdot 7} \frac{1}{3}$
 (1) $2\log_{27} 3$ (2) $\log_{27} 3$ (3) 1 (4) -1 (5) 0
2. Find the value of $\log_{25} \sqrt{5}$
 (1) 4 (2) -4 (3) $\frac{1}{4}$ (4) $-\frac{1}{4}$ (5) 1
3. Find the value of $\log_{\sqrt{7}} \left(\frac{1}{343} \right)$
 (1) 6 (2) -6 (3) $\frac{1}{6}$ (4) $-\frac{1}{6}$ (5) 1
4. Find x , if $\log_{\sqrt{5}} \frac{1}{x} = 6$
 (1) $\frac{1}{5}$ (2) $\frac{1}{25}$ (3) $\frac{1}{125}$ (4) 125 (5) $\frac{1}{625}$
5. If x is a positive number and $\log_{162} (x^2 - 9x) = 1$, then the value of x is
 (1) 16 (2) 18 (3) 19 (4) 20 (5) None of these
6. Find x , if $m^{2\log_m x} = 64$
 (1) 2 (2) 4 (3) ± 8 (4) $\frac{1}{2}$ (5) 8
7. Find $\log_3 x$, if $x^m = 243$.
 (1) $m/5$ (2) $5/m$ (3) $5m$ (4) $-5m$ (5) $-m/5$
8. Find x , if $\log_x 19 + \log_{\sqrt{x}} 19 = \log_{19} x$ and $x > 1$.
 (1) $19^{\sqrt{3}}$ (2) $\frac{1}{19^{\sqrt{3}}}$ (3) 19^3 (4) 19 (5) 3^{19}
9. The value of $\frac{1}{\log_3 60} + \frac{1}{\log_4 60} + \frac{1}{\log_5 60}$ is :
 (1) 0 (2) 1 (3) 5 (4) 60 (5) None of the above
10. If $\log_x y = 100$ and $\log_{2x} x = 10$, then the value of y is:
 (1) 2^{100} (2) 2^{10} (3) 2^{1000} (4) 2 (5) 2^{50}

PRACTICE TEST I

- Find the value of m , from the following simultaneous equations.
 $15m + 17n = 21$
 $17m + 15n = 11$
(1) 3 (2) -3 (3) 2 (4) -2 (5) -1
- Carla has Rs. 2,750 in her purse in denominations of hundred and fifty. She has 32 notes in all counting both hundred and fifty. How many hundred rupee notes does she have in her purse?
(1) 23 (2) 9 (3) 24 (4) 8 (5) 25
- If 1 is added to the numerator of a certain fraction, its value becomes $\frac{7}{19}$ and if 1 is added to the denominator of the original fraction, its value becomes $\frac{1}{3}$. Find the original fraction.
(1) $\frac{20}{57}$ (2) $\frac{13}{39}$ (3) $\frac{34}{96}$ (4) $\frac{13}{38}$ (5) None of these
- Aishwarya's age 10 years hence will be twice Deepika's present age. Six years back, Aishwarya's age was $\frac{5}{3}$ times Deepika's age at that time. Find the present age of Aishwarya and Deepika respectively.
(1) 36, 18 (2) 26, 18 (3) 36, 12 (4) 48, 36 (5) 18, 26
- Find the value of $(x + y)$, from the given set of equations.
 $\frac{7}{x} + \frac{13}{y} = 27$
 $\frac{13}{x} + \frac{7}{y} = 33$
(1) $\frac{3}{2}$ (2) $\frac{1}{2}$ (3) $\frac{5}{2}$ (4) 2
- Amar brought bananas to school. He gave one-fourth of the bananas to the Physics teacher and one-sixth of the bananas to his Chemistry teacher. The Chemistry teacher gave the head-master 2 bananas and now has 4 bananas left. How many bananas did Amar give to the Physics teacher?
(1) 12 (2) 36 (3) 5 (4) 9 (5) 23
- There are three cities: A, B and C. Three friends are discussing the population (in millions) of the three cities. One says: 'A has 9 million people'. The second says: 'B has as many people as A and C combined'. The third says: 'The number of people in A added to half of the number of people in B is the number of people in C'. What is the total number of people (in millions) in all three cities combined?
(1) 48 (2) 54 (3) 63 (4) 72 (5) 81
- Sam, Harry and Jake had some candies each. Together Sam and Harry had 19 candies. Even after giving three candies to Jake, Sam had two more candies than him. Then Harry gave two of his candies to Jake and was also left with two more candies than him. How many candies does Jake have now?
(1) 1 (2) 4 (3) 5 (4) 6 (5) 8

9. Students were standing in rows for exercise. Each row had an equal number of students. If 5 students less were to stand in each row, 6 more rows would be required and if 5 students more were to stand in each row then the number of rows required would be reduced by 2. Find the total number of students.
- (1) 10 (2) 40 (3) 50 (4) 70 (5) None of these
10. A three digit number is equal to 17 times the sum of the digits. If 198 is added to the number, the digits get reversed; also the sum of the extreme digits of the original number is less than the middle digit by unity. Find the sum of digits of the original number.
- (1) 9 (2) 8 (3) 7 (4) 10 (5) 11
11. In an MBA entrance exam, 1 mark is awarded for every correct answer and $\frac{1}{4}$ mark is deducted for each incorrect answer. There are two sections in the exam. A student gets an accuracy of 75% across each section. What is the minimum number of questions that he should attempt in all to clear the test, if the sectional cut-offs for the sections are 22 and 11 marks respectively?
- (1) 16 (2) 32 (3) 64 (4) 48 (5) 80
12. Hermione purchases 3 apples, 7 mangoes and 1 orange for a total of Rs. 120. Ron buys 4 apples, 5 mangoes and an orange for Rs. 164.50 from the same shop. If Harry picks 1 apple, 11 mangoes and an orange from the same shop, then how much does he have to pay?
- (1) Rs. 29 (2) Rs. 31 (3) Rs. 35 (4) Rs. 40 (5) Cannot be determined
13. 5 candies, 3 packets of chips and 2 pastries cost Rs. 140. The difference between the costs of 1 packet of chips and 1 pastry is Rs. 10 and the difference between the costs of 1 packet of chips and 1 candy is Rs. 28. How much will Anil need to pay if he has to buy 10 candies, 2 packets of chips and 5 pastries? Assume that the chips are the costliest on an individual basis.
- (1) Rs. 160 (2) Rs. 200 (3) Rs. 150 (4) Rs. 180 (5) Rs. 190
14. When a two digit number is divided by the sum of the digits, the quotient is 4. If the digits are reversed, the new number is 6 less than twice the original. Find the number.
- (1) 24 (2) 42 (3) 16 (4) 28 (5) None of these
15. A man earns Rs. 800/- more than his wife. One-fourth of the man's salary and one-eighth of the wife's salary amount to Rs. 500/- which is saved every month. Find their monthly expenditure.
- (1) Rs. 1,600 (2) Rs. 1,700 (3) Rs. 1,800 (4) Rs. 1,900 (5) Rs. 2,000

19 Quadratic and Higher Order Equations

PRACTICE TEST I

1. Find the roots of the equation

$$\frac{x^2}{2} + 9x + 28 = 0.$$

- (1) (4, 14) (2) (-4, -14) (3) (3, -21) (4) (-6.5, -11.5) (5) (12, 4)

2. Find the number of real roots for the equation $4x^2 + 5x - 9 = 0$.

- (1) 0 (2) 1 (3) 2 (4) 3

3. Find the value of the constant p if one root of the equation $(x - p)^2 - 9p = 36$ is zero.

- (1) -12 or 3 (2) 12 or 3 (3) 6 or -6 (4) 12 or -3 (5) -12 or -3

4. Find the sum of the roots of the equation $x^4 - 2x^2 + 1 = 0$.

- (1) -1 (2) 0 (3) 1 (4) 2

5. The difference between two numbers is 3 and the sum of their squares is 29. Find the product of those two numbers.

- (1) 10 (2) 5 (3) 12 (4) 15 (5) None of these

6. The equation $4x^2 - 12x + c = 0$ has equal roots. What is the value of c ?

- (1) 13 (2) 36 (3) 3 (4) 9 (5) 5

7. Find the value of $\frac{1}{\alpha^2} + \frac{1}{\beta^2}$, if α and β are the roots of the equation $7x^2 - 13x + 3 = 0$.

- (1) $\frac{9}{127}$ (2) $\frac{132}{9}$ (3) $\frac{27}{9}$ (4) $\frac{127}{9}$ (5) None of these

8. The roots of the equation $20x^2 - 41x + a = 0$ are reciprocal of each other. Find the value of a .

- (1) -20 (2) 41 (3) 20 (4) $1/20$ (5) $41/20$

9. Which of the following can be the value of m such that the quadratic equation $x^2 - (3m + 4)x + (8m + 9) = 0$ has equal roots?

- (1) -10 (2) -2 (3) $10/9$ (4) $-10/9$

10. If one of the roots of the quadratic equation $x^2 + bx + 32 = 0$ is 4 while the other equation $x^2 + bx + c = 0$ has equal roots, then the value of c is:

- (1) 4 (2) 8 (3) 12 (4) 36 (5) 144

PRACTICE TEST I

1. Find the set of values of
- x
- and
- y
- which does not satisfy

$$\frac{3}{14} < \frac{x}{y} < \frac{3}{12}$$

- (1)
- $(-2, -9)$
- (2)
- $(6, 26)$
- (3)
- $(-5, -21)$
- (4)
- $(2, 9)$
- (5)
- $(3, 11)$

2. Solve
- $4x + 5 > 5x - 13$
- .

- (1)
- $x < -8$
- (2)
- $x > 18$
- (3)
- $x > -18$
- (4)
- $x < -18$
- (5)
- $x < 18$

3. Solve
- $x^2 + 8x - 65 > 0$
- .

- (1)
- $-13 < x < 5$
- (2)
- $x > -5$
- (3)
- $x < 13$
- (4)
- $x > 5$
- or
- $x < -13$
- (5)
- $x > -13$
- or
- $x < 5$

4. If
- $-2 < x < 7$
- and
- $3 < y < 5$
- , then which of the following is true?

- (1)
- $x + y < 3$
- (2)
- $-19 < (2x - 3y) < 5$
- (3)
- $-13 < (2x - 3y) < -1$
- (4)
- $-4 < x - 3y < -3$

5. Solve
- $6x^2 - x - 35 < 0$
- .

- (1)
- $-\frac{5}{2} < x < \frac{7}{3}$
- (2)
- $-\frac{7}{3} < x < \frac{5}{2}$
- (3)
- $-\frac{7}{2} < x < \frac{5}{3}$
- (4)
- $x < -\frac{7}{3}$
- or
- $x > \frac{5}{2}$

6. Find the range of
- $\frac{ab}{c}$
- if
- $1 < a < 3$
- ,
- $0 < b < 2$
- and
- $-2 < c < -1$
- .

- (1)
- $(-6, 0)$
- (2)
- $(0, 6)$
- (3)
- $(-3, 0)$
- (4)
- $(-6, -3)$
- (5)
- $(0, 3)$

7. Which of the following values of
- x
- satisfy the inequality
- $\frac{x+1}{x+2} > 1$
- ?

- (1)
- $x > -2$
- (2)
- $-2 < x < 0$
- (3)
- $x < -2$
- (4)
- $x = 2$
- (5)
- $0 < x < 2$

8. Find the range of values of
- x
- that satisfy the inequalities
- $x^2 - x - 6 > 0$
- and
- $x^2 - 6x - 7 < 0$
- .

- (1)
- $-1 < x < 3$
- (2)
- $3 > x > -1$
- (3)
- $3 < x < 7$
- (4)
- $-1 < x < -2$
- (5)
- $-2 < x < 7$

9. Solve
- $\frac{x-2}{3x-5} < \frac{3}{4}$

- (1)
- $x < \frac{7}{5}$
- or
- $x > \frac{5}{3}$
- (2)
- $\frac{7}{5} < x < \frac{5}{3}$
- (3)
- $x > \frac{7}{5}$
- or
- $x < \frac{5}{3}$

- (4)
- $-\frac{7}{5} < x < \frac{5}{3}$
- (5) None of these

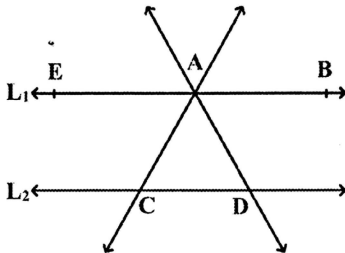
10. If
- x
- and
- y
- are two unequal positive numbers, then which of the following is definitely true?

- (1)
- $\frac{2xy}{x+y} < xy < \frac{x+y}{2}$
- (2)
- $x+y > \sqrt{4xy} > \frac{4xy}{x+y}$
- (3)
- $\sqrt{xy} > \frac{x+y}{2} > \frac{2xy}{x+y}$

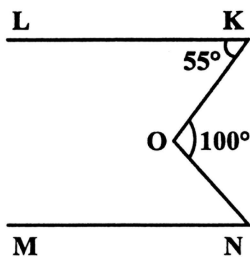
- (4)
- $\frac{2xy}{x+y} > xy > \frac{x+y}{2}$
- (5)
- $\frac{x+y}{2} < \frac{2xy}{x+y} < \sqrt{xy}$

PRACTICE TEST I

- What is the measure of the supplementary angle, if the measure of an angle is 47° ?
 (1) 43° (2) 133° (3) 12° (4) 27°
- Which of the following is a reflex angle?
 (1) 30° (2) 120° (3) 180° (4) 220°
- It is given that, $m\angle A + m\angle B + m\angle C = 210^\circ$ and $m\angle B$ is twice that of $m\angle C$. If $\angle B$ and $\angle C$ are supplementary, the measures of $\angle A$, $\angle B$ and $\angle C$ respectively are
 (1) $30^\circ, 120^\circ, 60^\circ$ (2) $120^\circ, 60^\circ, 30^\circ$ (3) $45^\circ, 110^\circ, 55^\circ$ (4) $30^\circ, 60^\circ, 120^\circ$
- $m\angle P$ is 20° more than the measure of its supplementary angle. Which of the following is the measure of $\angle P$?
 (1) 80° (2) 100° (3) 120° (4) None of these
- In the given figure, the lines L_1 and L_2 are parallel and the line segments AC and AD are perpendicular to each other. Moreover, $m\angle ACD = 35^\circ$ and lines AB , AC , and AD intersect at point A . Find $m\angle BAD$.

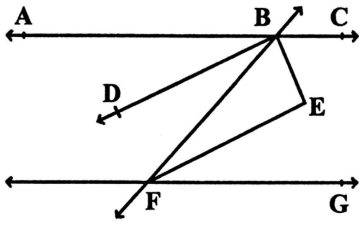


- (1) 50° (2) 45° (3) 35° (4) 55°
- A line X cuts three parallel line segments AB , CD , and EF at points P , Q , and R respectively and another line Y cuts them (AB , CD , and EF) at points S , T , and U respectively. If $2 \times PQ = QR$ and the length of the segment ST is 4 cm, then what is the length of the segment TU ?
 (1) 1 cm (2) 2 cm (3) 4 cm (4) 8 cm
- In the given figure, MN and LK are along parallel lines. $m\angle LKO = 55^\circ$ and $m\angle KON = 100^\circ$. Find $m\angle MNO$.



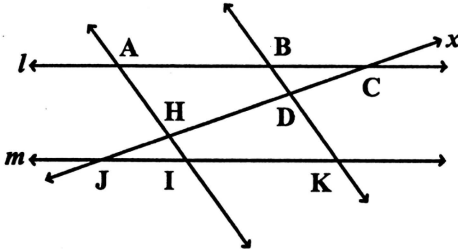
- (1) 55° (2) 35° (3) 45° (4) 40°

8. As shown in the figure, line AC and line FG are parallel to each other and $m\angle ABF = 75^\circ$. If ray BD and segment EF are along parallel lines and $m\angle DBF = 40^\circ$, then find $m\angle EFG$.



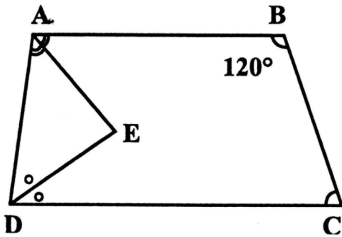
- (1) 55° (2) 35° (3) 45° (4) 40°

9. In the given figure, lines l and m are parallel to each other. Transversals AI and BK are also parallel to each other. If $m\angle HJI = 60^\circ$ and $m\angle JHI = 55^\circ$, then find $m\angle ABD$.



- (1) 105° (2) 125° (3) 115° (4) 120°

10. In the figure, DE and AE bisect $\angle ADC$ and $\angle DAB$ respectively. AB is parallel to CD. Find $m\angle AED$.



- (1) 60° (2) 75° (3) 80° (4) 90° (5) 120°

PRACTICE TEST I

1. Which of the following statements is/are true?

(1) $\tan \theta = \frac{1}{\cot \theta}$ (2) $\tan \theta = \frac{\sin \theta}{\cos \theta}$ (3) Both (1) and (2) (4) None of these

2. What is the value of $\frac{1a \cos A}{1 + \cos A}$, given that $\tan A = \frac{3}{4}$?

(1) $\frac{1}{4}$ (2) $\frac{9}{16}$ (3) $\frac{1}{9}$ (4) $\frac{1}{3}$

3. In a right angled triangle, If $\tan \theta = \frac{8}{6}$, find the hypotenuse of the triangle containing θ .

(1) 10 (2) 100 (3) 64 (4) 36 (5) 50

4. The angle of elevation of a tower 100m away from its foot is 60° . What is the height of the tower?

(1) $\frac{100}{\sqrt{3}}$ m (2) $100\sqrt{3}$ m (3) 100m (4) Cannot be determined (5) None of these

5. A straight tree breaks due to a storm and the broken part bends so that the top of the tree touches the ground making an angle 30° with the ground. The distance from the foot of the tree to the point where the top touches is 20m. Find the height of the tree.

(1) $20\sqrt{3}$ mm (2) $20/\sqrt{3}$ mm (3) $10/\sqrt{3}$ mm (4) $10\sqrt{3}$ mm (5) None of these

6. A sparrow perched 10 m high on a tree spots a grain on the ground that makes an angle of depression of 30° . Find the distance between the sparrow and the grain.

(1) $5\sqrt{3}$ m (2) $20\sqrt{3}$ m (3) 5m (4) 20m

7. Pole A, pole B and a lamp post P stand in a straight line in that order such that distance between A and B is 2 m and that between B and P is 2 m. The shadow of the top of B, which stands 2 m tall, falls at the foot of A. The distance between the foot of P and the point at which the shadow of A is incident is $4\sqrt{3}$ m. Find the height of the pole A.

(1) $\frac{4(\sqrt{3}-1)}{\sqrt{3}}$ m (2) $\frac{4(\sqrt{3}+1)}{\sqrt{3}}$ m (3) $12 + 4\sqrt{3}$ m (4) $12 - 4\sqrt{3}$ m

8. A ladder of length 24 feet is resting against a wall with its bottom making an angle of 60° with the floor. It slips down in such a way that its bottom now makes an angle of 30° with the floor. Find the horizontal distance by which the ladder slips along the floor.

(1) $12\sqrt{3}$ feet (2) $2\sqrt{3}$ feet (3) 2 feet (4) $12(\sqrt{3}-1)$ feet

9. A crow is sitting on top of a building which is 6 metre high. A man is standing at a distance of $\sqrt{108}$ metre from the building. What is the angle of elevation of the crow?

(1) 45° (2) 60° (3) 30° (4) 90° (5) 0°

10. An aeroplane flying horizontally 1250m above the ground is observed at an angle of elevation 45° . If, after 5 seconds, the elevation is observed to be 30° , find the speed of the aeroplane in (m/sec)
- (1) 100 m/sec (2) 105 m/sec (3) 107 m/sec (4) 110 m/sec (5) 115 m/sec

PRACTICE TEST I

- What is the volume of a cylinder which has lateral surface area $20\pi \text{ cm}^2$ and height 5 cm?
(1) $10\pi \text{ cm}^3$ (2) $20\pi \text{ cm}^3$ (3) $30\pi \text{ cm}^3$ (4) $50\pi \text{ cm}^3$
- Four solid metal spheres with same radii are melted and recast into a hemisphere without losing any metal. What is the percentage change in the total surface area of the solid?
(1) 100% (2) 20% (3) 25% (4) 50%
- A solid metal right circular cylinder is melted and recast into a right cone of the same base radius. What is the percentage increase in the height of the solid?
(1) 200% (2) 300% (3) 3000% (4) 100%
- Find the total surface area of a hemisphere with radius 28 cm.
(1) 9856 cm^2 (2) 3796 cm^2 (3) 7932 cm^2 (4) 7392 cm^2 (5) 4000 cm^2
- A spherical ball whose radius is 21 cm is dropped in a vessel filled with water up to the brim. Find the volume of water displaced by the ball.
(1) 38808 cm^3 (2) 38088 cm^3 (3) 19404 cm^3 (4) 12936 cm^3 (5) 30808 cm^3
- A gift is kept in a cubical box whose edge is 10 cm. This box is to be completely wrapped using a gift wrapper. 1 cm^2 of the wrap paper costs Rs. 2. Find the total cost of wrapping the box. (The box is covered by only one layer of the wrap paper)
(1) Rs. 800 (2) Rs. 2,000 (3) Rs. 1,200 (4) Rs. 1,000 (5) Rs. 600
- The length, breadth and height of a rectangular room are 15 ft, 10 ft and 12 ft. It has one door which measures 6 ft \times 4 ft and two windows which measure 5 ft \times 5 ft. What will be the expenditure incurred to paint the inner walls of the room (excluding the door, windows, the roof and the floor) at the rate of Rs. 14 per sq. ft?
(1) Rs. 7,364 (2) Rs. 8,400 (3) Rs. 24,164 (4) None of these
- A cylindrical well of inner diameter 4 m and height 7 m is to be covered with a concrete coating of thickness 0.25 m on its vertical inner walls. Find the approximate cost (in Rs.) of the concrete required at a rate of Rs. 900 per m^3 .
(1) Rs. 18,562 (2) Rs. 19,800 (3) Rs. 22,034 (4) Rs. 51,000
- A rectangular tank 11 m in length, 4 m in width and 4 m in height is half filled with water. How much time (in seconds) is required by a circular pipe which has a radius 20 cm to fill the remaining portion of the tank, if water flows into the tank at a rate of 7 m/s ?
(1) 700 (2) 450 (3) 100 (4) 400

-
10. Geeta wants to build a rectangular well 30 m wide, 40 m long and 20 m deep with its open surface on the ground. She also wants to build a wall of uniform width 1 m and height 0.5 m around the well using the earth removed from the well. How much extra earth is left after building the wall?
(1) 22078 m³ (2) 2032 m³ (3) 24928 m³ (4) 23928 m³
11. A right angled triangle has its area equal to that of a square whose side is 6 cm. What is the altitude of the triangle, if it is twice its base?
(1) 8 cm (2) 12 cm (3) 16 cm (4) 18 cm (5) None of these
12. If the length of a rectangle is decreased by 20% and the breadth is increased by 20%, a square of area 144 cm² is obtained. What is the original area of the rectangle in (cm²) ?
(1) 125 cm² (2) 145 cm² (3) 135 cm² (4) 150 cm² (5) 140 cm²
13. Find the area of the circular path if the external radius of the circular plot is 25m and the width of the path is 4m?
(1) 578.28 cm² (2) 538.28 cm² (3) 528.28 cm² (4) 548.28 cm² (5) 558.28 cm²
14. If the length of diagonals of a rhombus is 6m and 15m, then what is the area of the rhombus?
(1) 90 cm² (2) 60 cm² (3) 45 cm² (4) 75 cm² (5) None of these
15. If the side of the square increase by 20%, then what is the increase in its area and perimeter respectively?
(1) 24%, 20% (2) 20%, 44% (3) 44%, 44% (4) 20%, 20%, (5) 44%, 20%

24

Sequences, Progressions And Series

PRACTICE TEST I

- Find the next term of the following series 2, 5, 10, 17, 26, ...
(1) 36 (2) 35 (3) 34 (4) 33 (5) None of these
- Find the value of x in the sequence 4, 5, 7, 10, 14, x .
(1) 18 (2) 19 (3) 20 (4) 28 (5) 15
- A sequence is defined by the relationship $a_{n+1} = 2a_n - 1$. If the fifth term of this sequence is 17, find the value of a_1
(1) 1 (2) 2 (3) 3 (4) 4 (5) 5
- The first two terms of an A.P. are 3 and 5 respectively. Find the 5th term of the same sequence.
(1) 28 (2) 15 (3) 23 (4) 25 (5) 11
- Ten children are standing in a line. Ramesh wants to distribute some chocolates amongst these 10 children such that the first child in the line gets 4 chocolates and every subsequent child gets 3 chocolates more than the previous child. What is the total number of chocolates that Ramesh distributes?
(1) 120 (2) 156 (3) 126 (4) 130 (5) 175
- Divide the number 124 into 4 parts which are in A.P., such that product of first and fourth term is 128 less than the product of the second and the third term. Find the smallest number amongst these four numbers.
(1) 11 (2) 19 (3) 53 (4) 27 (5) 43
- The sum of the third and seventh term of an A.P is 8. Find the sum of the first nine terms of this progression?
(1) 24 (2) 32 (3) 36 (4) None of these (5) Cannot be determined
- The first term of a G.P. is 5 and the common ratio is 2. Find the sixth term of this progression.
(1) 620 (2) 160 (3) 225 (4) 260 (5) 120
- If 10, b and 40 are in G.P, then find the value of b .
(1) +400 (2) -20 (3) +20 (4) +25 (5) (2) or (3)
- The ratio of the sum of the first eight terms of a G.P. to the sum of the first four terms of the same G.P. is 97: 81, where the common ratio of the G.P. is a real number. The common ratio is:
(1) 2 (2) 3 (3) $\frac{3}{2}$ (4) $\frac{2}{3}$ (5) $\frac{4}{3}$
- The sum of an infinite G. P. is 45 and the sum of their squares is 135. Find the sum of its first term and common ratio?
(1) $\frac{13}{2}$ (2) $\frac{52}{6}$ (3) $\frac{13}{4}$ (4) None of these

12. The geometric mean of two positive numbers is 6 and it exceeds its harmonic mean by 2. Find its arithmetic mean.
 (1) 4 (2) 2 (3) 6 (4) 9 (5) 36
13. The first three terms of an H.P. are $1/5$, $1/7$ and $1/9$ respectively. Find the 7th term of the sequence
 (1) $\frac{1}{17}$ (2) $\frac{1}{29}$ (3) 17 (4) $\frac{1}{19}$
14. What is the sum of the first 20 terms of the following series $1^2 + 2^2 + 3^2 + 4^2 + 5^2 + \dots$
 (1) 5740 (2) 2870 (3) 1435 (4) 4420 (5) None of these
15. If $X = \frac{(1^3 + 2^3 + 3^3 + \dots + 199^3)}{(1 + 2 + 3 + \dots + 199)}$, What is the value of X ?
 (1) 19900 (2) 20000 (3) 20050 (4) 21000 (5) 21500

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Permutations and Combinations

PRACTICE TEST I

- The number of four-digit odd numbers that can be formed using the digits 1, 2, 3, 5, 7, 8 and 9 without repetition is
(1) 100 (2) 300 (3) 120 (4) 600 (5) None of these
- The number of four-digit numbers that can be formed from the digits 1, 2, 3, 4, 5, 7 and 8 when repetition is allowed is:
(1) 840 (2) 280 (3) 2401 (4) None of these
- In how many ways can you arrange the letters of the word DRIVE?
(1) $5!$ (2) $\frac{5!}{2!}$ (3) 5^5 (4) $4!$
- How many words can be formed using all the letters of the word KETTLE?
(1) 720 (2) 24 (3) 180 (4) 360
- Find the number of words that can be formed by arranging the letters of the word BLASTED such that B and E are never together.
(1) 600 (2) 3600 (3) 4320 (4) 1440
- In how many ways can five letters be posted in eight letter boxes?
(1) 8P_5 (2) 8^5 (3) 5^8 (4) ${}^8P_5 \times 5!$
- In how many ways can you make a committee of 3 boys and 5 girls from a group of 6 boys and 8 girls?
(1) 1120 (2) 40320 (3) 76 (4) 456
- Five boys and five girls are to be arranged in a line for a photograph. In how many ways can this be done such that no two boys are next to each other?
(1) $5! \times 5!$ (2) $10!$ (3) $5! \times 6!$ (4) $6! \times 6!$
- A necklace is to be designed using seven different beads. Find the number of ways to design it.
(1) 720 (2) 5040 (3) 360 (4) 1440
- Eight papers are to be taken at an examination, two of which are on English. In how many ways can the papers be arranged so that the two English papers are consecutive?
(1) 720 ways (2) 10080 ways (3) 5040 ways (4) 1440 ways (5) None of these

PRACTICE TEST II

- In how many ways can 15 green balls, 10 red balls and 3 blue balls of the same weight and size be arranged in a single line?
(1) ${}^{15}C_{13} \times 13!/10!$ (2) 450 (3) $15! \times 10! \times 3!$ (4) $28!/(15! \times 10! \times 3!)$ (5) None of these

2. After the meeting was over, each person present in the room shook a hand with every other person present in that room. If the total number of handshakes was 190, how many people were present in the room?
(1) 19 (2) 20 (3) 10 (4) 15 (5) None of these
3. In how many ways can a finger ring be formed using 5 precious stones of different colours?
(1) 24 (2) 12 (3) 120 (4) 60
4. In how many ways can you select a queen or a spade from a pack of cards?
(1) 8 (2) 16 (3) 17 (4) 18
5. In how many ways can a committee of 3 people comprising at least 2 boys be formed from a group of 4 boys and 5 girls?
(1) 120 (2) 30 (3) 84 (4) 34
6. Six boys and six girls are to be seated around a circular table such that no two girls are together. In how many ways can these people be arranged?
(1) $6! \times 6!$ (2) $5! \times 5!$ (3) $5! \times 6!$ (4) $\frac{5! \times 6!}{2}$
7. Nine books are to be arranged on a shelf of which 3 are Hindi books, 3 are History books and 3 are Science books. This has to be done in such a way that the three Hindi books are kept together, the three History books are kept together and the three Science books are kept together. In how many ways can this be done?
(1) 1296 (2) 216 (3) 1680 (4) 6
8. Six people are to be seated on six chairs around a circular table where five chairs are blue in colour and one is green. In how many ways can these people be arranged?
(1) 720 (2) 120 (3) 60 (4) 360
9. Ten points are drawn on a piece of paper of which five are collinear. How many triangles can be drawn using these points as vertices?
(1) 120 (2) 110 (3) 50 (4) 10
10. There are 3 groups consisting of 4 men and 2 women, 3 men and 5 women and 1 man and 4 women respectively. If I have to select at least 1 member from each group, in how many ways can I make a committee of three containing at least 2 women?
(1) 80 (2) 99 (3) 144 (4) 154

PRACTICE TEST I

- An urn contains 2 red balls, 1 green ball and 1 yellow ball. If a ball is drawn at random, then what is the probability of getting a red ball?
(1) $\frac{1}{3}$ (2) $\frac{1}{2}$ (3) $\frac{2}{3}$ (4) $\frac{1}{4}$
- Jack draws two cards from a set of 52 cards, without replacement. What is the probability that the first card drawn by Jack is Ace of Spades and the second card drawn by Jack is King of Spades?
(1) $\frac{1}{2704}$ (2) $\frac{4}{663}$ (3) $\frac{2}{663}$ (4) $\frac{1}{2652}$
- On the toss of three coins what is the probability of getting one heads and two tails?
(1) $\frac{3}{8}$ (2) $\frac{1}{4}$ (3) 1 (4) None of these
- Find the probability that the sum of the numbers which appear on the top face when two dice are thrown, is even.
(1) 1 (2) $\frac{1}{2}$ (3) $\frac{1}{6}$ (4) $\frac{1}{4}$ (5) $\frac{3}{2}$
- From a pack of cards, two cards are picked without replacement. What is the probability that at least one of the cards is an ace?
(1) $\frac{1}{13}$ (2) $\frac{16}{221}$ (3) $\frac{35}{221}$ (4) $\frac{33}{221}$
- 2 cards are drawn randomly from a pack of 52 cards. What is the probability that none of them are spades?
(1) $\frac{19}{34}$ (2) $\frac{1}{17}$ (3) $\frac{2}{17}$ (4) $\frac{15}{17}$ (5) None of these
- What is the probability of picking 3 distinct numbers from amongst the first 8 natural numbers such that their sum is 17?
(1) $\frac{1}{28}$ (2) $\frac{3}{56}$ (3) $\frac{1}{14}$ (4) $\frac{5}{56}$ (5) $\frac{3}{28}$
- An urn contains 9 red, 6 white and 5 blue balls. Three balls are drawn from this urn. What is the probability that at least two of these balls are different in colour?
(1) $\frac{756}{1140}$ (2) $\frac{384}{1140}$ (3) $\frac{29}{38}$ (4) $\frac{9}{10}$
- The odds in favour of India winning a match against Pakistan are 3:2. What is the probability that India wins the series of 3 matches if the probability of a tie is 0.2?
(1) 0.216 (2) 0.648 (3) 0.72 (4) 0.384
- A jar contains black and white marbles. Two marbles are chosen without replacement. The probability of selecting a black marble and then a white marble is 0.34, and the probability of selecting a black marble on the first draw is 0.47. What is the probability of selecting a white marble on the second draw, given that the first marble drawn was black?
(1) 72% (2) 74% (3) 76% (4) 70% (5) 75%

PRACTICE TEST I

Instructions for questions 1 to 5: Each question is followed by two statements, A and B. Answer each question using the following instructions:

Mark (1) if the question can be answered by using statement A alone but not by using statement B alone.

Mark (2) if the question can be answered by using statement B alone but not by using statement A alone.

Mark (3) if the question can be answered by using either of the statements alone.

Mark (4) if the question can be answered by using both the statements together but not by either of the statements alone.

Mark (5) if the question cannot be answered on the basis of the two statements.

- The cost of a vehicle varies directly as per its length. What is the cost of a vehicle 2 m long?
 - The difference in the costs of the two vehicles of length 1 m and 1.5 m is Rs. 10,000.
 - The sum of the costs of the two vehicles of length 1 m and 1.5 m is 45,000.
- How is Lekha related to Surekha?
 - Beenal's brother Amit is Surekha's husband.
 - Amit is Lekha's father's son.
- Five friends Aman, Raman, Vini, Mini and Tiny are sitting on a bench facing the north. Who is sitting in the middle?
 - They are arranged from left to right according to the alphabetical order of their names.
 - The person with the longest name is sitting in between Mini and Tiny.
- A, B, C and D are playing a game of cards with 52 standard bridge cards, where each person picks up 4 cards. The value of a card is the number on that card. The values for Ace, Jack, Queen and King are 1, 11, 12 and 13 respectively. The score of a player is the total value of all the cards he has picked up. The player with the highest score wins. When more than one person has the highest score, all of them are winners. In a particular game, is A a winner?
 - A does not pick up any Ace or any number card while B, C and D pick up at least one Ace each.
 - The cards picked up by A include 3 Aces while the 4th Ace is not picked up by anyone.
- John and Jim start simultaneously and run a race along a circular track. Does John win the race?
 - Speed of John is 'a' times the speed of Jim.
 - $a \times n < n$, where n is a proper fraction greater than 0.

Instructions for questions 6 and 7: Each question is followed by two statements, A and B. Answer each question using the following instructions:

Mark (1) if the question can be answered by using statement A alone but not by using statement B alone.

Mark (2) if the question can be answered by using statement B alone but not by using statement A alone.

Mark (3) if the question can be answered by using either of the statements alone.

Mark (4) if the question can be answered by using both the statements together but not by either of the statements alone.

6. What are the roots of the quadratic equation $ax^2 + bx + c = 0$?
- A. If b and c are interchanged, the roots of the quadratic equation become 3 and 4.
 B. If a and c are interchanged, the roots of the quadratic equation become 2 and 6.
7. P, Q, R and S are seated around a circular table such that P and Q sit next to each other. Who is the person sitting opposite S?
- A. R is seated adjacent to Q.
 B. P is seated adjacent to R.

Instructions for questions 8 to 10: Each question is followed by two statements A and B. Answer each question using the following instructions.

Mark (1) if the question can be answered by using statement A alone but not by using statement B alone.

Mark (2) if the question can be answered by using statement B alone but not by using statement A alone.

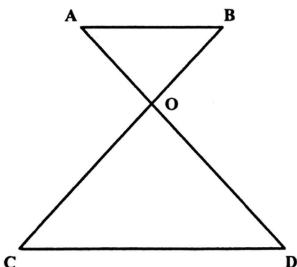
Mark (3) if the question can be answered by using both the statements together but not by using either of the statements alone.

Mark (4) if the question cannot be answered on the basis of the two statements.

8. Rajesh is travelling in a boat in a river stream. Will Rajesh reach Kotla from Chennai in 5 hours?
- A. Rajesh needs to travel 6 km upstream and 8 km downstream to reach Kotla from Chennai.
 B. Speed of the stream is twice the speed of the boat (in still water) in which Rajesh is travelling.
9. Is Raju taller than Chimu?
- A. When Raju, Sheetal, Chimu, Brijesh and Vaibhav are arranged from left to right (numbered 1 to 5) in increasing order of their heights, Raju stands at one of the ends.
 B. When Raju, Sheetal, Chimu, Brijesh and Vaibhav are arranged from left to right (numbered 1 to 5) in alphabetical order of their names, the person standing 4th and 5th are the same as those standing 4th and 5th when they are arranged from left to right (numbered 1 to 5) in increasing order of their heights.
10. If $abcd$ is a four digit number, then what is the last digit of $(abcd)^{994}$?
- A. $(abcd) = 6^n$, where n is a natural number.
 B. $(abcd) \times 2$ is divisible by 10.

Instructions for questions 11 and 12: Each of the following questions consists of a question followed by information in three statements. You have to study the question and the statements and decide that information in which of the statement/s is/are **not required** for answering the question and hence can be **dispensed with**.

11. In the figure given below, find $m \angle OCD$



AB || CD

A. $m\angle OAB = 50^\circ$

B. $OA = OB$

(1) A

(2) B

(3) C

(4) None of the statements can be dispensed with. (5) Both B and C

12. What is the present age of Sujit?

A. Sujit is 5 years older than Ryan.

B. 10 years ago, Ryan was 15 years old.

C. Five years hence, the sum of the ages of Ryan and Sujit will be 65.

(1) Both B and C

(2) Both A and B

(3) Any one of the three statements

(4) Both A and C

(5) None of the statements

Instructions for questions 13 and 14: Each of the following questions consists of a question followed by information in three statements. You have to study the question and the statements and decide that information in which of the statement/s is/are **required** either by themselves or together to answer the question.

13. Find the number of students who attended the seminar on Wednesday, if the number of students who attended it on Monday was 52.

A. The average of the number of students who attended the seminar on Monday, Tuesday and Wednesday was 53.

B. The average of the number of students who attended the seminar on Tuesday, Wednesday and Thursday was 58.

C. The number of students who attended the seminar on Tuesday was 59.

(1) Only B

(2) B and C

(3) Both A and C

(4) All the three

(5) Only C

14. Find the probability that a ball drawn from a bag is orange in colour.

A. The total number of balls in the bag is 50.

B. The number of orange coloured balls in the bag is 15.

C. The number of blue coloured balls in the bag is 35.

(1) Both A and C

(2) All the three

(3) Only C

(4) Both A and B

(5) Either B or C

15. What is the average age of the seven members A, B, C, D, E, F and G in a particular family?

I. Total age of C and F is 60 years.

II. Average age of A, B, D, E and G is 30 years.

III. Average age of A, B, D, F and G is 32 years.

(1) Only I

(2) Only I and II

(3) Only II and III

(4) Only I and III

(5) None of these

CALCULATION TECHNIQUES

PRACTICE TEST I

1. $117 \rightarrow +17$

$88 \rightarrow -12$

Step 1: $(117 - 12) = (88 + 17) = 105$.

Hence, the first part of the product is 105.

Step 2: $(+17) \times (-12) = -204$.

The number of digits in the second part should be equal to the number of zeroes in the base.

Since there are 2 zeroes in 100, the second part should have 2 digits.

Since the number is 204, borrow 3 from the first part.

This 3 becomes 300 when it comes to the second part.

Hence, the first part is now, $105 - 2 = 102$ and the second part is $300 - 204 = 96$.

Hence, the product of 117 and 88 is 10296.

Hence, **option 4**.

Alternatively,

$$117 \times 88 = (120 - 3) \times (90 - 2) = 10800 - 270 - 240 + 6 = 10296$$

Hence, **option 4**.

2. $997 \rightarrow -3$

$983 \rightarrow -17$

Step 1: $(997 - 17) = (983 - 3) = 980$

Step 2: $(-3) \times (-17) = +51$

The second part 51 has only two digits whereas the base 1000 has three zeroes.

As discussed earlier, the second part should have as many digits as the number of zeroes in the base of the number.

\therefore 51 will be written as 051.

Hence the product is 980051.

Hence, **option 3**.

3. $1013 \rightarrow +13$

$981 \rightarrow -19$

Step 1: $(1013 - 19) = (981 + 13) = 994$

Step 2: $(+13) \times (-19) = -247$

The second part is -247 and if one borrows 1 from the first part (the first part itself will then become 993), it becomes 1000 in the second part.

So the second part will effectively be $1000 - 247 = 753$

Since the base is 1000, the second part should have three digits i.e. 753.

Hence, the product of 1013 and 981 is 993753.

Hence, **option 5**.

4. Multiply each digit of 22345 directly by 11.

$11 \times 5 = 55$. Units digit = 5 and carry forward 5

$11 \times 4 = 44$. Tens digit = $4 + 5 = 9$ and carry forward 4

$11 \times 3 = 33$. Hundreds digit = $3 + 4 = 7$ and carry forward 3

$11 \times 2 = 22$. Thousands digit = $2 + 3 = 5$ and carry forward 2

$11 \times 2 = 22$. Ten Thousands digit = $2 + 2 = 4$ and carry forward 2

Hence, the product is 245795

Hence, **option 1**.

5. Observe that the numbers given are quite large and the percentages are also cumbersome to calculate. Also, observe that the given percentages can be easily represented as fractions, for ease of calculations.

$16.67\% \equiv 1/6$, $62.5\% \equiv 5/8$ and $14.28\% \equiv 1/7$

Hence, the given expression can be written as:

$$\left(\frac{1}{6} \times 32172\right) + \left(\frac{5}{8} \times 132000\right) - \left(\frac{1}{7} \times 22890\right)$$

$= 5362 + (5 \times 16500) - 3270$

$= 5362 + 82500 - 3270 = 84592$

Hence, **option 1**.

6.
$$\frac{[(24^2) + (3^6) + (21^2) - 18]}{\sqrt[3]{1728}}$$

$$= \frac{(576 + 729 + 441 - 18)}{12} = \frac{1728}{12} = 144$$

Hence, **option 3**.

7. This value can be found either as $20\% + 5\% + 1\%$ or $25\% + 1\%$

$25\% \text{ of } 496 = 1/4 \times 496 = 124$

$1\% \text{ of } 496 = 4.96$

$26\% \text{ of } 496 = 124 + 4.96 = 128.96$

Hence, **option 5**.

8. $21 \times 23 = (22 - 1) \times (22 + 1)$

$= 22^2 - 1^2$

$= 484 - 1 = 483$

Hence, **option 1**.

9. **Step 1:**

Multiply 7 by 45

$7 \times 45 = 315$

'5' becomes the units digit of the product and '31' is carried to the next step.

Step 2:

Multiply 45 by 9 and add the carry.

$$(9 \times 45) + 31 = 436$$

So, the product is 4365

Hence, **option 4**.

10. Note that all the answer options are between 30% and 40%. So, directly calculate 30% of 1382

$$10\% \text{ of } 1382 = 138.2$$

$$\therefore 30\% \text{ of } 1382 = 3 \times 138.2 = 414.6$$

$$457 - 414.6 = 42.4$$

$$1\% \text{ of } 1382 = 13.82$$

So, obviously, the percentage value is definitely greater than (30 + 1)%

So, look for a multiple of 13.82 which is closest to 42.4

Since $14 \times 3 = 42$, check for 3% of 1382 (i.e. 13.82×3)

$$3\% \text{ of } 1382 = 414.6/10 = 41.46$$

$$414.6 + 41.46 = 456.06$$

Thus, 33% of 1382 is 456.06

So, 457 is slightly greater than 33% of 1382.

The closest option is 33.03%

Hence, **option 4**.

11. $67812 \approx 67810$

$$976 \approx 980$$

$$\text{So, } 67810/980 = 6781/98$$

$$\approx 6781/100 \approx 67.81 \approx 68$$

Hence **option 2**

Alternatively,

Since 3 options are between 60 and 70, find 976×60 first.

$$976 \times 60 = 58560$$

Since $67812 > 58560$, the quotient is definitely greater than 60.

Hence, options 1 and 3 can be eliminated.

$$\text{Now, } 976 \times 70 = 68320$$

Since $67812 < 68320$, the quotient is definitely less than 70

Hence, option 4 can be eliminated,

Now, 67812 is closer to 68320 than to 58560.

So, the answer is more likely to be 69 than 62

$$976 \times 69 = 976 \times (70 - 1) = 68320 - 976 = 67344$$

Since this is the closest to 67810, the quotient is 69

Hence, **option 2**.

12. $36956 + 98297 \approx 36950 + 98300 - 3$

$$= 135250 + 3 = 135253$$

Hence, **option 1**

13. $27.5\% = 25\% + 2.5\%$

$$25\% \text{ of } 792 = \frac{25}{100} \times 792 = \frac{792}{4} = 198$$

$$2.5\% = 198/10 = 19.8$$

$$\therefore 27.5\% \text{ of } 792 = 198 + 19.8 = 217.8$$

Hence, **option 4**

14. 143×391 can be represented in terms of an addition/subtraction w.r.t. 150 and 400

$$143 \times 391 = (150 - 7) \times (400 - 9)$$

$$= 60000 - 2800 - 1350 + 63$$

$$= 55913$$

Hence, **option 5**.

15. $95862 - 46271 = (95800 - 46200) + (62 - 71)$

$$= 49600 - 9 = 49591$$

Hence, **option 3**

AVERAGES

PRACTICE TEST I

1. The average age of A, B, C & D is 26. Thus, the total age of A, B, C and D is $26 \times 4 = 104$.

The average age of B & D is 28. Thus, the total age of B & D is 56.

Thus, the total age of A & C = $104 - 56 = 48$.

Thus, average age of A & C = $48/2 = 24$.

Hence, **option 2**.

2. $\frac{A + B + C}{3} = 15$

$$\therefore A + B + C = 45 \quad \dots (i)$$

$$\frac{(A + 5) + B}{2} = 16$$

$$\therefore A + B = 32 - 5 = 27 \quad \dots (ii)$$

From these 2 equations,

$$\therefore C = 45 - 27 = 18$$

Hence, **option 3**.

3. $\frac{\text{Akash} + \text{Bharat} + \text{Chandra}}{3} = 34$

$$\therefore \text{Akash} + \text{Bharat} + \text{Chandra} = 102 \quad \dots (i)$$

$$\frac{\text{Akash} + \text{Bharat} + \text{Chandra} + \text{Dimple}}{4} = 29$$

$$\therefore \text{Akash} + \text{Bharat} + \text{Chandra} + \text{Dimple} = 116 \quad \dots (ii)$$

$$\therefore \text{Dimple} = 116 - 102 = 14$$

Hence, **option 1**.

4. $\frac{\text{Priya} + \text{Ruchi}}{2} = 32$

$$\therefore \text{Priya} + \text{Ruchi} = 64 \quad \dots (i)$$

Age of Ruchi = 18

$$\therefore \text{Age of Priya} = 64 - 18 = 46$$

$$\frac{\text{Shiv} + \text{Prem}}{2} = 36$$

$$\text{Shiv} + \text{Prem} = 72 \quad \dots \text{(ii)}$$

$$\text{Age of Prem} = 22$$

$$\therefore \text{Age of Shiv} = 72 - 22 = 50$$

Thus, average age of Shiv & Priya

$$= \frac{\text{Shiv} + \text{Priya}}{2}$$

$$= \frac{50 + 46}{2} = 48$$

Hence, **option 4**.

5. We have the average score of 4 matches to be

$$\frac{141 + 147 + 162 + 178}{4} = 157$$

Since the score in the 5th match was 7 less than the average, it was $157 - 7 = 150$

Hence, **option 5**.

6. Let the 8th number be x .

$$\text{Sum of all 15 numbers} = 15 \times 54 = 810$$

$$\text{Sum of the first 7 numbers} + x = 64 \times 8$$

$$= 512 \quad \dots \text{(i)}$$

$$x + \text{Sum of the last 7 numbers} = 60 \times 8$$

$$= 480 \quad \dots \text{(ii)}$$

Adding equations (i) and (ii),

$$\text{Sum of first 7 numbers} + 2x + \text{Sum of the last 7 numbers} = 992$$

$$\therefore (\text{Sum of first 7 numbers} + x + \text{Sum of the last 7 numbers}) + x = 992$$

The term in the brackets is the sum of all the 15 numbers.

$$\therefore 810 + x = 992$$

$$\therefore x = 182$$

Hence, **option 1**.

7. Let the number of students in the first and the second batch be x and y respectively.

Hence, the total marks obtained by the students of the first and second batch are $80x$ and $90y$ respectively.

When the two batches are combined, the total marks of the students of the classes are $80x + 90y$ and the combined number of students is $x + y$.

$$\therefore \frac{(80x + 90y)}{(x + y)} = 84$$

$$\therefore 80x + 90y = 84x + 84y$$

$$\therefore x : y = 3 : 2$$

Hence, **option 4**.

8. Age of teacher = (Total age of students and teacher taken together) - (Total age of only the students)

$$= (41 \times 24) - (40 \times 23.5)$$

$$= 984 - 940$$

$$= 44 \text{ years}$$

Hence, **option 3**.

9. The average of the 6 students increases by 2 kg when one student weighing 48 kg is replaced by another.

\therefore The total increase in weight is 12 kg.

Assume that the weight of each student in the original group was 48 kg.

Hence, one student weighing 48 kg is replaced by someone who increases the total weight of the group by 12 kg.

Hence, the replacement student has contributed the extra 12 kg.

Hence, the weight of the new student

$$= 48 + 12 = 60 \text{ kg}$$

Hence, **option 5**.

Alternatively,

The original group has one student weighing 48 kg.

Let the total weight of the remaining 5 students be n kg and the average weight of all 6 students be a .

$$\therefore (n + 48)/6 = a$$

$$\therefore n + 48 = 6a \quad \dots \text{(i)}$$

Now, the person weighing 48 kg is replaced with someone who weighs, say x kg.

Hence, the average goes by 2 kg and becomes $a + 2$

$$\therefore (n + x)/6 = a + 2$$

$$\therefore n + x = 6a + 12$$

$$\therefore n + x = (n + 48) + 12 \quad \dots \text{from (i)}$$

$$\therefore x = 60$$

Hence, the replacement student weighs 60 kg.

Hence, **option 5**.

10. Let the number of people initially present in the group be n .

Hence, the total age of the group is $25n$.

Four new friends with an average age of 21 years join this group.

The total age of the group after the new four friends joined = $25n + (4 \times 21) = 25n + 84$

The average age of the people in the new group is 23.

\therefore Total age of the group after the new four friends joined = $23(n + 4)$

$$\therefore 23(n + 4) = 25n + 84$$

$$\therefore 23n + 92 = 25n + 84$$

$$\therefore 2n = 8$$

$$\therefore n = 4$$

Thus, originally there were 4 people in the group.

Hence, **option 1**.

11. Let the temperatures on Sunday, Monday, Tuesday, Wednesday and Thursday be s , m , t , w and th respectively.

Hence, Sum of the temperatures on Sunday, Monday, Tuesday and Wednesday

$$\begin{aligned} &= s + m + w + t \\ &= 48 \times 4 \\ &= 192 \qquad \dots \text{(i)} \end{aligned}$$

Similarly, sum of the temperatures on Monday, Tuesday, Wednesday and Thursday

$$\begin{aligned} &= m + t + w + th \\ &= 49 \times 4 \\ &= 196 \qquad \dots \text{(ii)} \end{aligned}$$

Subtracting (i) from (ii)

$$th - s = 196 - 192 = 4$$

$$s : th = 12 : 13$$

$$\therefore 13x - 12x = 4$$

$$\therefore x = 4$$

$$\therefore \text{Temperature on Sunday} = 12x = 48^\circ$$

Hence, **option 2**.

12. Total age of the group of 20 women = $49 \times 20 = 980$

Total age of the 2 women who left the group = $45 + 50 = 95$

Let the average age of the 3 women who joined later be x . Hence, the sum of their ages = $3x$

Since the average age after the leaving and joining of women is still 49 years,

$$(980 - 95) + 3x = (49 \times 21)$$

$$\therefore 3x = 1029 - 885 = 144$$

$$\therefore x = 48$$

\therefore Average age of the 3 women = 48 years

Hence, **option 5**.

13. Since, the calculation involves two groups (in this case, departments); the concept of weighted averages is to be used.

Let the number of employees in department B be ' x '.

Using the formula of weighted average,

$$1200 = \frac{(900 \times 200) + (1400 \times x)}{200 + x}$$

$$\therefore 240000 + 1200x = 180000 + 1400x$$

$$\therefore x = 300$$

Hence, **option 4**.

14. Since the calculation involves two groups, use the concept of weighted averages.

Let the average age of the group be ' x '.

Using the formula for weighted average,

$$x = \frac{(25 \times 15) + (20 \times 12)}{(15 + 12)}$$

$$\therefore x = 22.78$$

Hence, **option 2**.

15. If n is the total number of students in the class, then

$(n - 1)$ students took each exam.

Hence, the total score of the class in the Mathematics exam was $26(n - 1)$.

Similarly, the total score of the class in the English exam was $34(n - 1)$

The total score of the class in Mathematics and English was 1920.

$$\therefore 26(n - 1) + 34(n - 1) = 1920$$

$$\therefore 60n - 60 = 1920$$

$$\therefore 60n = 1980$$

$$\therefore n = 33.$$

Hence, **option 2**.

PERCENTAGES

PRACTICE TEST I

1. Let the total number of marks that can be obtained = 100

$$\therefore \text{Passing marks} = 40$$

Let the marks scored by A = x

If A had scored 100% more marks, it implies that he would have to score twice the marks that he scored i.e. $2x$.

$$\text{Also, } 2\% \text{ of the total marks} = 0.02 \times 100 = 2$$

$$\text{Hence, from the given condition, } 2x + 2 = 40$$

$$\therefore x = 19$$

Thus, he scored 19% of the total possible marks (because the total possible marks assumed are 100).

Hence, **option 2**.

Note: Had the original total marks been assumed to be 200, the value of x would have been 38. However, this is still 19% of the total possible marks $[(38/200 \times 100) = 19\%]$

2. Matches won by India in the first two weeks = 50% of 6 = 3

If x is the number of matches they played after the first two weeks then:

Total number of matches played by India = $x + 6$

The Indian team won all their matches played after the first two weeks.

Hence, total number of matches won by the Indian team = $x + 3$

$$\therefore \frac{(x + 3)}{(x + 6)} = \frac{75}{100} = \frac{3}{4}$$

$$\therefore 4x + 12 = 3x + 18$$

$$\therefore x = 6$$

Hence, **option 1**.

3. Let the total number of students who appeared for the exam be 100.

Hence, number of students who cleared all cut-offs = 10% of 100 = 10

Similarly, number of students who cleared none of the cut-offs = 10% of 100 = 10

Now, there are 80 students remaining.

Hence, number of students who cleared exactly 1 section = 25% of 80 = 20

Similarly, number of students who cleared exactly 4 sections = 10% of 80 = 8

The number of remaining candidates = $80 - 28 = 52$

Hence, number of students who cleared exactly 2 sections = 25% of 52 = 13

The remaining students cleared all 3 sections.

Hence, the number of students who cleared exactly 3 sections = $52 - 13 = 39$

Therefore, if 100 students appeared for the test, then 39 students cleared 3 sections.

If 27300 students actually cleared three sections, the total number of students appearing for the test = $27300 \times 100/39 = 70000$.

Thus, 70000 students appeared for the test.

Hence, **option 5**.

4. Let the initial price of sugar and Sneha's consumption be Rs. x per unit and y units respectively.

Hence, total amount spent by Sneha on sugar = Rs. xy

New price of sugar = Rs. $1.2x$ per unit

Since Sneha wants to spend only 8% than her initial spend on sugar, the amount that she will spend on sugar = Rs. $1.08xy$

\therefore New quantity of sugar that Sneha will buy = $1.08xy/1.2x = 0.9y$

Hence, her consumption should reduce by 10%.

Hence, **option 2**.

5. Let the original C.P. be Rs. 100 per apple and Reena's initial consumption be 100 apples.

\therefore Initial expenditure = Rs. 10,000

Since the price of apples decreases by 15%, the new C.P. = Rs. 85

Since she increases her consumption by 20%, Reena's new consumption = 120 apples

\therefore New expenditure = $85 \times 120 =$ Rs. 10,200

Hence, percentage change in expenditure

$$= \frac{10200 - 10000}{10000} \times 100 = 2\%$$

Hence, **option 4**.

6. If the price of a commodity decreases by $a\%$, then the percentage increase in the consumption, so that the expenditure remains the same is:

$$\frac{a}{100 - a} \times 100$$

$$\therefore \text{Increase in consumption} = \frac{30}{100 - 30} \times 100$$

$$= 42.86\%$$

Hence, **option 2**.

7. Let the t-shirt's price be Rs. 100

\therefore The trouser's price is Rs. 160

i.e. The t-shirt's price is less than the trouser's price by Rs. 60

Since the t-shirt's price is being compared to the trouser's price, the t-shirt's price becomes the final value and the trouser's price becomes the base (or initial) value.

\therefore Percentage by which the t-shirt's price is less than the trouser's price

$$= \frac{60}{160} \times 100 = 37.5\%$$

Hence, **option 4**.

8. Let the original price of sugar be Rs. x per kg.

Hence, reduced price = Rs. $(80/100) \times x$

= Rs. $(4/5)x$.

Also, the total amount is the same in each case i.e. Rs. 80

Since, reduction in price enabled Rohan to purchase 10 kg more for Rs. 80

$$\therefore \frac{80}{\frac{4x}{5}} - \frac{80}{x} = 10$$

$$\therefore 20/x = 10$$

$$\therefore x = \text{Rs. } 2$$

Hence, **option 4**.

9. Let the number of chocolates that Seema initially had be x .

\therefore Number of chocolates distributed among the students of the first standard = 25% of $x = 0.25x$

At this stage, the remaining chocolates

$$= x - 0.25x = 0.75x$$

\therefore Number of chocolates distributed among the students of the second standard

$$= 20\% \text{ of } 0.75x$$

$$= 0.2 \times 0.75x = 0.15x$$

Thus, Seema has $x - 0.25x - 0.15x$

$$= 0.6x \text{ chocolates with her.}$$

The actual number of chocolates that she still has is 240

$$\therefore 0.6x = 240$$

$$\therefore x = 400.$$

Thus, Seema initially had 400 chocolates.

Hence, **option 3**.

10. Let the actual cost of food be Rs. f .

Service tax is 12.5% or $1/8^{\text{th}}$ of the actual cost of food.

$$\text{Hence, } (1/8) \times f = 40$$

$$\therefore f = 320.$$

Thus, the actual cost of food was Rs. 320.

The concerned person gave Rs. 400 and did not take anything back.

Thus, Amount Paid = Actual cost of food + Service Tax + Tip to waiter

Let Rs. t be the tip given to the waiter.

$$\therefore 400 = 320 + 40 + t$$

$$\therefore t = 400 - 360 = 40$$

Thus, the waiter received a tip of Rs. 40.

Hence, **option 4**.

11. Ajay got $30/50 = 60\%$ marks in the first test and $60/70 = 85.72\%$ in the second test.

Hence, the percentage increase in his performance was $[(85.72 - 60) \times 100]/60$

$$= 25.72 \times 5/3$$

$$= 42.86\%$$

Hence, **option 3**.

12. Since there are 3 successive discounts, the formula for successive discounts should be used.

Total % discount

$$= \left(1 - \frac{100 - 12.5}{100} \times \frac{100 - 10}{100} \times \frac{100 - 7}{100}\right) \times 100$$

$$= 26.76\%$$

Hence, **option 4**.

Alternatively,

Let the original price of the product be Rs. 100.

A discount of 12.5% implies that the price decreases by Rs. 12.5

Hence, price after the first discount = Rs. 87.5

The second discount is of 10% on Rs. 87.5 i.e. an actual discount of Rs. 8.75

Hence, price after the second discount

$$= 87.5 - 8.75 = \text{Rs. } 78.75$$

The third discount is of 7% on Rs. 78.75 i.e. an actual discount of $78.75 \times 0.07 = \text{Rs. } 5.5125$

$$\approx \text{Rs. } 5.51$$

Hence, price after the third discount

$$= 78.75 - 5.51 = \text{Rs. } 73.24$$

Thus, the shopkeeper sells the product at a price of Rs. 73.24

Hence, had he given a single discount, the discount amount would have been

$$100 - 73.24 = \text{Rs. } 26.76$$

Hence, on an original price of Rs. 100, the discount would have been 26.76%

Hence, **option 4**.

13. The daily wages are calculated as hourly rate \times work hours.

The hourly wages have increased by 15% and the work hours have reduced by 12.5%.

Hence, the percentage change in the total earnings can be found as shown below:

$$\text{Percentage change} = 15 - 12.5 - \frac{15 \times 12.5}{100}$$

$$= 0.625$$

Thus, his daily wages have increased by 0.625%.

$$\text{Hence, New daily wages} = 80 + (80 \times 0.00625) = 80 + 0.5 = \text{Rs. } 80.5$$

Hence, **option 3**.

14. The weight of the water has changed but the weight of the pulp will be the same in both the cases.

Weight of the pulp in 500 kg of fresh dates = 20% of 500 = 100 kg

Let the total weight of the dried dates be x .

Since dried dates are 80% pulp by weight

$$\therefore 80\% \text{ of } x = 100$$

$$\therefore x = 100/0.80 = 125 \text{ kg}$$

Hence, **option 4**.

15. This problem can be solved by either the conventional method or by using the answer options.

After the first cycle, the value of the painting decreased by Rs. 1,000.

\therefore The original price has to be more than Rs. 23,040

Hence, options 1 and 2 can be eliminated.

If Rs. 25,000 is the original price, then $x\%$ increase and $x\%$ decrease is equivalent to

$$x - x - \left(\frac{x \times x}{100}\right)\% = -\frac{x^2}{100}\%$$

$$\text{Now, } \frac{x^2}{100}\% \text{ of } 25,000 = 1000$$

$$\therefore x = 20\%$$

Another up-down cycle means an increase and decrease of 20% which is equivalent to a 4% decrease.

$$\therefore 24,000 - 4\% \text{ of } 24,000 = 24000 - 960$$

$$= 23040, \text{ which is the final price.}$$

Hence, **option 3**.

INTEREST AND GROWTH RATES

PRACTICE TEST I

1. The simple interest on the principal in 2 years = $7500 - 6500 = 1000$

\therefore Interest for a year is Rs. 500.

\therefore The principal = $6500 - (3 \times 500) = 5000$

\therefore Rate of interest = $(500/5000) \times 100 = 10\%$

Hence, **option 2**.

Alternatively,

Let the Principal be Rs. P and the rate of interest be r p.c.p.a

$$\therefore 6500 - P = (P \times 3 \times r)/100 \quad \dots (i)$$

$$7500 - P = (P \times 5 \times r)/100 \quad \dots (ii)$$

Subtracting (i) from (ii),

$$1000 = (2Pr)/100$$

$$\therefore Pr = 50000$$

Substitute this value in (i)

$$\therefore 6500 - P = (50000 \times 3)/100$$

$$\therefore P = \text{Rs. } 5,000$$

$$\therefore r = 50000/5000 = 10$$

Hence, rate of simple interest = 10%.

Hence, **option 2**.

2. Chintamani borrowed money at simple interest.

Hence, the interest to be paid

$$= (P \times N \times R)/100$$

$$= 50000 \times 3 \times 0.1 = \text{Rs. } 15,000$$

He invested the money at compound interest.

Hence, the amount obtained after investment

$$= P(1 + R/100)^3 = 50000 \times (1.1)^3 = \text{Rs. } 66,550$$

\therefore The compound interest obtained

$$= 66550 - 50000 = \text{Rs. } 16,550$$

The difference between the simple interest paid and the compound interest earned is his gain/loss.

$$\therefore \text{Chintamani gained} = 16550 - 15000$$

$$= \text{Rs. } 1,550$$

Hence, **option 3**.

3. Let n be the number of years after which the cost of the land and building become equal.

$$1331000 \times [1 - (10/100)]^n$$

$$= 729000 \times [1 + (10/100)]^n$$

$$\therefore 110^3/90^3 = (1 + 0.1)^n/(1 - 0.1)^n$$

$$\therefore 110^3/90^3 = (1.1/0.9)^n$$

$$\therefore (110/90)^3 = (110/90)^n$$

$$\therefore n = 3$$

Hence, **option 5**.

4. Let the rate of interest be x for Manoj.

Using the formula for simple interest,

$$I = (P \times N \times R)/100,$$

$$\text{Manoj's Interest} = (4000 \times 2 \times x)/100 = 80x$$

$$\text{Aditi's Interest} = [5000 \times 2 \times (x + 0.5)]/100$$

$$= 100(x + 0.5) = 100x + 50$$

The bank receives a total of Rs. 860 as interest from both of them.

$$\text{Hence, } 80x + 100x + 50 = 860$$

$$\therefore x = 4.5\%$$

\therefore Manoj borrowed the amount at 4.5% per annum and Aditi borrowed the amount at 5% per annum.

Hence, **option 4**.

5. Let P be the original principal, N be the original time period and R be the original rate of interest.

$$\therefore (PNR)/100 + 150 = [(P + 250)NR]/100$$

$$\therefore (250NR)/100 = 150$$

$$\therefore NR = 60$$

$$(P \times 2N \times R)/100 = (PNR)/100 + 1500$$

$$\therefore PNR = 150000$$

$$\therefore P = 2500$$

However, the values of N and R are not known.

\therefore The compound interest cannot be found.

Hence, the given data is insufficient to answer the question.

Hence, **option 5**.

6. For Compound Interest, the amount can be calculated using the following formula,

$$\text{Amount} = P \left(1 + \frac{r}{100}\right)^n$$

$$\therefore 108000 = 62500 \times \left(1 + \frac{20}{100}\right)^n$$

$$\therefore \frac{108000}{62500} = (1.2)^n$$

$$\therefore \frac{216}{125} = (1.2)^n$$

$$\therefore \left(\frac{6}{5}\right)^3 = (1.2)^n$$

$$\text{i.e. } (1.2)^3 = (1.2)^n$$

$$n = 3.$$

Hence, **option 4**.

7. The formula of compound interest is given by,

$$\text{Amount} = P \left(1 + \frac{r}{100}\right)^n$$

According to the given condition,

$$10000 = 5000 \times \left(1 + \frac{r}{100}\right)^6$$

$$\therefore \left(1 + \frac{r}{100}\right)^6 = 2$$

Now, amount after 18 years,

$$\therefore \text{Amount} = 5000 \times \left(1 + \frac{r}{100}\right)^{18}$$

$$\therefore \text{Amount} = 5000 \times \left[\left(1 + \frac{r}{100}\right)^6\right]^3$$

$$= 5000 \times (2)^3$$

$$= \text{Rs. } 40000$$

Hence, **option 5**.

8. The difference between the simple interest and the compound interest for two years is the interest accrued on the first year's interest.

Since the simple interest is constant for each year, the simple interest for the first year is Rs. 1,400.

Compound interest – Simple interest
= 2912 – 2800 = Rs. 112

∴ Rs. 112 is the interest on Rs. 1,400 for a year.

∴ The rate of interest = $(112/1400) \times 100\%$
= 8%

Simple Interest (SI) = $(P \times N \times R)/100$

∴ The principal, $P = (1400 \times 100)/(8 \times 1)$
= Rs. 17,500

Hence, **option 5**.

9. The difference between the compound interest and the simple interest for 2 years is given by the formula:

Difference = $P \times (R/100)^2$

∴ $850 = P \times (0.10)^2$

∴ $P = \text{Rs. } 85,000$

Hence, **option 3**.

Note: The difference between the compound interest and the simple interest for 2 years is actually the interest on the first year's interest. The first year's interest is given by $(R/100) \times P$

Hence, the interest on this will be $R/100 \times (R/100 \times P) = P \times (R/100)^2$

10. When compounded annually, the amount received at the end of the period is

$A = P[1 + (r/100)]^n$

When compounded annually, the amount received at the end of the period is

$A = P[1 + ((r/2)/100)]^{2n}$

Let the principal be P .

Interest on this amount when compounded annually at the rate of 20% per annum
= $P[(1.20)^2 - 1]$

Interest on this amount when compounded half yearly = $P[(1.10)^4 - 1]$

The difference between the two is Rs. 241

∴ $P[(1.10)^4 - 1] - P[(1.20)^2 - 1] = 241$

∴ $P(1.4641 - 1.44) = 241$

∴ $P = \text{Rs. } 10,000$

Hence, **option 2**.

11. Let the sum that the brother gets initially be P .

Then the sister gets $(12615 - P)$.

Since the brother and the sister get an equal amount at the age of 21, their money is invested for 9 and 11 years respectively,

$(12615 - P) \times (1.05)^{11} = P \times (1.05)^9$

∴ $1.05^2 = P/(12615 - P)$

∴ $P = 1.1025 \times (12615 - P)$

∴ $2.1025P \approx 13908$

$13908/2$ gives an answer of 6954.

Thus, the value of P has to be less than Rs. 6954.

Hence, options 3, 4 and 5 can be eliminated.

If $P = 6000$, then $2.1025P = 12615$

Hence, P cannot be Rs. 6000.

∴ $P = \text{Rs. } 6,615$

Hence, **option 1**.

12. Let the initial sum borrowed be P .

∴ Amount due after one year at the rate of 10% per annum = $P + 0.1P = 1.1P$

∴ Balance payment = $1.1P - 6500$

∴ Interest for the 2nd year

= $0.12 \times (1.1P - 6500)$

= $(3/4) \times (0.1P)$

∴ $P = \text{Rs. } 13,684$

Hence, **option 1**.

13. Let the principal be P and the time in which it doubles itself be t .

Since the compounding is done on a quarterly basis, the effective rate of interest for each quarter is $20/4 = 5\%$.

Hence, the following equation can be written,

$2P = P \times (1 + 0.05)^{4t}$

∴ $2 = (1.05)^{4t}$

∴ $2 = [(1.05)^4]^t \dots (i)$

$2 \approx (1.215)^t$

Now, $(1.2)^4 = (1.2)^2 \times (1.2)^2 \approx 2.07 > 2$

Also, $(1.2)^3 = 1.728 < 2$

∴ $t < 4$ and $t > 3$

All of the options are greater than 4 except option 4 where $t = 3.5$ years

Hence, **option 4**.

14. Let country A's population become more than country B's population after n years,

$(A's \text{ population after } n \text{ years}) / (B's \text{ population after } n \text{ years}) = (1 \times 1.1^n) / (1.5 \times 0.9^n) > 1$

i.e. $2 \times (11)^n > 3 \times 9^n$

Substituting values for n in the above expression,

If $n = 2$, L.H.S. = 242 and R.H.S. = 243

If $n = 3$, L.H.S. = 2662 and R.H.S. = 2187

∴ $n > 2$; hence, country A's population will become more than country B's population in the middle of the year 2010 (but not on 1st Jan, 2010)

∴ Country A's population will become more than that of country B's on the 1st Jan of 2011.

Hence, **option 4**.

15. Population of the richer countries after 5 years is:

$1.2 \times \left(1 + \frac{25}{100}\right)^5 = 3.662 \text{ billion}$

Population of the poorer countries after 5 years is:

$$5.4 \times \left(1 + \frac{15}{100}\right)^5 = 10.861 \text{ billion}$$

Let us first calculate the population PR in 5 years in the richer countries

So, total world population after 5 years
 $= 3.662 + 10.861 = 14.523$ billion

Hence, **option 5**.

PROFIT, LOSS AND DISCOUNT

PRACTICE TEST I

1. In such a case where no actual values are given, the easiest approach is to assume the CP as Rs. 100

There is a mark-up of 20%

$$\therefore \text{MP} = 1.2 \times 100 = \text{Rs. } 120$$

Now, there is a discount of 20%.

$$\therefore \text{SP} = 0.8 \times 120 = \text{Rs. } 96$$

Thus, there is a loss of Rs. 4 on a cost price of Rs. 100.

$$\therefore \text{Percentage loss} = \frac{4}{100} \times 100 = 4\%$$

Hence, **option 3**.

2. Let the CP of the article be x .

\therefore The shopkeeper sold the article at a loss of 8%

$$\therefore \text{The SP of the article} = 0.92x$$

But if the shopkeeper had sold the article for Rs. 540 more, he would have made a profit of 10%.

$$\text{In that case, SP} = 1.1x$$

$$\therefore 1.1x - 0.92x = 540$$

$$\therefore 0.18x = 540$$

$$\therefore x = 3000$$

\therefore The CP of the article is Rs. 3,000.

Hence, **option 4**.

3. Let the original marked price be Rs. 100.

\therefore The reduced price should have been Rs. 85.

However, due to the error, the marked price became Rs. 115.

In this case, the customer would have had to pay $= 115 - 85 = \text{Rs. } 30$ extra.

Hence, if the customer pays Rs. 30 more on an item with marked price Rs. 100,

then he pays Rs. 540 more on item with marked price $= (540 \times 100)/30 = \text{Rs. } 1,800$

\therefore The customer actually paid 15% extra i.e.

$$1.15 \times 1800 = \text{Rs. } 2,070$$

Hence, **option 2**.

4. The trader gives a 10% discount on the MP.

$$\therefore \text{SP} = 0.9 \times \text{MP}$$

Also, the trader makes a 20% profit on the CP.

$$\therefore \text{SP} = 1.2 \times \text{CP}$$

$$\therefore 0.9 \times \text{MP} = 1.2 \times \text{CP}$$

$$\therefore \text{MP} = 1.33 \times \text{CP}$$

$$\therefore \text{MP} = \text{CP} + 0.33\text{CP}$$

\therefore The trader marked the item 33.33% over his cost price.

Hence, **option 4**.

Alternatively,

Let the cost price be Rs. 100

$$\text{Profit} = 20\%$$

$$\therefore \text{SP} = 100 \times 1.2 = \text{Rs. } 120$$

Since there is a discount of 10%,

$$\text{SP} = 0.9 \times \text{MP}$$

$$\therefore \text{MP} = 120/0.9 = \text{Rs. } 133.33$$

Hence, **option 4**.

5. SP of Rs. 2,500 results in a 20% discount off the marked price,

$$\therefore \text{SP} = 2500 = 80\% \text{ of MP}$$

$$\therefore \text{MP} = 2500/0.8$$

\therefore The SP that would result in a 40% discount off the marked price is:

$$\text{New SP} = 60\% \text{ of MP} = 0.6 \times 2500/0.8 = 1875$$

\therefore The selling price would be Rs. 1875

Hence, **option 1**.

6. Since the two types of rice are mixed in the ratio 3 : 2, assume that the actual quantities of the two types of rice are 3 kg and 2 kg respectively.

Hence, total CP of 5 kg mixture of the two kinds of rice $= (30 \times 3) + (42 \times 2) = \text{Rs. } 174$

$$\text{SP of 5 kg mixture} = 38 \times 5 = 190$$

$$\therefore \text{Profit\%} = \frac{(190 - 174)}{174} \times 100$$

$$= \frac{16}{174} \times 100 \approx 9.19\%$$

Hence, **option 2**.

7. Let the price paid by Amit for the bike be Rs. X . He sold it to Sumit at 20% profit.

$$\therefore \text{Amit's S.P} = \text{Sumit's C.P} = \text{Rs. } 1.2x$$

Total C.P for Sumit after getting the bike painted

$$= \text{Rs. } (1.2x + 1000)$$

Sumit sold the bike to Rohit at 10% profit.

$$\text{Sumit's S.P} = \text{Rohit's C.P} = \text{Rs. } (1.2x + 1000) \times 1.1$$

Since, Rohit paid Rs.15,000 to Sumit for the bike,

$$\therefore (1.2x + 1000) \times 1.1 = 15000$$

$$\therefore x = 10,530.30 \approx \text{Rs. } 10,530$$

Hence, **option 3**.

8. By selling 150 bags, the shopkeeper the cost of 250 bags.

Thus, the money earned by selling the remaining 100 bags is his profit.

$$\begin{aligned}\text{Percentage Gain} &= \frac{\text{Remaining Goods}}{\text{Sold Goods}} \times 100 \\ &= \frac{100}{150} \times 100 = 66.67\%\end{aligned}$$

Hence, **option 5**.

Alternatively,

Selling Price of 150 bags is Rs. 7500.
 \therefore Selling Price of each bag = y = Rs. 50
 Let the Cost Price of each bag be Rs. x
 \therefore Cost Price of 250 bags = Rs. $250x$
 Since sale of 150 bags was enough to recover the cost price of 250 bags.
 $\therefore 7500 = 250x$
 $\therefore x = 30$

$$\begin{aligned}\text{Percentage Gain} &= \frac{\text{Remaining Goods}}{\text{Sold Goods}} \times 100 \\ &= \frac{100}{150} \times 100 = 66.67\%\end{aligned}$$

Hence, **option 5**.

9. Let the cost price be Rs. x .

When the selling price is Rs. 18,700, the owner loses 15%.

$$\therefore 0.85x = 18700$$

$$\therefore x = \text{Rs. } 22,000$$

If the owner wants to gain 15% then,

$$\begin{aligned}\text{Selling price} &= 1.15x = 1.15 \times 22000 \\ &= \text{Rs. } 25,300\end{aligned}$$

Hence, **option 3**.

10. Offer 1:

Price of the laptop = Rs. 35,000

After the discount, the price becomes

$$0.7 \times 35000 = \text{Rs. } 24,500$$

Offer 2:

Price of the laptop = Rs. 35,000

After the successive discounts, the price becomes

$$35000 \times \left(1 - \frac{20}{100}\right) \times \left(1 - \frac{10}{100}\right)$$

i.e. Rs. 25,200

Thus, Offer 1 is better.

Hence, **option 1**.

11. CP of 20 chocolates = Rs. 1

$$\therefore \text{CP of 1 chocolate} = 1/20 = 5 \text{ paise}$$

To gain a 20% profit he should sell them for
 $1.2 \times 5 \text{ ps} = 6 \text{ paise}$

$$\therefore \text{SP of 1 chocolate} = 6 \text{ paise}$$

\therefore He would sell $300/6 = 50$ chocolates for Rs. 3

Hence, **option 1**.

12. Let a be the CP of the first plot.

Let b be the CP of the second plot.

\therefore The first plot was sold at a gain of 12%.

$$\therefore \text{The SP of the first plot} = 1.12a$$

$$\therefore 1.12a = 1 \text{ crore}$$

$$\therefore a = \text{Rs. } 89,28,571.43$$

Similarly,

\therefore The second plot was sold at a loss of 12%.

$$\therefore \text{The SP of the second plot} = 0.88b$$

$$\therefore 0.88b = 1 \text{ crore}$$

$$\therefore b = \text{Rs. } 1,13,63,636.37$$

$$\therefore \text{Total CP} = a + b = \text{Rs. } 2,02,92,207.79$$

But total SP = Rs. 2 crore

$$\therefore \text{Loss} = \text{Total CP} - \text{Total SP} = 2,92,207.79$$

$$\therefore \text{Loss percentage} = \left[\frac{2,92,207.79}{2,02,92,207.79} \right] \times 100 = 1.44\%$$

Hence, **option 3**.

Alternatively,

Both the houses were sold at the same price.

Also, the percentage profit in the first case ($+a\%$) is equal to the percentage loss in the second case ($-a\%$).

In such a case, the overall transaction leads to a loss and the percentage loss is $(a^2/100)\%$

In this problem, $a = 12$.

Hence, percentage loss

$$= \frac{(12)^2}{100} = 144/100 = 1.44\%$$

Hence, **option 3**.

13. Let there be 100 litres of pure milk initially.

The milkman adds 20 litres of water to it so that he has 120 litres of the solution.

He then adds water to increase the volume of the mix to $120 \times 1.1 = 132$ litres

To sell 132 litres of adulterated milk, he needs to buy 100 litres of pure milk at Rs. 20 per litre.

$$\therefore \text{The cost of 132 litres of adulterated milk} = 100 \times 20 = \text{Rs. } 2,000$$

The selling price of these 132 litres

$$= 132 \times 22 = \text{Rs. } 2,904$$

$$\therefore \text{Profit percentage} = \left[\frac{(2904 - 2000)}{2000} \right] \times 100 = 45.2\%$$

$$\therefore \text{The percentage profit is } 45.2\%$$

Hence, **option 4**.

14. Since, the shopkeeper allows successive discounts of 10%, 5% and 4%,

\therefore Total discount

$$= \left[1 - \left(\frac{100 - 10}{100} \times \frac{100 - 5}{100} \times \frac{100 - 4}{100} \right) \right] \times 100$$

$$= 17.92\%$$

$$\therefore \text{Discount} = (17.92/100) \times 2750 = \text{Rs. } 492.8$$

$$\therefore \text{Selling Price} = \text{Marked Price} - \text{Discount}$$

$$= \text{Rs. } 2257.2$$

Hence, **option 4**.

15. 25% gain implies $SP = 1.25CP$
 Now, CP is 10% less i.e. $0.9CP$ and SP is Rs. 2 less i.e. $(SP - 2)$.
 Since the profit is still 25%
 $(SP - 2) = 1.25(0.9CP)$ where $SP = 1.25CP$
 $\therefore 1.25CP - 2 = 1.125CP$
 $\therefore 0.125CP = 2$
 $\therefore CP = \text{Rs. } 16$.
 Hence, **option 2**.

RATIO AND PROPORTION

PRACTICE TEST I

1. Let x be the number to be added.
 $\therefore (19 + x) : (43 + x) = 2 : 3$
 $\therefore 57 + 3x = 86 + 2x$
 $\therefore x = 29$
 $\therefore 29$ must be added to each term in the ratio $19 : 43$ so that it becomes equal to $2 : 3$
 Hence, **option 2**.
2. Let the company's investment in the road construction be x .
 $\therefore 4 : 5 = x : 6$ or $4/5 = x/6$
 $\therefore x = (6 \times 4)/5 = 4.8$
 \therefore The company invested Rs. 4.8 million in road construction.
 Hence, **option 3**.
3. Let the incomes of A and B be $3x$ and $4x$ respectively.
 Let their expenditures be $2y$ and $3y$ respectively.
 Savings = Income - Expenditure
 \therefore A's savings/B's savings = $(3x - 2y)/(4x - 3y)$
 The values of x and y are not known.
 Hence, the ratio of savings cannot be determined.
 Hence, **option 4**.
4. Since, the amount collected by B wing is common to both the ratios, it is to be used to compare the collections of all 3 wings.
 Hence, find the LCM of 5 and 2.
 LCM of 5 and 2 = 10
 \therefore The ratio of the amounts contributed by the people of all the three wings = $16 : 10 : 15$
 \therefore The amount contributed by each wing is $16x$, $10x$ and $15x$ respectively.
 $\therefore 16x + 10x + 15x = 20500$
 $\therefore x = 500$
 i.e. $10x = 5000$
 Hence, the amount collected by B wing is Rs. 5,000.
 Hence, **option 1**.

5. Let one of the parts be x .
 \therefore The other part is $(78 - x)$
 \therefore The ratio between the two parts is $7 : 6$

$$\therefore \frac{x}{(78 - x)} = \frac{7}{6}$$

- $\therefore 6x = 546 - 7x$
 $\therefore 13x = 546$
 $\therefore x = 42$ and $(78 - x) = 36$
 Product of 42 and 36 = 1512
 Hence, **option 3**.

6. Originally, let the number of seats for Mathematics, Physics and Biology be $5x$, $7x$ and $8x$ respectively.
 Number of increased seats are (140% of $5x$), (150% of $7x$) and (175% of $8x$) i.e. $1.4 \times 5x$, $1.5 \times 7x$ and $1.75 \times 8x$
 i.e. $7x$, $10.5x$ and $14x$ i.e. $14x : 21x : 28x$ or $2 : 3 : 4$
 Hence, **option 1**.

7. Let the initial number of members with Mr. Shah be $6k$ and the number of members with Mr. Raheja be $5k$.
 24 members went over from Mr. Shah's side to Mr. Raheja's side.
 Hence, the number of members now supporting
 Mr. Shah is $6k - 24$ while the number of members with Mr. Raheja is $5k + 24$.
 This ratio is now $2 : 3$
 $\therefore (6k - 24) : (5k + 24) = 2 : 3$
 $\therefore 18k - 72 = 10k + 48$
 $\therefore 8k = 120$
 $\therefore k = 15$
 \therefore The number of members with Mr. Shah initially
 $= 6k = 90$
 Hence, **option 1**.

8.

	Vessel 1		Vessel 2	
	Milk	Water	Milk	Water
Initially	38	0	0	24
After 1 st operation	0	0	8	24

- Now, the ratio of milk to water in vessel 2 is $8 : 24$
 $= 1 : 3$ and the ratio of milk to the total solution in vessel 2 is $8 : 32 = 1 : 4$
 \therefore Of the 20 litres, $1/4$ th (i.e. 5 litres) is milk and $3/4$ th (i.e. 15 litres) is water.
 \therefore After the 2nd iteration, amount of milk in vessel 1 = $30 + 5 = 35$ litres
 and amount of water in vessel 2 = $24 - 15$

= 9 litres

∴ The ratio of milk in vessel 1 to water in vessel 2 is 35 : 9.

Hence, **option 4**.

9. Let the numbers be A, B and C

∴ A + B + C = 98

A : B = 2 : 3 and B : C = 5 : 8

Since B is the common term being compared, equalise B in both ratios.

Take the LCM of 3 and 5 i.e. 15

So, A needs to get multiplied by 5 and C by 3

∴ A : B : C = 10 : 15 : 24

∴ B = $\frac{15}{49} \times 98 = 30$

Hence, **option 3**.

10. The ratio of the number of coins is 1 : 2 : 3 for the 50 paise, 25 paise and Rs. 1.50 coins respectively.

∴ In terms of monetary value, the ratio becomes

$(1 \times 0.5) : (2 \times 0.25) : (3 \times 1.5)$ which equals

0.5 : 0.5 : 4.5, i.e. 1 : 1 : 9.

∴ $(1/11)^{\text{th}}$ of the total value comes from 25 paise coins, i.e. $(1/11) \times 6600 = \text{Rs. } 600$ is in the form of 25 paise coins

∴ The total number of 25 paise coins is $600/0.25 = 2400$

Hence, **option 3**.

PRACTICE TEST II

1. Let the annual income of Mr. X and Mr. Y be Rs. $9x$ and $8x$ respectively.

Also, let their expenditures be Rs. $5y$ and Rs. $4y$ respectively.

Both individually save Rs. 5,000

∴ Income - Expenditure = Savings

For Mr. X,

$$9x - 5y = 5000 \quad \dots (i)$$

For Mr. Y,

$$8x - 4y = 5000 \quad \dots (ii)$$

Solving equations (i) and (ii),

$$x = 1250 \text{ and } y = 1250$$

∴ B's expenditure = $4y = \text{Rs. } 5,000$

Hence, **option 2**.

2. $5x - 13y = 3x - 8y$

$$\therefore 2x = 5y$$

$$\therefore x : y = 5 : 2$$

$$x^2 : y^2 = 25 : 4$$

$$2x^2 : 3y^2 = 50 : 12$$

Using Componendo and Dividendo law,

$$(2x^2 + 3y^2) : (2x^2 - 3y^2) = 62 : 38$$

$$= 31 : 19$$

Hence, **option 4**.

3. Let Vinod's share be x .

$$\therefore 6x = 10 \times (\text{Vinay's share})$$

$$\therefore \text{Vinay's share} = 3x/5$$

Similarly, Vinit's share = $6x/5$

$$\therefore x + (3x/5) + (6x/5) = 14x/5 = 798$$

$$\therefore x = (798/14) \times 5 = 57 \times 5 = 285$$

Hence, **option 5**.

Alternatively,

Let the share of Vinod, Vinay and Vinit be a , b and c respectively.

$$\text{Hence, } 6a = 10b \text{ and } 6a = 5c$$

$$\text{Hence, } 6a = 10b = 5c.$$

$$\text{Hence, } a : b : c = (10 \times 5) : (6 \times 5) : (6 \times 10)$$

$$= 50 : 30 : 60$$

$$= 5 : 3 : 6$$

$$\text{Hence, Vinod's share} = (5/14) \times 798 = 285$$

Hence, Vinod's share was Rs. 285.

Hence, **option 5**.

4. Let x be the fourth proportional.

$$\therefore 3/5 = 27/x$$

$$\therefore x = (27 \times 5)/3 = 45$$

Hence, **option 1**.

5. From the given equation, $k = \frac{(x^2 - y^2)^2}{x - y}$

Now, $(x^2 - y^2)$ can be written as $(x + y)(x - y)$.

$$\text{So, we have } k = \frac{(x + y)^2 \times (x - y)^2}{x - y}$$

$$= (x + y)^2 \times (x - y)$$

$$= (x + y)(x + y)(x - y)$$

$$= (x + y)(x^2 - y^2)$$

Hence, **option 3**.

5. Cost is proportional to the square root of the diameter.

$$\therefore \text{Cost} = k \times \sqrt{\text{diameter}},$$

where k is a constant of proportionality

∴ The cost of a plate with 24 cm diameter

$$= k\sqrt{24} = 2k\sqrt{6}$$

Similarly, the cost of plate with 18 cm diameter

$$= k\sqrt{18} = 3k\sqrt{2}$$

and the cost of a plate with 8 cm diameter

$$= k\sqrt{8}$$

$$= 2k\sqrt{2}$$

∴ The cost of an 18 cm and a 8 cm plate

$$= 3k\sqrt{2} + 2k\sqrt{2} = \text{Rs. } 5k\sqrt{2}$$

Let the cost of the 18 cm and 8 cm plates put together be x .

$$\therefore 346 : x :: 2k\sqrt{6} : 5k\sqrt{2}$$

$$\therefore x = \frac{(346 \times 5\sqrt{2})}{2\sqrt{6}} = \frac{346 \times 5}{2\sqrt{3}} = \frac{173 \times 5}{\sqrt{3}}$$

$$\approx \frac{173 \times 5}{1.73} \approx 500$$

∴ The additional cost of making the plates
 $\approx 500 - 346 \approx \text{Rs. } 154$
 Hence, **option 2**.

7. If $\frac{a}{b} = \frac{c}{d} = \frac{e}{f} = k$,

then $\frac{a + c + e}{b + d + f} = k$

Using this property, add the numerators and denominators to get,

$$r = \frac{x + y + z}{x + y + z} = 1$$

Similarly, if we subtract the denominators and numerators of the first two ratios, you get

$$r = \frac{x - y}{(y + z - x) - (z + x - y)}$$

$$= \frac{x - y}{2(y - x)} = \frac{-1}{2}$$

∴ r can take the values 1 and $-1/2$

Hence, **option 4**.

8. Let the weights of the two pieces be $4x$ and $5x$.
 Therefore, the weight of the original stone was $9x$.

Value of the stone is directly proportional to the square of its weight.

∴ The values of the original stone and the two pieces are proportional to $81x^2$, $16x^2$ and $25x^2$.
 Hence, the required ratio is $81 : (16 + 25)$
 $= 81 : 41$.

Hence, **option 2**.

9. $A : B : C = (20,000 \times 24) : (15,000 \times 24) : (20,000 \times 18) = 4 : 3 : 3$.

∴ B's share = $\frac{3}{10} \times 25000 = \text{Rs. } 7,500$

Hence, **option 1**.

10. A was a partner for all 12 months. Assume that B joined for x months.

$$\therefore \frac{85000 \times 12}{42500 \times x} = \frac{3}{1}$$

$$\therefore x = \frac{82500 \times 12}{42500 \times 3} = 8$$

Thus, B joined for 8 months.

Hence, **option 4**.

MIXTURES AND ALLIGATIONS

PRACTICE TEST I

1. In this case, the rate per kg of each type of pulse is the attribute while the quantity of pulses used is the weight assigned. The cost of

the resultant mixture is nothing but the weighted average of the two costs.

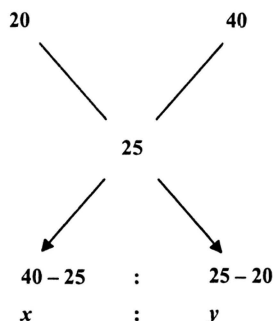
Hence, Cost of resultant mixture

$$= \frac{(10 \times 1) + (20 \times 4)}{(1 + 4)}$$

$$= \frac{90}{5} = \text{Rs. } 18 \text{ per kg}$$

Hence, **option 5**.

2. Since the concentration of water in each solution as well as in the final mixture is known, use the alligation cross to find the proportion.

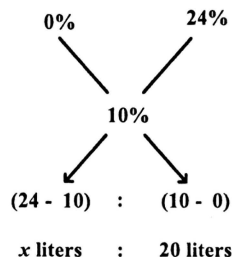


$$\frac{x}{y} = \frac{(40 - 25)}{(25 - 20)} = \frac{15}{5} = \frac{3}{1}$$

∴ The 20% water solution and the 40% water solution should be mixed in the ratio 3 : 1 to get a solution which has 25% water.

Hence, **option 1**.

3. Here, one solution has 24% wine and the resultant solution has 10% wine. The second solution being mixed is water (which has 0% wine). Thus, the alligation cross can be made as shown below:



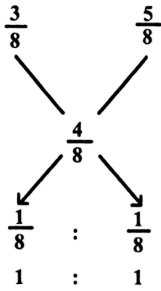
$$\therefore \frac{x}{20} = \frac{14}{10}$$

$$\therefore x = \frac{14 \times 20}{10} = 28$$

∴ 28 litres of water should be added.

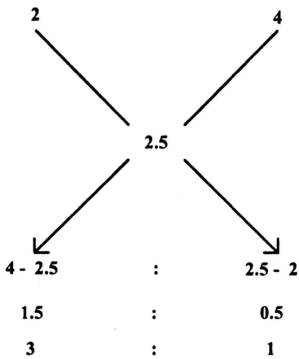
Hence, **option 4**.

4.



The first alloy has zinc and tin in the ratio 3 : 5.
 \therefore The proportion of zinc in the first alloy is $\frac{3}{8}$.
 Similarly, the ratio of zinc and tin in the second alloy is 5 : 3.
 \therefore The proportion of zinc in the second alloy is $\frac{5}{8}$.
 Since the ratio of zinc and tin in the mixture is 1 : 1, the proportion of zinc in the mixture of these two alloys is $\frac{1}{2}$ (or $\frac{4}{8}$).
 \therefore The ratio in which the two alloys should be mixed, to get a resultant mixture of zinc and tin in the ratio 1 : 1 can be found using the above diagram.
 \therefore The required ratio is 1 : 1.
 Hence, **option 1**.

5. S.P of the mixture = Rs. 3.75 per kg and profit = 50%.
 \therefore C.P = $3.75/1.5$ = Rs. 2.5 per kg
 Hence, the ratio in which the two types of coffee powder should be mixed is:



Hence, the two types of coffee powder in the mixture should be mixed in the ratio 1.5 : 0.5 i.e. 3 : 1
 Hence, **option 3**.

6. Capacity of the vessel = Quantity of milk = 72 litres.
 Quantity of milk replaced = Quantity of water added = y litres
 After first replacement:

$$\frac{\text{Quantity of milk remaining}}{\text{Quantity of total mixture}} = \left(\frac{x-y}{x}\right)$$

After second replacement:

$$\begin{aligned}
 &\frac{\text{Quantity of milk remaining}}{\text{Quantity of total mixture}} \\
 &= \left(\frac{x-y}{x}\right) \times \left(\frac{x-y}{x}\right) \\
 &= \left(\frac{x-y}{x}\right)^2
 \end{aligned}$$

Thus, after n replacements:

$$\frac{\text{Quantity of milk remaining}}{\text{Quantity of total mixture}} = \left(\frac{x-y}{x}\right)^n$$

Here, the replacement is done twice i.e. $n = 2$
 Also, the final ratio of milk to water is 25 : 11.
 So, the final ratio of milk to solution is 25 : (25 + 11)

$$\begin{aligned}
 \therefore \frac{25}{25+11} &= \left(\frac{72-y}{72}\right)^2 \\
 \therefore \sqrt{\frac{25}{36}} &= \left(\frac{72-y}{72}\right) \\
 \therefore \frac{5}{6} &= \left(\frac{72-y}{72}\right)
 \end{aligned}$$

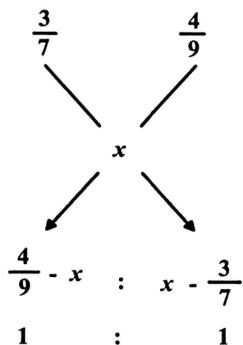
$\therefore 360 = 432 - 6y$
 $\therefore y = 12$ litres
 Hence, **option 3**.

Note: There is also a negative value of the square root, which comes out to be invalid, as shown below.

$$\begin{aligned}
 \frac{-5}{6} &= \frac{72-y}{72} \\
 \therefore -360 &= 432 - 6y \\
 \therefore y &= 132 \text{ litres}
 \end{aligned}$$

However, the capacity of the vessel is only 72 litres. Thus, 132 litres of milk cannot be removed out of it.
 Hence, this value is invalid.

7. The ratio of the students who passed to those who failed in class 1 is 3 : 4.
 Hence, $\frac{3}{7}$ th of the total students in class 1 have passed.
 Similarly, $\frac{4}{9}$ th of the total students in class 2 have passed.
 Also, the number of students in each class is the same.
 Hence,



$$\frac{\frac{4}{9} - x}{x - \frac{3}{7}} = \frac{1}{1}$$

$$\therefore \frac{4}{9} - x = x - \frac{3}{7}$$

$$\therefore x = 55/126$$

\therefore 55/126 of the total students in both the classes put together passed.

\therefore The passing percentage of all the students taken together = $55/126 \times 100 \approx 44\%$

Hence, **option 2**.

Alternatively,

\therefore The number of students in both classes is the same, the ratio of the total number of students who have passed to the total number of students is just the arithmetic mean of the corresponding ratios in the two classes.

\therefore The fraction of the total number of students who have passed

$$= \frac{1}{2} \left(\frac{3}{7} + \frac{4}{9} \right) = \frac{55}{126}$$

Hence, the percentage corresponding to this fraction is $5500/126 \approx 44\%$

Hence, **option 2**.

8. \therefore Equal amounts of each alloy are melted, the contribution to the fractional amount of each metal in the new alloy is $1/3$ times its fractional amount in any of the original alloys.

\therefore Fraction of copper in the new alloy

$$= \frac{1}{3} \times \frac{3}{7} = \frac{1}{7}$$

Fraction of aluminium in the new alloy

$$= \frac{1}{3} \left(\frac{2}{7} + \frac{1}{4} \right)$$

$$= \frac{15}{84}$$

\therefore The ratio of amount of copper and aluminium in the new alloy

$$= \frac{1}{7} : \frac{15}{84}$$

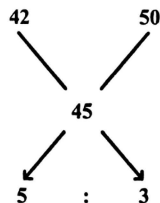
$$= 84 : 105 = 4 : 5$$

Hence, **option 4**.

9. The shopkeeper sells the mixture at Rs. 54 per litre thereby making a 20% profit.

\therefore Actual cost of the mixture = $54/1.2 =$ Rs. 45 per litre.

\therefore The amounts in which the two mixtures are to be used is given by the alligation rule shown below:



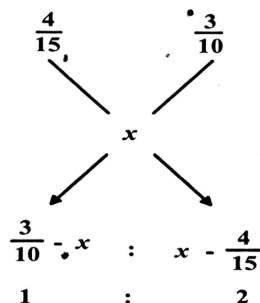
Hence, the Rs. 42 and the Rs. 50 variants should be mixed in the ratio 5 : 3.

\therefore The juice costing Rs. 50 forms $3/8$ th of the total mixture.

\therefore 40 litres of Orange-La has $(3/8) \times 40 = 15$ litres of the Rs. 50 variant of juice.

Hence, **option 1**.

10.



Since the question asks for the proportion of the 2 rupee coins in the final amount (in terms of value), the ratio of 2 rupee coins with respect to the total number of coins with each person needs to be alligated.

Also, the ratio of quantity of 2 rupee coins with each person is known.

Hence, the alligation cross can be drawn as shown above.

$$\text{Hence, } z \frac{\frac{3}{10} - x}{x - \frac{4}{15}} = \frac{1}{2}$$

$$\therefore x = \frac{13}{45}$$

i.e. the fraction of 2 rupee coins in the larger purse

$$= \frac{13}{45}$$

∴ The fraction of 5 rupee coins in the larger purse

$$= 1 - \frac{13}{45} = \frac{32}{45}$$

∴ If there are x 2 rupee coins, there will be

$$\left(\frac{32x}{13}\right) \text{ 5 rupee coins}$$

∴ The total value of these coins is Rs. 744,

$$2x + \frac{160x}{13} = 744$$

∴ $x = 52$

∴ There are 52 two-rupee coins in the total amount.

Their value = $52 \times 2 = \text{Rs. } 104$

Hence, **option 1**.

VARIATION

PRACTICE TEST I

1. If the time duration is constant, the number of men and the work done are directly proportional to each other.

∴ The number of men becomes 1.5 times ($200 \times 1.5 = 300$)

∴ The work done i.e. the length of the road will also increase to 1.5 times the original length i.e. 1.5 km

Hence, **option 2**.

Alternatively,

If the number of men required is n and the length of the road is l , then

$$n_1/n_2 = l_1/l_2$$

$$\text{Hence, } (200/300) = 1/l_2$$

$$\therefore l_2 = 1.5 \text{ km}$$

Hence, **option 2**.

2. Volume of a sphere is directly proportional to the cube of the radius.

$$V = (4/3)\pi r^3$$

∴ The ratio of radii is 1 : 2,

∴ The ratio of volume would be $1^3 : 2^3$, i.e.

$$1 : 8.$$

Hence, **option 3**.

3. Force is inversely proportional to the square of the distance between the charges.

$$\therefore F \propto \frac{1}{d^2}$$

where F and d are the force and the distance between the two charges respectively.

$$\text{Hence, } F_1 \times d_1^2 = F_2 \times d_2^2$$

$$\text{Hence, } 20 \times (200)^2 = F_2 \times (2000)^2$$

$$\therefore F_2 = 20 \times (1/10)^2 = 0.2 \text{ N}$$

Hence, **option 1**.

4. The volume of a cone varies directly with the product of the square of the radius and the height i.e. $V \propto r^2h$.

∴ The radius and height are doubled, the new volume will be proportional to $(2r)^2 \times (2h)$ i.e.

$$8r^2h = 8V, \text{ i.e. 8 times the old volume}$$

∴ Percentage change in the volume

$$= (8 - 1)/1 \times 100$$

$$= 700\%$$

Hence, **option 5**.

5. Let the bases of the trapezoid be b_1 and b_2 , and the height be h .

The equation for the area of the trapezoid can be written as:

$$S = k \times h \times (b_1 + b_2)$$

where k is the constant of proportionality.

Substituting the given values,

$$285 = k \times 19 \times (11 + 19)$$

$$\therefore k = 0.5$$

∴ The area of the second trapezoid,

$$S = 0.5 \times 10 \times (10 + 15)$$

$$\therefore S = 125 \text{ m}^2$$

Hence, **option 3**.

6. The equation for the number of cranes c can be written as: $c = k \times y/w$

Substituting the values from the question,

$$4 = k \times \frac{8}{6}$$

$$\therefore k = 3$$

In the second case, the equation can be written as:

$$c = 3 \times y/w$$

$$5 = 3 \times 20/w$$

$$\therefore w = 12$$

Hence, **option 4**.

7. Let the area be a , radius be r and the perimeter be p of the circle.

Then,

$$a = k/r^3 \quad \dots \text{(i)}$$

$$p = k/a \quad \dots \text{(ii)}$$

∴ The constant of proportionality, k , is equal for both the cases.

From equation (ii), $a = k/p$,

From equation (i), $a = k/r^3$

$$\therefore k/p = k/r^3$$

$$\therefore p = r^3$$

$$\text{If } r = 8, p = 8^3 = 512 \text{ units}$$

Hence, **option 4**.

8. Let the marks of Mahesh, Ramesh and Durgesh be m , r , and d respectively.

$$\text{Hence, } m = k \times r^2 \times d^4$$

Let m' denote Mahesh's new marks.

$$m' = k \times (2r)^2 \times (d/2)^4$$

$\therefore m' = k \times 4 \times r^2 \times d^4 / 16 = (k \times r^2 \times d^4) / 4$
 $\therefore m' = m / 4$
 \therefore The marks of Mahesh will reduce by 75%.
 Hence, **option 2**.

9. The following relations can be established:

$$P = k_1 \times Q$$

$$Z = \frac{k_2}{Q}$$

$$A = k_3 \times \frac{P}{Z}$$

$$= k_3 \times \frac{(k_1 \times Q)}{\left(\frac{k_2}{Q}\right)} = k' \times Q^2$$

\therefore From the given relations, A is directly proportional to Q^2 .

Substituting the values from the question,
 $27 = k_1 \times 9$

$$\therefore k_1 = 3 \text{ and } 3 = \frac{k_2}{9}$$

$$\therefore k_2 = 27 \text{ and } 90 = k' \times 81$$

$$\therefore k' = \frac{90}{81}$$

$$\therefore \text{When } P = 81, \text{ then } Q = \frac{81}{3} = 27$$

$$A = \frac{90}{81} \times 27^2 = 810$$

Hence, **option 4**.

10. Work Done = Number of Students \times Hours worked per day \times Number of days worked.

Here, the work to be done is "solving n number of problems". Since the number of problems to be solved in the second case is five times the number of problems to be solved in the first case, the work done in the second case is five times the work done in the first case.

Let the number of students required in the second case be x .

$$\therefore \frac{W}{5W} = \frac{8 \times 5 \times 9}{x \times 4 \times 15}$$

$$\therefore x = \frac{8 \times 5 \times 9 \times 5}{4 \times 15} = 30$$

Thus, 30 students will be required.

Hence, **option 2**.

TIME AND DISTANCE

PRACTICE TEST I

1. Time = Distance/Speed

\therefore Time taken for the bus to travel from City A to City B = $220/55 = 4$ hours

\therefore Time taken for the bus to travel from City B to City C = $220/110 = 2$ hours

\therefore Total time taken for travelling from City A to City B and then to City C = $4 + 2 = 6$ hours

Hence, **option 3**.

2. Since all three contestants have completed the race, they have travelled the same distance.

\therefore The distance is constant, their speed is inversely proportional to the time taken to complete the race.

\therefore The ratio of speeds = $1/8 : 1/3 : 1/6$

$$= (3/24) : (8/24) : (4/24)$$

$$= 3 : 8 : 4$$

Hence, **option 2**.

3. Let the total time that Meher takes to complete the entire journey be t hours.

Meher spent 20%, 50% and the remaining 30% of the time walking, in the bus and in the cab respectively.

Thus, time spent walking, in the bus and in the cab is $0.2t$, $0.5t$ and $0.3t$ respectively.

$$\therefore \text{Average speed} = \frac{\text{Total Distance covered}}{\text{Total Time taken}}$$

$$= \frac{10(0.2t) + 40(0.5t) + 50(0.3t)}{t}$$

$$= 37 \text{ km/hr}$$

Hence, **option 1**.

4. Let the time that Arun usually takes to reach his office on time be t minutes.

\therefore The distance from his house to his office is constant and speed is inversely proportional to time,

$$\frac{40}{60} = \frac{t - 10}{t + 15}$$

Note that in the above equation, there is no need to convert the speed to m/min, as the ratio is being taken. As such, the converting factor cancels out.

$$\therefore 2(t + 15) = 3(t - 10)$$

$$\therefore 2t + 30 = 3t - 30$$

$$\therefore t = 60 \text{ min}$$

Thus, he generally takes 60 minutes to reach his office exactly on time.

Hence, **option 4**.

5. Anurag's speed from Santacruz to Prabhadevi is 6 km/hr while his speed in the reverse trip is y km/hr.

Hence, his average speed is s

$$= (2 \times 6 \times y) / (6 + y)$$

$$= 12y / (6 + y) \text{ km/hr.}$$

Since the average speed as well as y are not known, the problem can be solved only by using the answer options.

Replace s by each option and check.

While doing so, consider the case where $s = 12$ km/hr.

In this case, $12 = 12y/(6 + y)$.

This gives $y = 6 + y$ which is not possible.

Hence, $s \neq 12$.

Hence, Anurag's average speed for the whole journey cannot be 12 km/hr.

Hence, **option 4**.

6. Since both the trains start simultaneously and then meet each other, they have travelled for the same amount of time.

Hence, the distance travelled by the trains is directly proportional to their speed.

If d is the distance travelled by the slower train, then $(d + 320)$ is the distance travelled by the faster train.

Hence,

$$\frac{d + 320}{d} = \frac{100}{80}$$

$$\therefore d = 1280 \text{ km}$$

\therefore The distance between the two stations
 $= d + (d + 320) = 2d + 320 = 2560 + 320$
 $= 2880 \text{ km}$

Hence, **option 3**.

7. Here the distance 180 kms is redundant information.

Let the initial speed of the bus be x km/hr.

Had there been no accident, the bus would have covered the distance (say d) between the place where the bus broke down and Nashik at a speed of x km/hr.

Let t be the time taken to cover distance d at x km/hr.

However, after the accident, the bus will cover this distance at $5x/6$ km/hr.

Here, the time taken increases by 30 minutes.

\therefore The distance is the same in both cases (d), the time taken will be inversely proportional to the speed.

$$\text{Hence, } \frac{x}{5x/6} = \frac{t + 30}{t}$$

$\therefore t = 150$ minutes; i.e. the time taken to cover d km when moving at a speed of x km/hr is 150 minutes.

If the accident occurred 50 km further, the bus would have been only 10 minutes late.

The distance between the new accident spot and Nashik is $(d - 50)$ km.

Let t' minutes be the time taken by the bus to cover

$(d - 50)$ km at x km/hr.

Then, the time taken to cover the same distance at

$5x/6$ km/hr will be $(t' + 10)$ minutes.

\therefore Speed is inversely proportional to time when distance is constant,

$$\frac{x}{5x/6} = \frac{t' + 10}{t'}$$

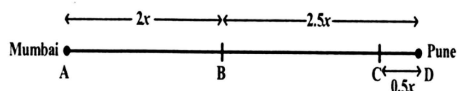
$\therefore t' = 50$ minutes; i.e. the time taken to cover $(d - 50)$ km when moving at a speed of x km/hr is 50 minutes.

Thus, the time taken to cover 50 km when moving at a speed of x km/hr is 100 minutes.

$$\therefore x = \frac{50}{100} = 30 \text{ km/hr}$$

Hence, **option 5**.

8.



Let the speed of the car be ' x ' km/hr.

Let A be the point in Mumbai from where the car begins its trip, B be the point where the car meets the bus for the first time and C be the point where the car meets the bus while returning from Pune.

The car starts at 8.00 p.m. and meets the bus at point B at 10.00 p.m. Hence the distance of point AB is $2x$ km.

At 12.30 a.m., the car reaches Pune which is point D.

\therefore The distance BD = $2.5x$ km

After resting for 1 hour, it starts its return journey at 1.30 a.m. and meets the same bus again at point C at 2.00 a.m.

\therefore The distance CD = $0.5x$ km

Moreover, the time required for the bus to reach point C from point B is 4 hrs.

Thus the bus takes 4 hrs to cover a distance of $2x$ km.

Hence it would take 1 hour to cover a distance of $0.5x$ km.

\therefore The bus would take 1 hour to reach D from C.

Since the car has met the bus at 2:00 a.m., the bus would reach Pune at 3.00 a.m.

Hence, **option 2**.

9. Usha beats Parvati by 10 m in a 100 m race and Parvati beats Anuja by 5 m in the same race.

Hence, when Usha covers 100 m, Parvati covers 90 m in the same race in the same time.

Similarly, when Parvati covers 100 m, Anuja covers 95 m in the same race in the same time.

∴ When Parvati covers 90 m, Anuja covers $(90 \times 95)/100 = 85.5$ m

Thus, when Usha covers 100 m, Anuja covers 85.5 m.

∴ Usha beats Anuja by $100 - 85.5 = 14.5$ m

Hence, **option 3**.

10. Shashi beats Manohar by 15 m in a 100 m sprint.

Manohar had just run 85 meters, when Shashi completed the race.

Manohar's speed is 10 m/s.

Hence, Manohar runs 85 meters in 8.5 seconds.

Therefore, Shashi's speed = $100/8.5$

Manohar completes the race in 10 seconds and beats Randheer by 7 seconds, therefore Randheer completes the race in 17 seconds.

So, Randheer's speed = $100/17$

Hence, ratio of Shashi's speed to Randheer's speed

= $(100/8.5) : (100/17) = 17 : 8.5 = 2 : 1$

Hence, **option 3**.

PRACTICE TEST II

1. Since the length of the train is required in metres, convert the speed of the train from km/hr to m/s.

The train runs at $108 \text{ km/hr} = 108 \times 5/18 = 30 \text{ m/s}$

Compared to the train, the length of the pole is considered to be negligible.

∴ The length of the pole will be negligible, and the train crosses it in 13 seconds;

∴ The distance covered by the train in 13 seconds is

equal to the length of the train.

∴ Length of train = Speed (in m/s) × Time (in seconds)

= $30 \times 13 = 390$ metres

∴ The train is 390 metres long.

Hence, **option 1**.

2. From Mumbai to Delhi, the airplane goes from west to east while the air current flows from east to west.

Hence, in this case, the airplane and air current go in opposite directions.

Hence, the airplane will travel at $1100 - 100$

= 1000 km/hr while going from Mumbai to Delhi.

From Delhi to Mumbai, both, the airplane and the air current go in the same direction i.e. from east to west.

Hence, the airplane will travel at $1100 + 100 = 1200 \text{ km/hr}$ while Coming from Delhi to Mumbai.

∴ The total time taken for the whole journey

$$= \frac{4800}{1000} + \frac{4800}{1200} = 4.8 + 4 = 8.8 \text{ hours}$$

Hence, **option 4**.

3. Let the speed of the ship upstream be 'u' miles/hr and speed downstream be 'd' miles/hr.

$$\text{Hence, } \frac{40}{u} + \frac{90}{d} = 10$$

$$\frac{60}{u} + \frac{60}{d} = 10$$

Solving for u and d,

$d = 15 \text{ miles/hr}$ and $u = 10 \text{ miles/hr}$

∴ The speed of the ship in still water

$$= \frac{d + u}{2} = \frac{15 + 10}{2} = 12.5 \text{ miles/hr}$$

Hence, **option 2**.

4. Total distance to be covered = Sum of the lengths of the trains = $210 + 120 = 330$ m
Since the answer options give the time in seconds, convert the speed of the 2 trains from km/hr to m/s.

Relative speed = Sum of the speeds
= $50 + 70 = 120 \text{ km/hr}$

$$= 120 \times \frac{5}{18} = 33.33 \text{ m/s}$$

∴ Time taken = $\frac{\text{Distance to be covered}}{\text{Relative speed}}$

$$= \frac{330}{33.33} = 9.9 \text{ seconds} \approx 10 \text{ seconds}$$

Hence, **option 3**.

5. Let Deepika's speed be $s_d \text{ km/hr}$.
Let Gurmeet's speed be $s_g \text{ km/hr}$.
Deepika walks in the same direction as Gurmeet.

∴ The relative speed of Deepika with respect to Gurmeet is $(s_d - s_g) \text{ km/hr}$.

∴ Gurmeet's speed is 4 km/hr , in 45 minutes Gurmeet would have travelled $(45/60) \times 4 = 3 \text{ kms}$.

Now, Deepika covers up these 3 kms in 36 minutes at a relative speed of $(s_d - s_g)$.

∴ Speed = Distance/Time

$$\therefore (s_d - s_g) = 3 \text{ km}/36 \text{ minutes} = (3 \times 60)/36$$

$$= 5 \text{ km/hr}$$

However, $s_g = 4 \text{ km/hr}$

$$\therefore s_d - 4 = 5$$

$$\therefore s_d = 9 \text{ km/hr}$$

Hence, **option 5**.

6. In one leap, Tom covers 3 m and in one minute he covers $= 12 \times 3 = 36 \text{ m}$

In one leap, Jerry covers 2 m and in one minute he covers $= 16 \times 2 = 32 \text{ m}$

In 4 minutes, Tom covers 144 m.

Now, Jerry is $200 - 144 = 56 \text{ m}$ away from Tom

Relative speed of Tom and Jerry $= 36 - 32$

$$= 4 \text{ m/min}$$

\therefore Time required for Tom to catch Jerry

$$= 56/4 = 14 \text{ min}$$

\therefore Total time taken by Tom to catch Jerry

$$= 14 + 4 = 18 \text{ min}$$

Hence, **option 5**.

7. Both the speeds given here are multiple of 18, hence convert them to m/s in the beginning itself.

Hence, $43.2 \text{ km/hr} = 43.2 \times 5/18 = 12 \text{ m/s}$

$54 \text{ km/hr} = 54 \times 5/18 = 15 \text{ m/s}$

\therefore The two cyclists start in opposite directions, the relative speed would be the sum of the two speeds $= 12 + 15 = 27 \text{ m/s}$

The faster cyclist will meet the slower one for the first time after $1080/27 = 40 \text{ sec}$

\therefore The faster cyclist meets the slower one after every 40 sec.

The faster cyclist completes one round every

$$1080/15 = 72 \text{ sec}$$

The slower cyclist completes one round every

$$1080/12 = 90 \text{ sec}$$

\therefore The two cyclists will meet for the first time at the starting point after the L.C.M. of the time taken by each to complete a round; L.C.M. (72, 90) = 360 sec.

\therefore When they meet at the starting point for the first time they would have met each other $360/40 = 9$ times (which includes their meeting at the starting point for the first time)

Hence, **option 4**.

8. Let d metres be the circumference of the circular track.

When Anu meets Bali for the first time, she covers 300 m and Bali covers $(d - 300) \text{ m}$.

When Anu meets Bali for the second time, Bali covers 40 m and Anu covers $(d - 40) \text{ m}$.

Bali has covered only 40 m in the second case as it is given that Bali is yet to complete one round.

Also, between the first and second meeting, Anu meets Bali at 260 m instead of 300 m.

Thus, Anu runs 40 m less than the circumference before meeting Bali for the second time.

Hence, Anu runs $(d - 40) \text{ m}$ between the first and second meeting.

In both the cases, whenever they meet, time taken is constant and hence distance travelled by them is proportional to their speed.

$$\therefore \frac{300}{(d - 300)} = \frac{(d - 40)}{40}$$

$$\therefore d = 340 \text{ m}$$

\therefore The circumference of the track is 340 m.

Hence, **option 4**.

9. Circumference of the circle, $C = 2\pi r = 10 \text{ cm}$

\therefore The distance between two adjacent points out of A, B, C and D is $10/4 = 2.5 \text{ cm}$

Let the speeds of the beetles at the points B, C and D be $b \text{ cm/s}$, $c \text{ cm/s}$ and $d \text{ cm/s}$ respectively.

The relative speed of the spider and the insect initially at B is equal to $(1 + b) \text{ cm/s}$, since their directions of travel are opposite.

$$\text{Relative Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\therefore 1 + b = \frac{2.5}{2.083}$$

$$\therefore b = 0.2 \text{ cm/s}$$

The relative speed of the spider and the insect initially at C is equal to $(1 - c) \text{ cm/s}$, since their directions of travel are the same.

$$\therefore 1 - c = \frac{5}{12.5}$$

$$\therefore c = 0.6 \text{ cm/s}$$

The relative speed of the spider and the insect initially at D is equal to $(1 - d) \text{ cm/s}$, since their directions of travel are the same.

$$\therefore 1 - d = \frac{7.5}{37.5}$$

$$\therefore d = 0.8 \text{ cm/s}$$

$$\therefore b : c : d = 0.2 : 0.6 : 0.8 = 1 : 3 : 4$$

Hence, **option 1**.

10. The relative speed of the swimmer swimming along with the stream is $(10 + 5) = 15 \text{ km/hr}$

$$= (1/4) \text{ km/min,}$$

The relative speed of the other swimmer swimming against the stream is $(10 - 5)$

$$= 5 \text{ km/hr}$$

$$= (1/12) \text{ km/min.}$$

Their relative speed with respect to each other is 20 km/hr and they are 25 km apart.

- \therefore Time taken by them to meet (cover 25 km)
 $= (25/20) = 1.25 \text{ hr} = 75 \text{ min}$
 Now in 74 min, distance covered by one swimmer is $74/4 \text{ km}$ and distance travelled by second swimmer is $74/12 \text{ km}$.
 i.e. They are $[25 - (74/4 + 74/12)] = 1/3 \text{ km}$ apart.
 Hence, **option 2**.

CLOCKS

PRACTICE TEST I

1. Between 7:30 and 8:00, the two hands of the clock will be at right angles only if the minute hand is ahead of the hour hand.
 $\therefore \theta = +90^\circ$
 Now $\theta = 6 \left| \frac{11}{12}m - 5h \right|$
 Using the formula, Now $\theta = 6 \left| \frac{11}{12}m - 5h \right|$
 Here, $h = 7$
 $\therefore 90 = 6 \left(\frac{11}{12}m - 5 \times 7 \right)$
 $\therefore \frac{11m}{12} = 15 + 35 = 50$
 $\therefore m = \frac{600}{11} = 54 \frac{6}{11} \text{ minutes.}$
 Hence, **option 2**.
2. To coincide with each other, the angle between them should be 0° .
 $\theta = 6 \left| \frac{11}{12}m - 5h \right|$
 Since $\theta = 0^\circ$
 $\frac{11}{12}m = 5h$
 Since the required time is between 1 O'clock and 2 O'clock, $h = 1$
 $11m = 60 \times 1$
 $\therefore m = \frac{60}{11} = 5 \frac{5}{11} \text{ minutes past 1}$
 Hence, **option 1**.
3. If a vertical line is drawn across an object dividing it into two symmetric halves, then in a mirror image both the halves exchange their places.
 \therefore If we draw a vertical line joining 12 and 6 in a clock, the clock is divided into two equal halves and they exchange their positions on the mirror.

- At the original time, the hour hand is between 7 and 8. Hence, in the mirror, the hour hand should be between 4 and 5.
 Similarly, at the original time, the minute hand is at 15. Hence, in the mirror, the minute hand should be at 45.
 \therefore Time on the mirror is 4 hours 45 minutes.
 Hence, **option 4**.

4. The angle at 2:35 is the same irrespective of whether it is a.m. or p.m.

At 2:35 a.m. $h = 2$ and $m = 35$

$$\therefore \theta = 6 \left| \frac{11}{12}m - 5h \right|$$

$$\therefore \theta = 6 \left| \frac{11 \times 35}{12} - 5 \times 2 \right|$$

$$\therefore \theta = \frac{11 \times 35 - 120}{2}$$

$$\therefore \theta = \frac{265}{2} = 132 \frac{1}{2}^\circ$$

Hence, **option 3**.

5. Between 5 O'clock and 6 O'clock, the two hands twice make an angle of 62° .
 $\therefore h = 5$ and $\theta = \pm 62^\circ$

Case (i): $\theta = +62^\circ$

$$\theta = 6 \left| \frac{11}{12}m - 5h \right|$$

$$\therefore 62 = 6 \left(\frac{11m}{12} - 5 \times 5 \right)$$

$$\therefore \frac{11m}{2} = 62 + 150 = 212$$

$$\therefore m = \frac{212 \times 2}{11} = \frac{424}{11.85}$$

$$= 38 \frac{6}{11} \text{ minutes past 5}$$

Case (ii): $\theta = -62^\circ$

$$\theta = 6 \left| \frac{11}{12}m - 5h \right|$$

$$\therefore -62 = 6 \left(\frac{11m}{12} - 5 \times 5 \right)$$

$$\therefore \frac{11m}{2} = -62 + 150 = 88$$

$$\therefore m = \frac{88 \times 2}{11} = 16 \text{ minutes past 5}$$

Hence, **option 4**.

6. When the hands of the clock are in the same straight line but not together, they are 30 minute spaces apart.
 At 7 o'clock, they are 25 minute spaces apart.
 \therefore Minute hand will have to gain only 5 minute spaces.
 55 minute spaces are gained in 60 minutes

$$5 \text{ minute spaces are gained in } \left(\frac{60}{55} \times 5\right) \text{ min}$$

$$= 5 \frac{5}{11} \text{ minutes}$$

$$\therefore \text{Required time} = 5 \frac{5}{11} \text{ minutes past 7.}$$

Hence, **option 1.**

7. At 3 o'clock, the minute hand is 15 minute spaces apart from the hour hand.
For the two hands to coincide, the minute hand must gain 15 minute spaces.
55 minute spaces are gained in 60 minutes.

$$\text{So, 15 minutes are gained in } \left(\frac{60}{55} \times 15\right) \text{ min}$$

$$= 16 \frac{4}{11} \text{ minutes}$$

\therefore The hands are coincident at

$$16 \frac{4}{11} \text{ minutes past 3.}$$

Hence, **option 4.**

8. At 5 o'clock, the hands are 25 minute spaces apart.
To be at right angles and that too between 5.30 and 6, the minute hand has to gain $(25 + 15) = 40$ minute spaces.
55 minute spaces are gained in 60 minutes.
40 minute spaces are gained in

$$\left(\frac{60}{55} \times 40\right) \text{ min} = 43 \frac{7}{11} \text{ minutes}$$

$$\therefore \text{Required time} = 43 \frac{7}{11} \text{ minutes past 5.}$$

Hence, **option 5.**

9. Here, $h = 4$ and $m = 20$

$$\therefore \theta = 6 \left(\frac{11m}{12} - 5h \right)$$

$$\therefore \theta = \left(\frac{11 \times 20}{2} \right) - (6 \times 5 \times 4) = 10^\circ$$

Here, the angle is actually -10 because the hour hand is ahead of the minute hand.

Hence, **option 3.**

10. Here, $h = 4$ and $m = 40$

$$\therefore \theta = 6 \left(\frac{11m}{12} - 5h \right)$$

$$\therefore \theta = \left(\frac{11 \times 40}{2} \right) - (6 \times 5 \times 4) = 100^\circ$$

Hence, **option 1.**

TIME AND WORK

PRACTICE TEST I

1. A alone completes the work in 4 days.
 \therefore Work completed by A in 1 day = $1/4$
B alone completes the work in 5 days.
 \therefore Work completed by B in 1 day = $1/5$
 \therefore Total work done in one day = $1/4 + 1/5$
 $= 9/20$
 \therefore Number of days to complete the work
 $= 20/9$

Hence, **option 2.**

2. Let B alone take b hours to complete the work.

\therefore Work completed by B in one hour = $1/b$
A takes 25 hours to complete the work alone.

\therefore Work completed by A in one hour = $1/25$
Work done by A and B together in 1 hour

$$= \frac{1}{25} + \frac{1}{b}$$

A and B can complete the job together in 10 hours.

$$\therefore \frac{1}{25} + \frac{1}{b} = \frac{1}{10}$$

$$\therefore \frac{1}{b} = \frac{1}{10} - \frac{1}{25}$$

$$\therefore \frac{1}{b} = \frac{3}{50}$$

$$\therefore b = \frac{50}{3} = 16.66 \text{ hours}$$

Hence, **option 3.**

Alternatively,

Using the concept of assumed total work.

Let the total work to be done be the L.C.M of 25 and 10 i.e. 50 units.

Hence, A can do $50/25 = 2$ units of work per hour.

Similarly, A and B together can do $50/10 = 5$ units of work per hour

Hence, B alone can do $5 - 2 = 3$ units of work per hour.

Hence, B can complete 50 units of work in $50/3$

$= 16.66$ hours.

Hence, **option 3.**

3. Rate at which the tank empties = (Capacity of the tank)/(Time taken to empty the tank)

$$= \frac{1300}{7.2} = 180.55 \frac{\text{litres}}{\text{min}}$$

Hence, **option 3.**

4. The man is half as efficient as the woman.

The woman completes $2/3^{\text{rd}}$ of a task in 1 day.

\therefore The man completes half of it i.e. $1/3^{\text{rd}}$ of a task in 1 day.

\therefore The man completes the task in 3 days.

Hence, **option 4**.

5. Let the total work be 1 unit

In half a day, $\left(\frac{1}{2}\right) \left(\frac{7}{8}\right)$ of work is done

$$\text{Work left} = 1 - \frac{7}{16} = \frac{9}{16}$$

Hence, **option 1**.

6. In such a case, Total work = Number of workers \times Working hours per day \times Number of days

Also, since a room of specific dimensions is being built, the work can be equated in terms of the volume of the room.

Hence,

$$\text{Total work} = \text{Length} \times \text{Breadth} \times \text{Height}$$

Hence,

Let the number of men required in the second case be x .

$$\therefore \frac{10 \times 7 \times 16}{x \times 7 \times 8} = \frac{60 \times 5 \times 14}{50 \times 6 \times 28}$$

$$\therefore x = 40$$

Hence, **option 3**.

7. Ajay and Vijay can individually complete the project in 8 and 16 days respectively. Hence, in one day Ajay and Vijay will individually complete $(1/8)^{\text{th}}$ and $(1/16)^{\text{th}}$ part of the project respectively. Since, they work alternately, the portion of the project completed by them in 2 days will be equal to

$$\left(\frac{1}{8} + \frac{1}{16}\right) = \frac{3}{16}$$

\therefore Over 5 such sessions (i.e. 10 days), they can complete

$$5 \times \frac{3}{16} = \frac{15}{16} \text{ parts of the project.}$$

Now, $1 - 15/16 = 1/16^{\text{th}}$ of the project is remaining.

On the 11th day, it is Ajay's turn. Ajay's work rate is $1/8$ and the work to be done is $1/16$

$$\therefore \text{Time required by Ajay} = \frac{\text{Work to be done}}{\text{Work rate}}$$

$$= \left(\frac{1}{\frac{16}{1}} \times \frac{1}{8}\right) = 0.5$$

Hence, an additional half a day is required.

Hence, both of them together require 10.5 days, if they work alternately (starting with Ajay).

Hence, **option 4**.

8. A can complete the entire work alone in 40 days.

Also, B does some proportion of the work alone in 21 days.

So, let the total work be the LCM of 40 and 21 i.e. 840 units

So, A can do $840/40$ i.e. 21 units/day

Since A works alone for 5 days, work done by $A = 5 \times 21 = 105$ units

B completes the remaining $840 - 105 = 735$ units of work in 21 days.

Thus, B can do $735/21 = 35$ units/day.

Therefore, if A and B started together, they could do $21 + 35$ i.e. 56 units of work/day.

So, time taken to complete 840 units of work $= 840/56 = 15$ days.

Thus, A and B can together complete the work in 15 days.

Hence, **option 4**.

9. Pipe A alone fills the tank in 4 hours.

\therefore Portion of the tank filled by A alone in 1 hour = $1/4$

Pipe B alone fills the tank in 12 hours.

\therefore Portion of the tank filled by B alone in 1 hour = $1/12$

Pipe C alone empties the tank in 3 hours.

\therefore Portion of the tank emptied by C alone in 1 hour = $1/3$

\therefore When all three pipes are opened simultaneously, then in 1 hour:

Portion of tank filled = Portion of tank filled by A + Portion of tank filled by B - Portion of tank emptied by C

$$\text{Tank filled in 1 hour} = \frac{1}{4} + \frac{1}{12} - \frac{1}{3} = 0$$

Hence, in one hour, there is no net inflow or outflow in the tank.

Hence, at the end of five hours as well, the tank neither spills nor gets empty.

Thus, it remains full.

Hence, **option 2**.

10. Pipe A alone empties the tank in 3 hours.

\therefore Tank emptied by A in 1 hour = $1/3$

Pipe B alone fills the tank in 9 hours.

\therefore Tank filled by B in 1 hour = $1/9$

Pipe C alone fills the tank in 12 hours.

\therefore Tank filled by C in 1 hour = $1/12$

When all the three pipes are opened simultaneously, then in 1 hour:

Tank emptied = Tank emptied by A - Tank filled by B - Tank filled by C

$$= \frac{1}{3} - \frac{1}{9} - \frac{1}{12} = \frac{5}{36}$$

∴ Portion of the tank emptied in 1 hour = 5/36

Thus, the tank gets empty in 36/5 or 7.2 hours.

Hence, **option 1**.

PRACTICE TEST II

1. The number of days taken by the man, woman and child (working together) to complete the work = 6

Work done in 1 day when all 3 work together = 1/6

Let the man take m days to finish the task.

Number of days taken by a woman = $3m$ and number of days taken by a child = $6m$

Work done by them in one day can be given as,

$$\frac{1}{m} + \frac{1}{3m} + \frac{1}{6m} = \frac{1}{6}$$

$$\therefore \frac{9}{6m} = \frac{1}{6}$$

$$\therefore 6m = 54$$

∴ Time taken by the child alone to complete the job is 54 days.

Hence, **option 4**.

Note: We did not cancel 6 in the equation above as the time taken by a child ($6m$) was needed. Had we cancelled, we would have got m and then we would have had to multiply it again by 6.

2. Let the men with equal capacity take x days each to complete the task alone and let A take y days to complete the task alone.

Then work done in 1 day by each of the 4 equal capacity men = $1/x$

Work done in 1 day by A = $1/y$

Also, 4 equal capacity men and A complete the work in 5 days.

∴ Work done in 1 day by all of them together = 1/5

$$\therefore \frac{4}{x} + \frac{1}{y} = \frac{1}{5} \quad \dots (i)$$

A man with double capacity of A takes $y/2$ days to do the job.

∴ We get:

$$\frac{3}{x} + \frac{1}{\frac{y}{2}} = \frac{1}{3}$$

$$\therefore \frac{3}{x} + \frac{2}{y} = \frac{1}{3} \quad \dots (ii)$$

Substituting $1/x$ as m and $1/y$ as n in (i) and (ii), we get,

$$4m + n = 1/5$$

$$3m + 2n = 1/3$$

Solving, we get,

$$m = 1/75 \text{ and } n = 11/75$$

$$\therefore x = 75 \text{ and } y = 75/11$$

∴ Each of the men of equal capacity can complete the task alone in 75 days.

Hence, **option 2**.

3. Let the total task be equivalent to the LCM of 14, 8 and 7 i.e. 56 units.

∴ A and B together complete the task in 14 days

∴ They can together complete 56/14

$$= 4 \text{ units/day}$$

$$\therefore A + B = 4$$

Similarly,

$$B + C = 7 \text{ and}$$

$$C + A = 8$$

Solving the 3 equations simultaneously,

$A = 2.5$ units/day, $B = 1.5$ units/day and C

$= 5.5$ units/day

∴ C does the maximum work in a single day, and is the most efficient.

Hence, **option 3**.

Alternatively,

∴ A and B together take more time than C and B together to complete the same task, the additional time required must be because of A.

∴ A is slower than C.

∴ C is more efficient than A.

Similarly, A and B together take more time than A and C together to complete the same task. Hence, in this case, the additional time taken must be because of B.

∴ B is slower than C.

∴ C is more efficient than B.

∴ C is more efficient than A as well as B.

∴ C is the most efficient.

Hence, **option 3**.

4. The least efficient person in the group is B (refer to the previous question).

Let A take a days, B take b days and C take c days to complete the task.

$$\text{Task completed by A in 1 day} = \frac{1}{a}$$

$$\text{Task completed by B in 1 day} = \frac{1}{b}$$

Task completed by C in 1 day = $\frac{1}{c}$

$$\frac{1}{a} + \frac{1}{b} = \frac{1}{14} \quad \dots (i)$$

$$\frac{1}{b} + \frac{1}{c} = \frac{1}{8} \quad \dots (ii)$$

$$\frac{1}{a} + \frac{1}{c} = \frac{1}{7} \quad \dots (iii)$$

(iii) - (ii) gives us,

$$\frac{1}{a} - \frac{1}{b} = \frac{1}{56} \quad \dots (iv)$$

(i) - (iv) gives us,

$$\frac{2}{b} = \frac{3}{56} \text{ or } \frac{1}{b} = \frac{3}{112}$$

Putting the value of $1/b$ in equation (i),

$$1/a = 5/112.$$

Putting the value of $1/b$ in equation (ii), $1/c = 11/112$.

\therefore A, B and C take $112/5$, $112/3$ and $112/11$ days respectively to complete the task alone.

When multiple fractions have the same numerator, the largest fraction is the one that has the smallest denominator.

\therefore B takes the longest time to complete the task alone.

\therefore B, the least efficient amongst the three takes $112/3$ days to complete the task alone.

Hence, **option 2**.

5. Let the rate of the outlet pipe be x m³/min.

Filling rate when both pipes are open = $(200 - x)$ m³/min $\dots (i)$

Time taken for the tank to fill when both pipes are open = 20 minutes

Capacity of tank = 1400 m³

$$\therefore \text{Filling rate} = \frac{1400}{20} = 70 \text{ m}^3/\text{min} \quad \dots (ii)$$

From (i) and (ii), we get,

$$200 - x = 70$$

$$\therefore x = 130 \text{ m}^3/\text{min}$$

If the inlet pipe is not open, the outlet pipe empties a completely filled tank in

$$\frac{1400}{130} = 10 \frac{10}{13} \text{ min}$$

Hence, **option 4**.

6. 20 men working 5 hours of a day can build a wall in 10 days.

These 20 men have worked for 6 days. This implies that they have built $6/10$ i.e. 60% of the wall in 6 days.

Since the length of the wall is 190 feet, part of wall completed in 6 days = $0.6 \times 190 = 114$ feet.

Now, amount of wall still left = $190 - 114 = 76$ feet.

Also, number of men left = $20 - 4 = 16$

The rate of working is the same in both cases.

Let the number of days now required be d .

$$\therefore \frac{114}{76} = \frac{20 \times 5 \times 6}{16 \times 5 \times d}$$

$$\therefore d = 5 \text{ days}$$

Hence, **option 2**.

7. Amount of work **done** by Arjun in one day = $1/7$

Amount of work done by Karan in one day = $1/11$

Amount of work done by Arjun and Karan in one day = $1/7 + 1/11 = 18/77$

\therefore Number of days required to complete the work = $77/18 = 4.28$ days

Hence, **option 3**.

8. Pipe A can fill the tank in 4 minutes.

Part of tank filled by pipe A in one minute = $1/4$

Pipes A and B can together fill the tank in 3 minutes.

Part of tank together filled by pipes A & B in one minute = $1/3$

In one minute, pipe B can fill

$$\frac{1}{3} - \frac{1}{4} = \frac{1}{12} \text{ th of the tank}$$

Thus, B alone can fill the tank in 12 minutes.

Hence, **option 2**.

9. In one day X can finish $1/15^{\text{th}}$ of the work.

In one day Y can finish $1/10^{\text{th}}$ of the work.

Let us say that in one day Z can complete, $1/Z^{\text{th}}$ of the work.

When all the three work together, in one day the can complete,

$$= \frac{1}{15} + \frac{1}{10} + \frac{1}{Z} \text{ th of the work}$$

According to the question,

$$\frac{1}{15} + \frac{1}{10} + \frac{1}{Z} = \frac{1}{5}$$

$$\text{Or, } Z = 30 \text{ days}$$

$$\begin{aligned} \text{So, ratio of their efficiencies} &= \frac{1}{15} : \frac{1}{10} : \frac{1}{30} \\ &= 2 : 3 : 1 \end{aligned}$$

So, out of Rs. 720, share of Z = $1/6 \times 720$

= Rs. 120

Hence, **option 1**.

10. A and B can individually complete the project in 20 and 30 days respectively.

Let the total work pertaining to the project be the LCM of 20 and 30 i.e. 60 units.

So, A can do $60/20 = 3$ units of work per day and B can do $60/30 = 2$ units of work per day.

Thus, when A and B work together, they do $3 + 2 = 5$ units of work per day.

A quits 10 days before the project is completed.

So, for the last 10 days, B works alone.

In these 10 days, B completes $10 \times 2 = 20$ units of work

Thus, A and B completed $60 - 20 = 40$ units of work when they worked together.

So, A and B worked together for $40/5 = 8$ days

So, total time for project to be completed = $8 + 10 = 18$ days

Hence, **option 5**.

NUMBER SYSTEMS

Practice Test I

$$\begin{aligned} 1. & 1.5 + 1.8 \div 0.9 + (3 - 4) - 1.2 \times 2 \\ & = 1.5 + 1.8 \div 0.9 - 1 - 1.2 \times 2 \\ & = 1.5 + 2 - 1 - 2.4 \\ & = 0.1 \end{aligned}$$

Hence, **option 5**.

$$\begin{aligned} 2. & [3 + (2 - 4) \times 7 + 3 - (8 \times 2 - 12) \div 4] \\ & = [3 + (-2) \times 7 + 3 - (16 - 12) \div 4] \\ & = [3 + (-2 \times 7) + 3 - (4 \div 4)] \\ & = (3 - 14 + 3 - 1) \\ & = -9 \end{aligned}$$

Hence, **option 1**.

$$\begin{aligned} 3. & \left(5 + \left[\frac{1}{3} + \frac{1}{4}\right] \times 12 - 3\right) - 3 \times \frac{1}{3} \\ & = 5 + \left(\frac{7}{12} \times 12\right) - 3 - 1 \\ & = (5 + 7 - 3) - 1 \\ & = 9 - 1 = 8 \end{aligned}$$

Hence, **option 1**.

$$\begin{aligned} 4. & \frac{13}{3} - \left\{\frac{1}{6} \times \left(3 + \frac{11}{5} + 5 - \frac{21}{5}\right)\right\} \\ & = \frac{13}{3} - \left\{\frac{1}{6} \times \left(8 - \frac{10}{5}\right)\right\} \\ & = \frac{13}{3} - \left\{\frac{1}{6} \times (6)\right\} = \frac{13}{3} - 1 = \frac{10}{3} = 3\frac{1}{3} \end{aligned}$$

Hence, **option 2**.

$$\begin{aligned} 5. & 5 = [(3 + 4)^y - 24]^{0.5} \\ \therefore & 5^2 = [(3 + 4)^y - 24] \\ \therefore & 25 = 7^y - 24 \\ \therefore & 49 = 7^y \\ \therefore & y = 2 \end{aligned}$$

Hence, **option 2**.

$$6. \frac{\sqrt{0.25} \times \sqrt{x}}{\sqrt{1_{16}^9}} + \sqrt{0.0169}$$

= 0.25 can be written as

$$\frac{0.5 \times \sqrt{x}}{\sqrt{\frac{25}{16}}} + 0.13 = 0.25$$

$$\therefore \frac{0.5 \times \sqrt{x} \times 4}{5} = 0.12$$

$$\therefore \sqrt{x} = \frac{0.12 \times 5}{0.5 \times 4} = 0.3$$

$$\therefore x = 0.09$$

Hence, **option 2**.

$$7. \frac{\sqrt{p^2 q^6 r^8} \times \sqrt[3]{p^3 q^2 r^6}}{(pqr)^2 \times \sqrt{p^5 q^4 r^7}} \text{ can be written as}$$

$$\frac{pq^3 r^4 \times pq^{\frac{2}{3}} r^2}{p^2 q^2 r^2 \times p^{\frac{5}{2}} q^2 r^{\frac{7}{2}}}$$

$$= \frac{p^2 q^{\frac{11}{3}} r^6}{p^2 q^4 r^{\frac{11}{2}}}$$

$$= p^{-\frac{5}{2}} q^{-\frac{1}{3}} r^{\frac{1}{2}}$$

$$= (p^{-5} r)^{\frac{1}{2}} q^{-\frac{1}{3}}$$

Hence, **option 4**.

8. Let the required number be N .

Since, the remainder is 2 when the number is divided by 13, you can write,

$$N = 13Q + 2$$

$$\text{Hence, } N^2 = (13Q + 2)^2$$

$$\therefore N^2 = (13Q)^2 + 2(13Q)(2) + (2)^2 = 169Q^2 + 52Q + 4$$

The first two terms are divisible by 13, but 4 is not divisible by 13.

\therefore The remainder is 4.

Hence, **option 2**.

9. Let the original number be x .

According to the question,

$$\frac{7}{4} \times x - \frac{4}{7} \times x = 99$$

$$\therefore \frac{(49 - 16)x}{28} = 99$$

$$\therefore \frac{33x}{28} = 99$$

$$\therefore x = 84$$

Hence, **option 4**.

10. Whatever be the value of n , $32n$ is divisible by 16.

So, we need to check whether $82n^3$ is divisible by 16 or not.

$$82n^3 = (80 + 2)n^3$$

$$= (16 \times 5 + 2)n^3$$

$$\therefore 2 \times n^3 \text{ must be divisible by } 16$$

$$\therefore n^3 = 8$$

$$\therefore n = 2$$

Hence, **option 1.**

NUMBER THEORY

PRACTICE TEST I

1. $12 = 2^2 \times 3$

$24 = 2^3 \times 3$

$16 = 2^4$

$32 = 2^5$

$8 = 2^3$

The factor common to all the numbers is 2 and its highest power available among all the given numbers is 2^2 i.e. 4

Hence, the HCF is 4.

Hence, **option 2.**

2. All the signals will become red again for the first time at the LCM of the time taken by each signal respectively to turn red.

$8 = 2^3$

$12 = 2^2 \times 3$

$16 = 2^4$

$20 = 2^2 \times 5$

$\text{LCM of } 8, 12, 16 \text{ and } 20 = 2^4 \times 3 \times 5 = 240\text{s}$

$= 4 \text{ minutes}$

Thus, all four signals will turn red again for the first time after 4 minutes.

Hence, **option 4.**

3. $32 = 2^5$

$128 = 2^7$

$512 = 2^9$

$1024 = 2^{10}$

Thus, the LCM of the 4 numbers will be the highest power of 2 i.e. $2^{10} = 1024$

Hence, $X = 1024$ and sum of digits of X

$= 1 + 0 + 2 + 4 = 7$

Hence, **option 2.**

4. As one group consists of students from only one class, 91, 143 and 208 students should be divided into equal sized groups of the largest possible size.

Thus, you need to find HCF (91, 143, 208).

$91 = 7 \times 13$

$143 = 11 \times 13$

$208 = 4 \times 4 \times 13$

$\text{Thus, HCF } (91, 143, 208) = 13$

Therefore, the largest possible group size is 13.

Hence, **option 4.**

5. Let the required number be x .

When 98 is divided by x , we get a remainder 2.

Therefore, when 96 is divided by x , the remainder should be 0.

Therefore, 96 is divisible by x .

Similarly, 144, 264 and 360 are divisible by x .

The largest number that will divide these numbers will be the HCF of these numbers.

Therefore, find the HCF of 96, 144, 264 and 360.

$$\therefore x = \text{HCF } (96, 144, 264, 360)$$

By factorization,

$96 = 2^5 \times 3$

$144 = 2^4 \times 3^2$

$264 = 2^3 \times 3 \times 11$

$360 = 2^3 \times 3^2 \times 5$

$$\therefore x = \text{HCF } (96, 144, 264, 360) = 2^3 \times 3 = 24$$

$$\therefore \text{The required number is } 24.$$

Hence, **option 2.**

6. Let the required number be x .

HCF \times LCM of two numbers

= Product of the two numbers

$$\therefore 7200 \times 18 = 450 \times x$$

$$\therefore x = \frac{7200 \times 18}{450} = 288$$

Hence, **option 3.**

7. \therefore HCF of both the numbers = 9.

Hence, the numbers are multiples of 9 i.e. of the form $9a$ and $9b$

Also, LCM will be of the form $9(a \times b)$

$$\therefore 108 = 9(a \times b)$$

$$\therefore a \times b = 12$$

\therefore The possible combinations are:

$a = 1$ and $b = 12$ [The final numbers are 9 and 108]

$a = 3$ and $b = 4$ [The final numbers are 27 and 36]

$a = 2$ and $b = 6$ [The final numbers are 18 and 54. This case is not possible as HCF changes to 18 from 9]

In an ordered pair, the order of the two values is important.

Hence, (x, y) and (y, x) are two different ordered pairs.

\therefore The total number of ordered pairs of integers (x, y) is 4

i.e. $[(9, 108), (27, 36), (108, 9), (36, 27)]$

Hence, **option 1.**

8. The highest 4 digit number divisible by 12, 40, 32 and 72 will be a multiple of the L.C.M. of the given four numbers.

$12 = 2^2 \times 3$

$40 = 5 \times 2^3$

$$32 = 2^5$$

$$72 = 2^3 \times 3^2$$

$$\therefore \text{L.C.M.} = 2^5 \times 3^2 \times 5 = 1440$$

Now, the highest 4 digit number is 9999

It is clear that 9999 is not divisible by 1440.

Therefore, the required number has to be some number smaller than 9999 and divisible by 1440.

If we divide 9999 by 1440, we get a remainder of 1359

$$\text{Hence, the highest 4 digit number divisible by } 1440 = 9999 - 1359 = 8640$$

$$\therefore N = 8640$$

Hence, **option 3**.

9. Since 2 is the HCF of the two numbers, let the uncommon factors in these two numbers be x and y respectively.

Therefore, the 2 numbers will be $2x$ and $2y$ respectively.

$$\therefore 2x \times 2y = 1924$$

$$\therefore xy = 481$$

But 481 can be expressed as 13×37

$$\text{Thus, the larger of 2 numbers is } a = 37 \times 2 = 74 \text{ and } b = 13 \times 2 = 26$$

Hence, **option 4**.

10. When a perfect square is expressed in terms of powers of its prime factors, the powers are all even.

1260 can be expressed in terms of powers of its prime factors as $2^2 \times 3^2 \times 5 \times 7$.

Now, observe that the powers of 5 and 7 here are odd, i.e. 5 and 7 occur alone in this prime factor representation.

Therefore, 1260 must be multiplied by $5 \times 7 = 35$ to make it a perfect square.

Hence, **option 3**.

11. $123x$ is divisible by 7, therefore, $123 - 2x$ should also be divisible by 7.

Now, $123 - 2x$ is divisible by 7,

$$\text{when } 123 - 2x = 119, 105$$

These are the only multiples of 7 possible if x is a single digit.

Therefore, $123x$ is divisible by 7 when $x = 2, 9$

Hence, options 2 and 3 can be eliminated.

Now, when $x = 2$, the number becomes 1232.

The sum of the digits of this number

$$= 1 + 2 + 3 + 2 = 8$$

\therefore This number is not divisible by 3.

Now, when $x = 9$, the number becomes 1239.

The sum of the digits of this number

$$= 1 + 2 + 3 + 9 = 15$$

This number is divisible by 3.

$\therefore 123x$ is divisible by 3 as well as 7 when $x = 9$

Hence, **option 4**.

12. Let the equal remainder be r .

So, $1086 - r$, $946 - r$ and $995 - r$ are divisible by the required number.

Thus, $(1086 - r) - (946 - r)$ is also divisible by the required number.

Thus, 140 is divisible by the required number.

Similarly, 49 and 91 are also divisible by the required number.

Thus, the required number has to be the HCF of 49, 91 and 140.

$$49 = 7^2$$

$$91 = 7 \times 13$$

$$140 = 2^2 \times 5 \times 7$$

Thus, the required number i.e. the HCF is 7

Hence, **option 4**.

13. Let the other number be x .

For two numbers,

H.C.F \times L.C.M = product of two numbers

$$\text{So, } 36 \times 1950 = 234 \times x$$

$$\text{Or, } x = 300$$

Hence, **option 2**.

14. On observation we see that,

$$3 - 1 = 2, 4 - 2 = 2 \text{ and } 5 - 3 = 2$$

Since the difference is constant i.e. 2, the required number = LCM (3, 4, 5) - 2

The L.C.M of 3, 4, 5 is 60

$$\therefore \text{The required number is } = 60 - 2 = 58$$

Hence, **option 1**.

15. LCM of 3, 4, 5 and 8 is 120.

The least 4 digit number, which is a multiple of 120 is 1080.

Hence, the answer should be 1080 which is not given in any of the options.

Hence, **option 5**.

CALENDARS

PRACTICE TEST I

1. 17th May 2003 = 2000 years + 2 years + 1st

January 2003 to 17th May 2003.

2000 years have 0 odd days.

2001 and 2002 are both non-leap years.

Hence, these 2 years have 2 odd days.

Now consider the period from 1st January 2003 to 17th May 2003.

Month: Jan + Feb + Mar + Apr + May

$$\text{Odd days: } 3 + 0 + 3 + 2 + 3$$

$$= 11 \text{ odd days}$$

$$\text{Total number of odd days} = 2 + 11 = 13 \text{ odd days}$$

$$13 \div 7 = 1 \text{ week} + 6 \text{ odd days}$$

6 odd days implies Saturday.

Hence, 17th May 2003 is a Saturday.

Hence, **option 1**.

2. Consider the period 1900 to 2000.

The first leap year in this period is in 1904 and the 25th leap year is in 2000. Hence, there are 25 leap years and 2 centuries (1900 and 2000) in this period.

Hence, there can be at most 2 centuries in the given period.

Now, consider the period 1901 to 2000. While there are 25 leap years in this period as well, there is only

1 century (2000).

Hence, there has to be at least 1 century in the given period.

Hence, only statements 1 and 4 are true.

Hence, **option 3**.

3. March 2008 = 2000 years + 7 years + 1st January 2008 to March 2008

2000 years have 0 odd days.

7 years consist of 1 leap year and 6 non leap years.

1 leap year has 2 odd days and 6 non leap years have 6 odd days.

∴ Number of odd days in 7 years = 8

In 2008,

January will have 3 odd days.

February will have 1 odd day as 2008 is a leap year.

∴ Total number of odd days before 1st March 2008

= $8 + 3 + 1 = 12$ or 5 odd days.

Hence, the 6th odd day (Saturday) has to correspond to 1st March 2008.

Hence, 2nd March has to be the 1st Sunday of March.

Hence, the Sundays in March have to fall on the dates 2, 9, 16, 23 and 30.

Hence, **option 1**.

4. 26th March, 2023 = 2000 years + 22 years + 1st January 2023 to 26th March 2023

2000 years have 0 odd days.

22 years have 5 leap years and 17 non leap years.

Hence, number of odd days in 22 years

= $(5 \times 2) + (17 \times 1) = 27$

Consider the year 2023:

Month: Jan + Feb + Mar

Odd days: $3 + 0 + 5$

= 8 odd days

In March, 5 odd days are taken because the period up to 26th March is considered.

Total number of odd days = $27 + 8 = 35$ odd days

$35 \div 7 = 5$ weeks + 0 odd days

Hence, total number of odd days = 0

Hence, 26th March, 2023 should be a Sunday.

Hence, **option 5**.

5. The remainder of $436 \div 9$ will give the number of odd days in that calendar year.

$436 = (9 \times 48) + 4$

Hence, this year will have 48 weeks and 4 odd days.

Hence, the number of odd days in that particular calendar year is 4.

Hence, **option 4**.

6. Since 1988 is a leap year and as your birthday is before February 29, your birthday in the next year will be two days after Tuesday.

This is because a leap year has two odd days.

Hence, your birthday will fall on a Thursday next year.

Hence, **option 2**.

7. The number of odd days from 6th November to 29th November in the same calendar year = the remainder of $23 \div 7$ i.e. 2.

Hence, 29th November corresponds to

Monday + 2 = Wednesday.

Hence, **option 4**.

8. Consider the period from 16th November 1993 to

16th November 2008.

From 1993 to 2008, total completed years

= $2008 - 1993 = 15$ years

Out of these 15 years,

Number of leap years = 4 and number of non-leap years = 11

∴ Number of odd days from 1993 to 2008

= $(11 \times 1) + (4 \times 2) = 19$

Now, number of odd days from 25th October, 1993 to 16th November, 1993 = $6 + 2 = 8$

∴ Total number odd days = $19 + 8 = 27$ or $27 + 7$

= 6 odd days

Hence, 6 days from Monday implies

Monday + 6 = Sunday

Hence, **option 1**.

9. The number of odd days between 30th March 1996 and 9th March 1996 is 21.

$(21 \div 7 = 0$ odd days)

Hence, 9th March 1996 was also a Friday.

1996 is a leap year. However, 9th March 1996 is after 29th February.

Hence, the number of odd days from 9th March 1996 to 9th March 1997 is only 1.

Hence, 9th March 1997 is a Saturday.

Hence, **option 2**.

10. There are 100 years between January 26, 1903 and January 26, 2003. There are 25 leap years and 75 non leap years in this period.
 $(\because 2000 \text{ is a leap year})$
 \therefore Number of odd days = $(25 \times 2) + (75 \times 1)$
 $= 125 = 17 \text{ weeks} + 6 \text{ days}$
 Hence, there are 6 odd days.
 Since we are going back in time, the number of odd days needs to be reduced from Sunday. 6 days before Sunday is Monday.
 \therefore January 26, 1903 was a Monday.
 Hence, **option 2**.

ALGEBRAIC FORMULAE AND OPERATIONS

PRACTICE TEST I

1. $(12x^2 - 12xy + 9y^2) + (6xy + 7y^2)$
 $= 12x^2 + (-12 + 6)xy + (9 + 7)y^2$
 $= 12x^2 - 6xy + 16y^2$
 Hence, **option 1**.
2. $(5x - 8y + 3z) \times (6x^2 - 7y^2)$
 $= 5x(6x^2 - 7y^2) - 8y(6x^2 - 7y^2)$
 $\quad + 3z(6x^2 - 7y^2)$
 $= 30x^3 - 35xy^2 - 48x^2y + 56y^3 + 18x^2z$
 $\quad - 21y^2z$
 Hence, **option 5**.
3. Since $(a - b)^2 = (a + b)^2 - 4ab$
 $\therefore (a - b) = \sqrt{81 - 77} = \pm 2$
 Only +2 is among the options given.
 Hence, **option 3**.
4. $(12a^2 - 12ab - 9b^2) \div (6a + 3b)$
 $(12a^2 - 12ab - 9b^2)$
 $= 12a^2 - 18ab + 6ab - 9b^2$
 $= 6a(2a - 3b) + 3b(2a - 3b)$
 $= (6a + 3b)(2a - 3b)$
 $\therefore (12a^2 - 12ab - 9b^2) \div (6a + 3b)$
 $= [(6a + 3b)(2a - 3b)] \div (6a + 3b)$
 $= (2a - 3b)$
 Hence, **option 4**.
5. $x^2y^2 - 8xy - 48$
 $= x^2y^2 - 12xy + 4xy - 48$
 $= xy(xy - 12) + 4(xy - 12)$
 $= (xy - 12)(xy + 4)$
 Hence, **option 2**.
6. $(2x^3 - 5x^2y - 12xy^2)$
 $= x(2x^2 - 5xy - 12y^2)$
 $= x(2x^2 - 8xy + 3xy - 12y^2)$
 $= x[2x(x - 4y) + 3y(x - 4y)]$
 $= x(2x + 3y)(x - 4y)$
 Hence, **option 4**.
7. The average marks of a student is the ratio of the total marks of all the students to the number of students
 $= (x^2 + 4x + 3)/(x + 1)$
 $= [(x + 1)(x + 3)]/(x + 1)$
 $= x + 3$
 $\therefore x + 3 = 49$
 $\therefore x = 46$
 \therefore The number of students in the class = $x + 1$
 $= 47$
 Hence, **option 2**.
8. $(x^4 - 11x^2 + 10)$
 $= x^4 - 10x^2 - x^2 + 10$
 $= x^2(x^2 - 10) - 1(x^2 - 10)$
 $= (x^2 - 10)(x^2 - 1)$
 $= (x - 1)(x + 1)(x^2 - 10)$
 Hence, **option 3**.
9. Given that, $a^2 + \frac{1}{a^2} = 7$
 $\left(a + \frac{1}{a}\right)^2 = a^2 + \frac{1}{a^2} + 2 = 7 + 2 = 9$
 $\therefore \left(a + \frac{1}{a}\right) = \sqrt{9} = \pm 3$
 Among 3 and -3, only -3 is given in the option.
 Hence, **option 1**.
10. $3x + 4x^4y^4 + 6x^3z + 5x^2y^2z^2$
 $= x(3 + 4x^3y^4 + 6x^2z + 5xy^2z^2)$
 Thus, x is one of the divisors.
 Hence, **option 1**.

SURDS AND INDICES

Practice Test I

1. A pure surd does not have any term outside the root sign.
 To convert a mixed surd into a pure surd, take the coefficient of the surd inside the root sign.
 $3\sqrt{13} = \sqrt{13 \times 3 \times 3} = \sqrt{13 \times 9} = \sqrt{117}$.
 Hence, **option 4**.
2. Since both the terms in the numerator are in the form of square roots, try and express each term as a perfect square.
 $\frac{\sqrt{9} \times \sqrt{2916}}{2} = \frac{3 \times 54}{2} = 81$.
 Hence, **option 1**.
3. To rationalize the surd, multiply the denominator as well as the numerator by the conjugate of the denominator.
 i.e. $(4 + \sqrt{3})$

$$\begin{aligned} & \frac{1}{4-\sqrt{3}} \times \frac{4+\sqrt{3}}{4+\sqrt{3}} \\ &= \frac{4+\sqrt{3}}{(4-\sqrt{3}) \times (4+\sqrt{3})} \\ &= \frac{4+\sqrt{3}}{16-3} \\ &= \frac{4+\sqrt{3}}{13} \end{aligned}$$

Hence, **option 4**.

$$\begin{aligned} 4. \quad x + \frac{1}{x} &= (7+4\sqrt{3}) + \frac{1}{(7+4\sqrt{3})} \\ &= \frac{(7+4\sqrt{3})^2 + 1}{(7+4\sqrt{3})} \\ &= \frac{98 + 56\sqrt{3}}{(7+4\sqrt{3})} \\ &= \frac{14(7+4\sqrt{3})}{(7+4\sqrt{3})} \end{aligned}$$

Hence, we get,

$$x + \frac{1}{x} = 14$$

Hence, **option 4**.

5. Observe that on the left hand side, a is the only rational part and that b is the coefficient of the irrational part.

Hence, on the right hand side, the rational and irrational parts need to be split up.

Hence, the denominator of the RHS needs to be rationalized.

$$\begin{aligned} a + b\sqrt{2} &= \frac{3 + 2\sqrt{2}}{3 - 2\sqrt{2}} \\ &= \frac{3 + 2\sqrt{2}}{3 - 2\sqrt{2}} \times \frac{3 + 2\sqrt{2}}{3 + 2\sqrt{2}} \\ &= \frac{(3 + 2\sqrt{2})^2}{9 - 8} \end{aligned}$$

$$a + b\sqrt{2} = 17 + 12\sqrt{2}$$

$$\therefore a = 17 \text{ and } b = 12$$

Hence, **option 1**.

$$\begin{aligned} 6. \quad & \frac{\sqrt{11}-1}{\sqrt{11}+1} + \frac{\sqrt{11}+1}{\sqrt{11}-1} \\ &= \frac{\sqrt{11}-1 \times \sqrt{11}-1}{\sqrt{11}+1 \times \sqrt{11}-1} + \frac{\sqrt{11}+1 \times \sqrt{11}+1}{\sqrt{11}-1 \times \sqrt{11}+1} \\ &= \frac{(\sqrt{11}-1)^2}{10} + \frac{(\sqrt{11}+1)^2}{10} \\ &= \frac{(11-2 \times \sqrt{11}+1) + (11+2 \times \sqrt{11}+1)}{10} \end{aligned}$$

$$= \frac{24}{10} = 2.4$$

$$\therefore A + B\sqrt{11} = 2.4 + 0\sqrt{11}$$

$$\therefore A = 2.4 \text{ and } B = 0.$$

Hence, **option 4**.

7. All the terms in this problem can be expressed as some power of 3.

\therefore The given expression can be expressed as:

$$\begin{aligned} & \frac{3^{7a} \times 9^{2a+1} \times 243^{3a-5}}{3^{a-1} \times 81^{3a-4} \times 27^{4a}} \\ &= \frac{3^{7a} \times (3^2)^{2a+1} \times (3^5)^{3a-5}}{3^{a-1} \times (3^4)^{3a-4} \times (3^3)^{4a}} \\ &= \frac{3^{7a} \times 3^{4a+2} \times 3^{15a-25}}{3^{a-1} \times 3^{12a-16} \times 3^{12a}} \\ &= \frac{3^{7a+4a+2+15a-25}}{3^{a-1+12a-16+12a}} \\ &= \frac{3^{26a-23}}{3^{25a-17}} \end{aligned}$$

Thus, we have,

$$\frac{3^{7a} \times 9^{2a+1} \times 243^{3a-5}}{3^{a-1} \times 81^{3a-4} \times 27^{4a}} = 3^{a-6}$$

Hence, **option 5**.

8. This is an application of the principle of comparison of a surd and a rational number.

Since the LCM of the indices 3, 2 and 6 is 6, represent all three surds in option 1 using the index 6 and will then compare the radicands.

$$\begin{aligned} \sqrt[3]{16} &= \sqrt[6]{16^2} = \sqrt[6]{256} \\ \sqrt{12} &= \sqrt[6]{12^3} = \sqrt[6]{1728} \\ \therefore \sqrt[3]{16} &< \sqrt{12} > \sqrt[6]{320} \end{aligned}$$

\therefore The expression in option 1 is not true.

Hence, options 1, 4 and 5 can be eliminated.

Similarly, for option 2, the LCM of 3 and 6 is also 6. Hence, we represent the second surd with the index 1/6.

$$\sqrt[3]{2} = \sqrt[6]{2^2} = \sqrt[6]{4} > \sqrt[6]{3}$$

\therefore The expression in option 2 is also not true.

In option 3, the indices are 1/3 and 1/4. Hence, express the surds using the index 12.

$$\begin{aligned} \sqrt[3]{4} &= \sqrt[12]{256} \text{ and } \sqrt[4]{5} = \sqrt[12]{125} \\ \therefore \sqrt[3]{4} &> \sqrt[4]{5} \end{aligned}$$

Hence, the expression in option 3 is true.

Hence, **option 3**.

9. The denominators of each term are the conjugates of the numerators of the other term.

$$m = \frac{\sqrt{x^2-y^2}+x}{\sqrt{x^2+y^2}+y} + \frac{\sqrt{x^2+y^2}-y}{x-\sqrt{x^2-y^2}}$$

$$\begin{aligned}
 &= \frac{\sqrt{x^2 - y^2} + x}{\sqrt{x^2 + y^2} + y} \times \frac{x - \sqrt{x^2 - y^2}}{\sqrt{x^2 + y^2} - y} \\
 &= \frac{x^2 - (x^2 - y^2)}{(x^2 + y^2) - y^2} = \frac{y^2}{x^2}
 \end{aligned}$$

Hence, **option 1**.

10 Let the positive square root be $(a + \sqrt{b})$

$$\therefore 5 + \sqrt{24} = (a + \sqrt{b})^2$$

$$\therefore 5 + 2\sqrt{6} = (a^2 + b) + 2a\sqrt{b}$$

Comparing the rational and irrational parts,

$$a^2 + b = 5 \text{ and } a\sqrt{b} = \sqrt{6}$$

Hence, a and \sqrt{b} could be $\sqrt{2}$ and $\sqrt{3}$, in any order.

$$\therefore \sqrt{5 + \sqrt{24}} = \pm(\sqrt{2} + \sqrt{3})$$

Since the positive square root is required, choose the root with the positive sign.

Hence, **option 4**.

LOGARITHMS

PRACTICE TEST I

- 1.** Since the base of both the terms is 27, try and express 3 and $1/3$ in terms of 27 or apply the rules for addition of two logarithms.

Hence,

$$\begin{aligned}
 \log_{27} 3 + \log_{27} \frac{1}{3} &= \log_{27} \left(3 \times \frac{1}{3} \right) = \log_{27} 1 \\
 &= 0
 \end{aligned}$$

Hence, **option 5**.

2. $\log_{25} \sqrt{5}$

$$= \frac{\log_{10} \sqrt{5}}{\log_{10} 25} \text{ as } \log_b m = \frac{\log_a m}{\log_a b}$$

$$= \frac{\log_{10} 5^{\frac{1}{2}}}{\log_{10} 5^2}$$

$$= \frac{\frac{1}{2}(\log_{10} 5)}{2(\log_{10} 5)}$$

$$= \frac{1}{4}$$

Hence, **option 3**.

3. $\log_{\sqrt{7}} \left(\frac{1}{343} \right) = \log_{\sqrt{7}} \left(\frac{1}{7^3} \right)$

$$= \log_{\sqrt{7}} \left(\frac{1}{\sqrt{7}^6} \right)$$

$$= \log_{\sqrt{7}} (\sqrt{7})^{-6}$$

$$= -6(\log_{\sqrt{7}} \sqrt{7})$$

Therefore, we have,

$$\log_{\sqrt{7}} \left(\frac{1}{343} \right) = -6$$

Hence, **option 2**.

4. $\log_{\sqrt{5}} \left(\frac{1}{x} \right) = 6$

$$\therefore (\sqrt{5}^6) = \frac{1}{x}$$

$$\therefore 1/x = 125$$

$$x = \frac{1}{125}$$

Hence, **option 3**.

5. $\log_a a = 1$

$$\log_{162}(x^2 - 9x) = 1$$

$$\therefore (x^2 - 9x) = 162$$

$$\therefore x^2 - 9x - 162 = 0$$

$$\therefore (x - 18)(x + 9) = 0$$

$$\therefore x = 18 \text{ or } x = -9$$

$$\because x \text{ is positive, } x \neq -9$$

$$\therefore x = 18$$

Hence, **option 2**.

6. $m^{2\log_m x} = 64$

$$\therefore 2(\log_m x) = \log_m 64$$

$$\therefore \log_m x^2 = \log_m 64$$

$$\therefore x^2 = 64$$

$$\therefore x = \pm 8$$

But logarithms of negative numbers are not defined.

$$\therefore x = 8$$

Hence, **option 5**.

Alternatively,

$$\therefore m^{2\log_m x} = 64$$

$$\therefore m^{\log_m x^2} = 64$$

Since, $a^{\log_a b} = b$, we have,

$$x^2 = 64 \text{ and hence } x = \pm 8$$

Since logarithms of negative numbers are not defined,

$$\therefore x = 8$$

Hence, **option 5**.

7. $x^m = 243$

$$\therefore \log_3 x^m = \log_3 243$$

$$\therefore m \times \log_3 x = \log_3 243$$

$$\therefore m \times \log_3 x = \log_3 3^5 = 5(\log_3 3) = 5$$

$$\therefore \log_3 x = 5/m$$

Hence, **option 2**.

8. $\log_x 19 + \log_{\sqrt{x}} 19 = \log_{19} x$

$$\therefore \frac{\log 19}{\log x} + \frac{\log 19}{\frac{1}{2}(\log x)} = \frac{\log x}{\log 19}$$

$$\therefore \frac{\log 19}{\log x} + \frac{2(\log 19)}{\log x} = \frac{\log x}{\log 19}$$

$$\therefore \frac{3(\log 19)}{\log x} = \frac{\log x}{\log 19}$$

$$\therefore (\log x)^2 = 3(\log 19)^2$$

$$\therefore \log x = \pm\sqrt{3}(\log 19)$$

$$\therefore x = 19^{\pm\sqrt{3}}$$

$$\text{Since } x > 1, x = 19^{\sqrt{3}}$$

Hence, **option 1.**

$$\begin{aligned} 9. \frac{1}{\log_3 60} + \frac{1}{\log_4 60} + \frac{1}{\log_5 60} \\ &= \log_{60} 3 + \log_{60} 4 + \log_{60} 5 \\ &= \log_{60} (3 \times 4 \times 5) \\ &= \log_{60} 60 \\ &= 1 \end{aligned}$$

Hence, **option 2**

$$10. \log_2 x = 10 \Rightarrow$$

$$\text{or, } x = 2^{10}.$$

$$\therefore \log_2 y = 100$$

$$\Rightarrow y = x^{100}$$

$$\Rightarrow y = (2^{10})^{100} \quad \dots [\text{put value of } x]$$

$$\Rightarrow y = 2^{1000}.$$

Hence, **option 3.**

LINEAR EQUATIONS

PRACTICE TEST I

1. When the coefficients of an equation are interchanged to form a second equation, it is often easier to form two new equations by adding and subtracting the original equations and then solving the two new equations.

$$15m + 17n = 21 \quad \dots (i)$$

$$17m + 15n = 11 \quad \dots (ii)$$

Adding equations (i) and (ii),

$$32m + 32n = 32$$

$$\therefore m + n = 1 \quad \dots (iii)$$

Subtracting equation (i) from equation (ii),

$$2m - 2n = -10$$

$$\therefore m - n = -5 \quad \dots (iv)$$

Solving equation (iii) and equation (iv),

$$m = -2 \text{ and } n = 3$$

Hence, **option 4.**

2. Let the number of hundred rupee notes with Carla be x and the number of fifty rupee notes be y .

$$x + y = 32 \quad \dots (i)$$

$$100x + 50y = 2750 \quad \dots (ii)$$

$$\therefore 2x + y = 55$$

$$\therefore x + (x + y) = 55$$

$$\therefore x + 32 = 55 \quad \dots (\text{from (i)})$$

$$\therefore x = 23$$

\therefore The number of hundred rupee notes is 23.

Hence, **option 1.**

3. Let the fraction be x/y .

From the first condition,

$$\frac{x+1}{y} = \frac{7}{19} \quad \dots (i)$$

From the second condition,

$$\frac{x}{y+1} = \frac{1}{3} \quad \dots (ii)$$

Solving equation (i),

$$19x + 19 = 7y$$

$$\therefore 19x - 7y = -19 \quad \dots (iii)$$

Solving equation (ii),

$$3x = y + 1$$

$$\therefore 3x - y = 1 \quad \dots (iv)$$

Multiplying equation (iv) by 7, and subtracting from equation (iii),

$$x = 13 \text{ and } y = 38$$

$$\therefore \text{The original fraction} = \frac{13}{38}$$

Hence, **option 4.**

Alternatively,

This problem can be solved by using the options.

Check by adding 1 to the denominator of every option. Whichever option becomes $1/3$ after simplification can be a possible answer.

In this case, only the last option turns out to be $1/3$ after adding 1 to the denominator.

Hence, **option 4.**

4. Let the present ages of Aishwarya and Deepika be x and y respectively.

According to the first condition,

$$x + 10 = 2y$$

According to the second condition,

$$(x - 6) = 5/3 \times (y - 6)$$

After simplifying both the equations,

$$x - 2y = -10 \quad \dots (i)$$

$$3x - 5y = -12 \quad \dots (ii)$$

Multiplying (i) by 3, and subtracting from equation (ii),

$$x = 26 \text{ and } y = 18$$

Hence, **option 2.**

5. Let $u = \frac{1}{x}$ and $v = \frac{1}{y}$

$$7u + 13v = 27 \quad \dots (i)$$

$$13u + 7v = 33 \quad \dots (ii)$$

Multiplying equation (i) by 13 and equation (ii) by 7,

$$91u + 169v = 351$$

$$91u + 49v = 231$$

Solving, $v = 1$ and $u = 2$

$$\therefore x = \frac{1}{2} \text{ and } y = 1$$

$$\therefore x + y = \frac{3}{2}$$

Hence, **option 1**.

6. Let 'x' be the number of bananas that Amar brought to school.

The Physics and Chemistry teacher were given $x/4$ and $x/6$ bananas respectively. After giving 2 bananas to the Head Master, the chemistry teacher still had 4 bananas left.

$$\therefore x/6 - 2 = 4$$

$$\therefore x = 6 \times 6 = 36$$

The Physics teacher was given one-fourth of the total number of bananas,

\therefore The Physics teacher received $x/4 = 9$ bananas.

Hence, **option 4**.

7. Population of A (in millions) = 9

Let the number of people in city B (in millions) be b , while those in city C (in millions) be c .

From the given information,

$$b = 9 + c \quad \dots (i)$$

$$\text{and } c = 9 + b/2$$

$$\text{i.e. } 2c = 18 + b \quad \dots (ii)$$

Solving equations (i) and (ii),

$$b = 36 \text{ and } c = 27$$

\therefore The total number of people in cities A, B and C combined = $9 + 36 + 27 = 72$ million.

Hence, **option 4**.

8. Let Sam, Harry and Jake have x , y and z number of candies with them respectively.

If Sam gives three candies to Jake, then he is left with

$x - 3$ candies and Jake now has $z + 3$ candies.

$$\therefore x - 3 = (z + 3) + 2 \quad \dots (i)$$

If Harry gives two candies to Jake, he is now left with

$y - 2$ candies whereas Jake has $z + 3 + 2 = z + 5$ candies.

$$\therefore y - 2 = (z + 5) + 2 \quad \dots (ii)$$

Solving equation (i) and equation (ii), we get,

$$y - x = 1$$

\therefore Sam and Harry together had 19 candies.

$$\therefore x + y = 19$$

$$\therefore x = 9, y = 10 \text{ and } z = 1$$

Jake has now $z + 5 = 6$ candies

Hence, **option 4**.

9. Let the number of rows be y and number of students in each row be x .

Thus, the total number of students = xy .

In each case, the number of students per row and number of rows will change, but the total number of students will remain constant.

$$xy = (x - 5) \times (y + 6)$$

$$xy = xy + 6x - 5y - 30$$

$$6x - 5y = 30 \quad \dots (i)$$

Also,

$$xy = (x + 5) \times (y - 2)$$

$$\therefore xy = xy - 2x + 5y - 10$$

$$\therefore 2x - 5y = -10 \quad \dots (ii)$$

Subtracting equation (ii) from equation (i),

$$4x = 40$$

$$\therefore x = 10$$

Substituting the value of x in (ii), $y = 6$.

$$\therefore \text{Number of students} = 10 \times 6 = 60$$

Hence, **option 5**.

10. Let x , y and z be the digits in hundred's, ten's and unit's place respectively.

\therefore The three digit number is equal to 17 times the sum of the digits,

$$\therefore 100x + 10y + z = 17(x + y + z)$$

$$\therefore 83x - 7y - 16z = 0 \quad \dots (i)$$

Also,

If 198 is added to the number the digits get reversed,

$$\therefore 100x + 10y + z + 198 = 100z + 10y + x$$

$$\therefore 99z - 99x = 198$$

$$\therefore z - x = 2 \quad \dots (ii)$$

\therefore The sum of the extreme digits of the original number is less than the middle digit by unity,

$$\therefore x + z = y - 1 \quad \dots (iii)$$

Hence, $z = x + 2$ and $y = 2x + 3$... from (ii) and (iii)

$$\text{Hence, } 83x - 7(2x + 3) - 16(2 + x) = 0$$

$$\therefore 53x = 53$$

$$\therefore x = 1$$

$$\therefore y = 2(1) + 3 = 5$$

$$\therefore z = 1 + 2 = 3$$

\therefore The sum of the digits of the original number would be $x + y + z = 1 + 5 + 3 = 9$

Hence, **option 1**.

11. Let x and y be the number of questions attempted in Section 1 and 2 respectively.

In section 1, 75% of x are correct and 25% of x are incorrect.

The student should score at least 22 and 11 in sections 1 and 2 respectively.

Marks obtained in section 1 = 22

$$\therefore 0.75x - (1/4) \times (0.25x) = 22$$

$$x = 32$$

As he has the same accuracy in both the sections,

$$\therefore 0.75y - (1/4) \times (0.25y) = 11$$

$$y = 16$$

∴ Minimum number of questions to be attempted in both the sections together
 $= x + y = 32 + 16 = 48$
 Hence, **option 4**.

12. In this problem, there are three variables and two equations to solve from.

∴ You cannot find out the value of all the variables. The method involved here is to see whether 'the price Harry has to pay' can be found out from the set of equations given.

Let the cost of an apple, a mango and an orange be x, y and z respectively.

$$\therefore 3x + 7y + z = 120 \quad \dots (i)$$

$$\text{and } 4x + 5y + z = 164.5 \quad \dots (ii)$$

The price that Harry has to pay can be written as, $x + 11y + z$

See if you can get the value of this equation without solving the equations completely.

Multiplying equation (i) by 3 and equation (ii) by 2,

$$9x + 21y + 3z = 360 \quad \dots (iii)$$

$$\text{and } 8x + 10y + 2z = 329 \quad \dots (iv)$$

Subtracting equation (iv) from equation (iii),

$$x + 11y + z = 31$$

∴ The price Harry has to pay is Rs. 31.

Hence, **option 2**.

13. Let the cost of 1 candy, 1 packet of chips and 1 pastry be Rs. x , Rs. y and Rs. z respectively.

Since the chips are the costliest on an individual basis, $y > x$ and $y > z$.

Hence,

$$5x + 3y + 2z = 140 \quad \dots (i)$$

$$y - z = 10 \quad \dots (ii)$$

$$y - x = 28 \quad \dots (iii)$$

Multiplying equation (ii) by 2 and adding it to equation (i) gives,

$$5x + 5y = 160$$

$$\text{i.e. } x + y = 2 \quad \dots (iv)$$

Solving equations (ii) and (iv),

$$x = 2 \text{ and } y = 30$$

Substituting these values in equation (i) gives,
 $z = 20$

$$\therefore \text{Anil has to pay } [(10 \times 2) + (2 \times 30) + (5 \times 20)]$$

$$= \text{Rs. } 180.$$

Hence, **option 4**.

14. Let the two digit number be xy which can be represented as $(10x + y)$.

Given that,

$$\frac{10x + y}{x + y} = 4 \quad \dots (1)$$

When the digits are reversed, it becomes

$$(10y + x)$$

According to the question,

$$10y + x = 2(10x + y) - 6 \quad \dots (2)$$

From equation (1) we get,

$$10x + y = 4(x + y)$$

$$10x + y = 4x + 4y$$

$$6x = 3y$$

$$2x = y \quad \dots (3)$$

Solving equation (2),

$$10y + x = 2(10x + y) - 6$$

$$10y + x = 20x + 2y - 6$$

$$8y = 19x - 6$$

From equation (3) we have $y = 2x$, substituting the same in the above equation

$$8(2x) = 19x - 6$$

$$3x = 6$$

$$x = 2$$

$$\therefore y = 2x = 2 \times 2 = 4$$

Thus, the number is 24.

Hence, **option 1**.

15. Let the wife's salary be Rs. x .

So, the salary of the husband is Rs. $(x + 800)$

According to the question,

$$\frac{x + 800}{4} + \frac{x}{8} = 500$$

$$2(x + 800) + x = 500 \times 8$$

$$2x + 1600 + x = 4000$$

$$3x + 1600 = 4000$$

$$3x = 4000 - 1600$$

$$3x = 2400$$

$$x = 800$$

∴ Wife's salary

= Rs. 800 and husband's salary

= Rs. $(800 + 800) = \text{Rs. } 1,600$

So total salary = Rs. $(800 + 1600) = \text{Rs. } 2,400$

Saving = Rs. 500

So, expenditure = Rs. $(2400 - 500) = \text{Rs. } 1,900$

Hence, **option 4**.

QUADRATIC AND HIGHER ORDER EQUATIONS

PRACTICE TEST I

1. $\frac{x^2}{2} + 9x + 28 = 0$

$$\therefore x = \frac{(-b \pm \sqrt{b^2 - 4ac})}{2a}$$

$$a = \frac{1}{2}, b = 9, c = 28$$

$$\therefore x = \frac{-9 \pm \sqrt{9^2 - (4 \times \frac{1}{2} \times 28)}}{(2 \times \frac{1}{2})}$$

$x = -9 \pm 5$
 $\therefore x = -4$ or -14
 Hence, the roots are -4 and -14 .
 Hence, **option 2**.

Alternatively,

When the equation is of the form $ax^2 + bx + c = 0$ i.e. all coefficients are positive, then both the roots are negative.

Hence, options 1, 3 and 5 can be eliminated.
 Note that in options 2 and 4, none of the root values

are repeated.

Hence, take any one value and substitute it in the original equation.

If it satisfies the equation, the given option will contain the two roots of the equation.

Consider $x = -4$

$$\therefore (-4)^2/2 + 9(-4) + 28 = 8 - 36 + 28 = 0$$

Thus, $x = -4$ is one of the roots of the equation.

Hence, **option 2**.

2. For the given equation, $a = 4$, $b = 5$ and $c = -9$
 Hence, the discriminant, $\Delta = b^2 - 4ac = 25 + 144 = 169$

Since the value of the discriminant is greater than zero, the given equation has 2 real roots.

Hence, **option 3**.

3. $(x - p)^2 - 9p = 36$
 $\therefore x^2 - 2px + p^2 - 9p = 36$
 Since 0 is one of the roots of the given equation,

$$p^2 - 9p = 36$$

$$\therefore p^2 - 9p - 36 = 0$$

$$\therefore p^2 - 12p + 3p - 36 = 0$$

$$\therefore p(p - 12) + 3(p - 12) = 0$$

$$\therefore p = 12 \text{ or } p = -3$$

Hence, **option 4**.

4. $x^4 - 2x^2 + 1 = 0$
 Put $x^2 = y$
 $\therefore y^2 - 2y + 1 = 0$
 $\therefore (y - 1)^2 = 0$
 $\therefore y = 1$
 $\therefore x^2 = 1$
 $\therefore x = -1$ or $x = 1$

Thus, the four roots of the equation are $+1$, $+1$, -1 and -1 .

\therefore The sum of the roots is 0.

Hence, **option 2**.

5. Let the numbers be x and y .

From the given data,

$$x - y = 3 \quad \dots \text{(i)}$$

$$x^2 + y^2 = 29 \quad \dots \text{(ii)}$$

Now,

$$(x - y)^2 = x^2 - 2xy + y^2$$

$$\therefore (x - y)^2 = (x^2 + y^2) - 2xy$$

$$\therefore 9 = 29 - 2xy$$

$$\therefore xy = 10$$

Hence, **option 1**.

6. If a quadratic equation has equal roots, the value of the discriminant, $\Delta = 0$

$$\text{i.e. } b^2 - 4ac = 0$$

$$\therefore 12^2 - 16c = 0$$

$$\therefore c = 9$$

Hence, **option 4**.

7. In the given equation, $7x^2 - 13x + 3 = 0$,

$$a = 7, b = -13 \text{ and } c = 3$$

$$\therefore \alpha + \beta = (-b/a) = (13/7) \text{ and}$$

$$\alpha\beta = (c/a) = (3/7)$$

$$\text{Now, } \frac{1}{\alpha^2} + \frac{1}{\beta^2} = \frac{\alpha^2 + \beta^2}{(\alpha\beta)^2} \quad \dots \text{(i)}$$

$$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta = (13/7)^2 - 2(3/7) = (127/49)$$

Hence,

$$\frac{1}{\alpha^2} + \frac{1}{\beta^2} = \frac{\alpha^2 + \beta^2}{(\alpha\beta)^2} = \frac{127}{49} \times \frac{49}{9} = \frac{127}{9}$$

Hence, **option 4**.

8. Since the roots of the equation are reciprocals of each other, let the roots be x and $1/x$.

Sum of the roots = $41/20$ and product of the roots = $a/20$

$$\therefore x + 1/x = 41/20 \text{ and } x \times (1/x) = a/20$$

$$\therefore a = 20$$

Hence, **option 3**.

9. Since the equation has equal roots, the discriminant, i.e. $b^2 - 4ac = 0$.

$$\therefore (3m + 4)^2 - 4(8m + 9) = 0$$

$$\therefore (3m + 4)^2 = 4(8m + 9)$$

$$9m^2 + 24m + 16 = 32m + 36$$

$$9m^2 - 8m - 20 = 0$$

$$\therefore 9m^2 - 18m + 10m - 20 = 0$$

$$\therefore 9m(m - 2) + 10(m - 2) = 0$$

$$\therefore m = 2 \text{ or } m = -10/9$$

\therefore The value of m can be 2 or $-10/9$.

Among these two values, only $-10/9$ is given among the options.

Hence, **option 4**.

10. It is given that one root of the quadratic equation

$$x^2 + bx + 32 = 0 \text{ is } 4.$$

Since the product of the two roots of this equation is 32, the other root has to be 8.

Also sum of the roots of this equation is $-b$.

$$\therefore -b = 4 + 8$$

$$\therefore b = -12$$

Since the equation $x^2 + bx + c = 0$ has equal roots, the discriminant is zero.

$$\therefore 4c = b^2 = (-12)^2 = 144$$

$$\therefore c = 36$$

Hence, **option 4**.

INEQUALITIES

PRACTICE TEST I

$$1 \quad \frac{3}{14} < \frac{x}{y} < \frac{3}{12}$$

Since all the options give the range in terms of integers, it makes more sense to convert the given fractions to integers and then see which option lies outside this range.

$$\therefore 0.214 < \frac{x}{y} < 0.25$$

Taking each option at a time, the value of x/y becomes,

$$\text{Option 1 : } 0.222$$

$$\text{Option 2 : } 0.231$$

$$\text{Option 3 : } 0.238$$

$$\text{Option 4 : } 0.222$$

$$\text{Option 5 : } 0.2727$$

Considering all the options, only option 5 does not satisfy the given relation.

Hence, **option 5**.

$$2. \quad 4x + 5 > 5x - 13$$

$$\therefore 4x - 5x > -13 - 5$$

$$\therefore -x > -18$$

$$\therefore x < 18$$

Note that since we are multiplying by -1 on both sides, the inequality sign changes.

Hence, **option 5**.

$$3. \quad x^2 + 8x - 65 > 0$$

$$\therefore x^2 + 13x - 5x - 65 > 0$$

$$\therefore (x + 13)(x - 5) > 0$$

Hence, $x > -13$ and $x > 5$ (Case I) or $x < -13$ and $x < 5$ (Case II)

$$\therefore x > 5 \text{ or } x < -13$$

Hence, **option 4**.

$$4. \quad -2 < x < 7 \text{ and } 3 < y < 5$$

Hence,

$$-4 < 2x < 14$$

$$-15 < -3y < -9$$

Since the second inequality is multiplied by -3 , the inequality changes.

Adding both the inequalities, we get,

$$-19 < (2x - 3y) < 5$$

Note that $2x - 3y$ is calculated first because it is present in 2 options. This makes the process of elimination faster.

Hence, **option 2**.

$$5. \quad 6x^2 - x - 35 < 0$$

$$6x^2 - 15x + 14x - 35 < 0$$

$$3x(2x - 5) + 7(2x - 5) < 0$$

$$(3x + 7)(2x - 5) < 0$$

Hence, either $(3x + 7) < 0$ and $(2x - 5) > 0$
or $(3x + 7) > 0$ and $(2x - 5) < 0$

$$\therefore -\frac{7}{3} < x < \frac{5}{2}$$

Hence, **option 2**.

6. Since both a and b are positive, multiplying them keeps the sense of the inequality as it is.

$$\therefore 0 < ab < 6$$

As c is negative, dividing by c reverses the sense of the inequality.

$$\therefore -6 < \frac{ab}{c} < 0$$

Hence, **option 1**.

$$7. \quad \frac{x+1}{x+2} > 1$$

$$\frac{x+1-x-2}{x+2} > 0$$

$$\therefore \frac{-1}{x+2} > 0$$

Since the numerator is negative, denominator has to be negative to satisfy the inequality.

This is satisfied only when $x < -2$.

$$\therefore x < -2$$

Hence, **option 3**.

Alternatively,

You can check each answer option by substituting a suitable value of x as per the condition in each option.

Hence, **option 3**.

$$8. \quad x^2 - x - 6 > 0$$

$$\therefore x^2 - 3x + 2x - 6 > 0$$

$$\therefore (x - 3)(x + 2) > 0$$

$$\therefore x > 3 \text{ or } x < -2 \quad \dots \text{(i)}$$

$$x^2 - 6x - 7 < 0$$

$$\therefore x^2 - 7x + x - 7 < 0$$

$$\therefore (x - 7)(x + 1) < 0$$

$$\therefore -1 < x < 7 \quad \dots \text{(ii)}$$

From (i) and (ii), the range of values of x that satisfy both the inequalities is

$$3 < x < 7$$

Hence, **option 3**.

$$9. \quad \frac{x-2}{3x-5} - \frac{3}{4} < 0$$

$$\therefore \frac{4x - 8 - 9x + 15}{4(3x - 5)} < 0$$

$$\therefore \frac{7 - 5x}{4(3x - 5)} < 0$$

\therefore Either $7 - 5x < 0$ and $(3x - 5) > 0$ or $7 - 5x > 0$ and $(3x - 5) < 0$

\therefore Either $x > \frac{7}{5}$ and $x > \frac{5}{3}$ or $x < \frac{7}{5}$ and $x < \frac{5}{3}$

\therefore Either $x > 1.4$ and $x > 1.67$ or $x < 1.4$ and $x < 1.67$

$\therefore x > \frac{5}{3}$ or $x < \frac{7}{5}$

Hence, **option 1.**

10. In such a case, substitute values for x and y in the given options and check for the answer. Since x and y are unequal number, let x and y be 1 and 2 respectively.

Option 1: $2xy/(x + y) = (2 \times 1 \times 2)/(1 + 2) = 4/3 = 1.33$

$xy = 1 \times 2 = 2$

$(x + y)/2 = (1 + 2)/2 = 3/2 = 1.5$

$1.33 < 2$ and $2 > 1.5$

Hence, option 1 and 4 can be eliminated.

Option 2: $x + y = 1 + 2 = 3$

$4xy/(x + y) = 2 \times (4/3) = 8/3 = 2.33$

$\sqrt{4xy} = \sqrt{4 \times 1 \times 2} = 2.828$

$3 > 2.828 > 2.33$

Hence, **option 2.**

BASICS OF GEOMETRY

PRACTICE TEST I

1. Two angles are said to be supplementary if the sum of their measures is 180° .

\therefore Measure of the supplementary angle = $180^\circ - 47^\circ = 133^\circ$

Hence, **option 2.**

2. A reflex angle is an angle that is greater than 180° but less than 360° .

Hence, among the given options, 220° is a reflex angle.

Hence, **option 4.**

3. $m \angle B + m \angle C = 180^\circ$ (Supplementary angles) and

$m \angle A + m \angle B + m \angle C = 210^\circ$

$\therefore m \angle A = 210^\circ - 180^\circ = 30^\circ$

Now, $m \angle B = 2 \times (m \angle C)$ and the sum of $m \angle B$ and

$m \angle C$ is 180° .

$\therefore m \angle B = 120^\circ$ and $m \angle C = 60^\circ$

Hence, **option 1.**

4. Let $m \angle P$ be x° .

$\therefore x =$ Measure of the supplementary angle of $\angle P + 20^\circ$

\therefore Measure of the supplementary angle of $\angle P = x - 20^\circ$

The sum of these two angles should be 180° .

$\therefore x + (x - 20^\circ) = 180^\circ$

$\therefore x = 100^\circ$

Hence, **option 2.**

5. L_1 and L_2 are parallel to each other.

Line AC is the transversal.

$\therefore m \angle ACD = m \angle EAC = 35^\circ$

($\because \angle ACD$ and $\angle EAC$ are Alternate angles)

Since AC and AD are perpendicular to each other.

$m \angle CAD = 90^\circ$

But, $m \angle EAC + m \angle CAD + m \angle DAB = 180^\circ$

$\therefore 35^\circ + 90^\circ + m \angle BAD = 180^\circ$

$\therefore m \angle BAD = 55^\circ$

Hence, **option 4.**

6. Transversals make intercepts of equal proportions on parallel lines.

Using the Equal Intercept Ratio theorem, we have,

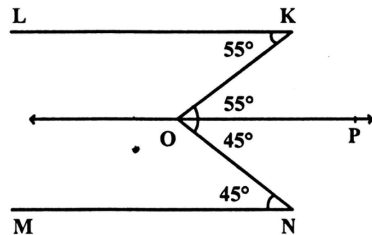
$$\frac{PQ}{QR} = \frac{ST}{TU}$$

$$\therefore \frac{1}{2} = \frac{4}{TU}$$

$\therefore TU = 8 \text{ cm}$

Hence, **option 4.**

- 7.



Draw line OP parallel to LK.

\because LK and MN are parallel lines, line OP is parallel to both the lines.

$\therefore m \angle LKO = m \angle KOP = 55^\circ$

($\because \angle LKO$ and $\angle KOP$ form a pair of Alternate angles)

But, $m \angle KON = m \angle KOP + m \angle PON$

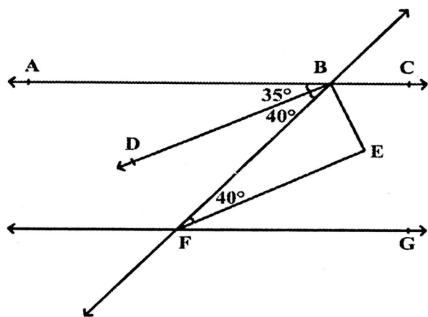
$\therefore m \angle PON = 100^\circ - 55^\circ = 45^\circ$

$\therefore m \angle MNO = 45^\circ$

($\because \angle MNO$ and $\angle PON$ form a pair of alternate angles)

Hence, **option 3.**

8.



Ray BD and EF are along parallel lines and line BF is the transversal.

$$\therefore m \angle DBF = m \angle EFB = 40^\circ$$

($\because \angle DBF$ and $\angle EFB$ form a pair of Alternate angles)

$m \angle ABF = m \angle BFG = 75^\circ$, as they form a pair of alternate angles across lines AC and FG with BF as the transversal.

Now, $m \angle BFG = m \angle BFE + m \angle EFG$

$$\therefore m \angle EFG = 75^\circ - 40^\circ = 35^\circ$$

Hence, **option 2**.

9. In ΔHJI , $m \angle HJI = 60^\circ$ and $m \angle JHI = 55^\circ$

$$\therefore m \angle JIH = 65^\circ \text{ i.e. } m \angle JIA = 65^\circ$$

$\angle JIA$ and $\angle IAB$ form a pair of alternate angles with respect to parallel lines l and m with line AI as a transversal.

$$\therefore m \angle JIA = m \angle IAB = 65^\circ$$

Also, $\angle IAB$ and $\angle ABD$ are interior angles with respect to parallel lines AI and BK with line l as a transversal.

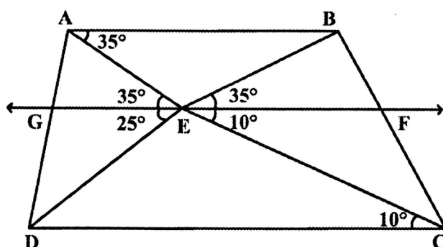
$$\therefore m \angle IAB + m \angle ABD = 180^\circ$$

$$\therefore 65^\circ + m \angle ABD = 180^\circ$$

$$\therefore m \angle ABD = 115^\circ$$

Hence, **option 3**.

10.



Construct a line EF parallel to both AB and CD.

$$\therefore m \angle CEF = m \angle ECD = 10^\circ$$

($\because \angle CEF$ and $\angle ECD$ form a pair of Alternate angles)

$$\text{Also, } m \angle AEG = m \angle EAB = 35^\circ$$

($\because \angle AEG$ and $\angle EAB$ form a pair of Alternate angles)

$$\therefore m \angle GED = 60^\circ - 35^\circ = 25^\circ$$

$$\text{But, } m \angle GED + m \angle CED + m \angle CEF = 180^\circ$$

$$\therefore 25^\circ + m \angle CED + 10^\circ = 180^\circ$$

$$\therefore m \angle CED = 145^\circ$$

Hence, **option 4**.

TRIGONOMETRY

PRACTICE TEST I

$$1. \tan \theta = \frac{1}{\cot \theta} = \frac{\sin \theta}{\cos \theta}$$

Hence, both (1) and (2) are true.

Hence, **option 3**.

$$2. \tan A = \frac{\text{Opposite side}}{\text{Adjacent side}} = \frac{3}{4}$$

\therefore Consider a triangle having an angle A such that the side opposite to $A = 3$ and the side adjacent to $A = 4$

Hence,

$$\text{Hypotenuse} = \sqrt{3^2 + 4^2} = 5$$

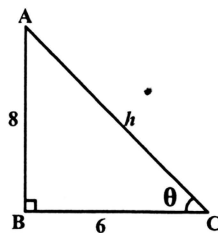
$$\text{But, } \cos A = \frac{\text{Adjacent side}}{\text{Hypotenuse}} = \frac{4}{5}$$

$$\therefore \frac{1 - \cos A}{1 + \cos A} = \frac{1 - \frac{4}{5}}{1 + \frac{4}{5}} = \frac{1}{9}$$

Hence, **option 3**

3. In a right angled triangle,

$$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}} = \frac{8}{6}$$



By Pythagoras theorem,

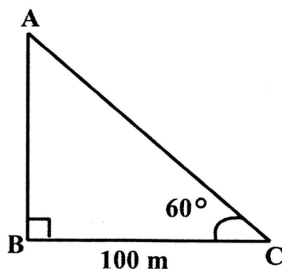
$$h^2 = 8^2 + 6^2$$

$$\therefore h^2 = 100$$

$$\therefore h = 10$$

Hence, **option 1**.

4. In the diagram given below, let the tower be denoted by AB.



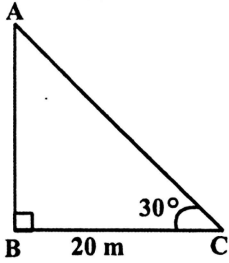
$$\tan 60^\circ = \frac{AB}{AC}$$

$$\therefore \sqrt{3} = \frac{AB}{100}$$

$$\therefore AB = 100\sqrt{3}m$$

Hence, **option 2**.

5. Let the point at which the tree breaks be A. So, AC is the part of the tree that has broken while AB is the part that is still standing. Finally, C is the top of the tree touching the ground. Thus, the figure is as shown below:



$$\cos 30^\circ = \frac{CB}{AC}$$

$$\therefore \frac{\sqrt{3}}{2} = \frac{20}{AC}$$

$$\therefore \sqrt{3}AC = 40$$

$$\therefore AC = \frac{40}{\sqrt{3}}$$

$$\text{Next, } \tan 30^\circ = \frac{AB}{BC}$$

$$\therefore \frac{1}{\sqrt{3}} = \frac{AB}{20}$$

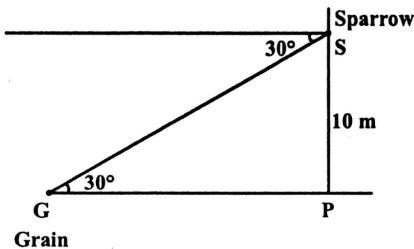
$$\therefore AB = \frac{20}{\sqrt{3}}$$

$$\therefore \text{The height of the tree} = \frac{40}{\sqrt{3}} + \frac{20}{\sqrt{3}} = \frac{60}{\sqrt{3}}$$

$$= 20\sqrt{3}m$$

Hence, **option 1**.

6.



The data given can be represented diagrammatically as shown above.

Let the point at which the sparrow is perched be S and the point at which the grain is present be G.

Hence, the distance between the sparrow and the grain is SG.

From the figure, $\angle SGP = 30^\circ$

$$SP = 10m$$

$$\sin 30^\circ = \frac{SP}{SG}$$

$$\therefore \frac{1}{2} = \frac{SP}{SG}$$

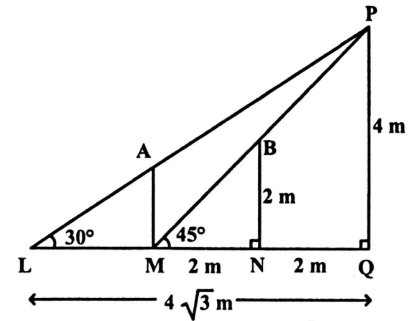
$$\therefore SG = 2 \times SP$$

$$\therefore SG = 2 \times 10 = 20m$$

\therefore Distance between the sparrow and the grain is 20 m.

Hence, **option 4**.

7.



The given data can be represented as shown above.

From the figure, $BN = MN$ and $\angle BNM = 90^\circ$

$$\tan \angle BMN = \frac{BN}{MN} = 1$$

$$\therefore \angle BMN = 45^\circ$$

$$\tan \angle PMQ = \frac{PQ}{MQ}$$

$$\angle PMQ = \angle BMN$$

$$\therefore \frac{PQ}{MQ} = 1$$

$$\therefore PQ = MQ = 4m$$

The shadow of pole A falls at point L.

$$\tan \angle PLQ = \frac{PQ}{LQ} = \frac{4}{4\sqrt{3}} = \frac{1}{\sqrt{3}}$$

$$\therefore \angle PLQ = 30^\circ$$

$$\therefore LM = 4\sqrt{3} - 4$$

$$\text{As } \tan \angle ALM = \tan 30^\circ = \frac{AM}{LM}$$

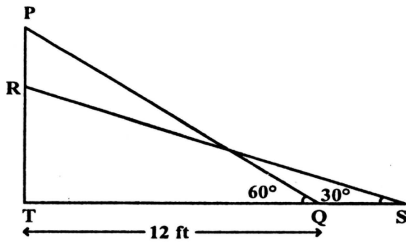
$$\therefore AM = LM \times \tan 30^\circ$$

$$\therefore AM = (4\sqrt{3} - 4) \times \frac{1}{\sqrt{3}}$$

$$= \frac{4(\sqrt{3} - 1)}{\sqrt{3}}m$$

Hence, **option 1**.

8.



Let the length of the ladder be $PQ = 24$ feet
 Let Q and S be the point at which the bottom of the ladder meets the ground, in the beginning and after slipping, respectively.

From the figure,

ΔPTQ is a right triangle and $\angle PQT = 60^\circ$

So, $\angle QPT = 30^\circ$

$$\sin 30^\circ = \frac{1}{2}$$

$$\frac{TQ}{PQ} = \frac{1}{2}$$

$\therefore TQ = 12$ feet

Also, ΔRTS is a right triangle. $RS = 24$ feet and $\angle RST = 30^\circ$

$\therefore \angle SRT = 60^\circ$

$$\sin 60^\circ = \frac{\sqrt{3}}{2}$$

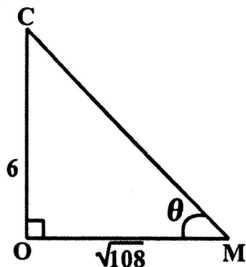
$$\frac{TS}{RS} = \frac{\sqrt{3}}{2}$$

$$TS = 12\sqrt{3}$$

$$QS = TS - TQ = 12\sqrt{3} - 12 = 12(\sqrt{3} - 1) \text{ feet}$$

Hence, **option 4.**

9.



Refer to the figure above,

Let C be the position of the crow

Let M be the position of the man

Let angle of elevation of the crow with respect to the man be θ

We know,

In a right angled triangle,

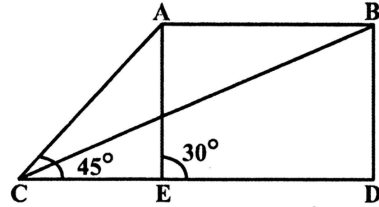
$$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$$

$$\tan \theta = \frac{6}{\sqrt{108}} = \frac{6}{6\sqrt{3}} = \frac{1}{\sqrt{3}}$$

$$\therefore \theta = \tan^{-1} \frac{1}{\sqrt{3}} = 30^\circ$$

Hence, **option 3.**

10. The diagram looks like :



Let ' A ' and ' B ' be two positions of the airplane and ' C ' be the point of observer. ' A ' is the initial position of the plane and ' B ' is the position of the plane after 5 seconds.

$$\tan 30 = \frac{BD}{CD}$$

$$\frac{1}{\sqrt{3}} = \frac{750}{CD}$$

$$CD = 750\sqrt{3} \text{ m}$$

$$\tan 45 = \frac{AE}{CE}$$

$$\text{But } BD = AE = 750 \text{ m}$$

$$\text{So, } 1 = \frac{750}{CE}$$

$$CE = 750 \text{ m}$$

$$\therefore \text{Distance covered by airplane} = AB = ED$$

$$= CD - CE$$

$$= 750\sqrt{3} - 750$$

$$= (750 \times 1.732 - 750)$$

$$= 1299 - 750$$

$$= 549 \text{ m}$$

$$\text{So, speed} = 549/5 = 110 \text{ sec (approximately)}$$

Hence, **option 4.**

MENSURATION

PRACTICE TEST I

1. Lateral surface area of a cylinder = $2\pi rh$, where r is the radius of the base cylinder and h is the height of the cylinder.

$$\therefore 2 \times \pi \times r \times 5 = 20\pi$$

$$\therefore r = 2 \text{ cm}$$

$$\therefore \text{Volume of a cylinder} = \pi \times r^2 \times h$$

$$= \pi \times 2^2 \times 5 = 20\pi \text{ cm}^3$$

Hence, **option 2.**

2. Let the radii of the four spheres and the new hemisphere be r_1 and r_2 respectively.

Volume of the four original spheres = Volume of the new hemisphere

$$\therefore 4 \times (4/3) \times \pi r_1^3 = (2/3) \times \pi r_2^3$$

$$\therefore r_2 = 2r_1$$

Original total surface area of the four spheres

$$= 4 \times (4\pi r_1^2) = 16\pi r_1^2$$

New total surface area of the new hemisphere

$$= 3\pi r_2^2 = 3\pi(2r_1)^2 = 12\pi r_1^2$$

\therefore Reduction in total surface area

$$= 16\pi r_1^2 - 12\pi r_1^2 = 4\pi r_1^2$$

\therefore Percentage reduction

$$= (4\pi r_1^2 \times 100)/(16\pi r_1^2) = 25\%$$

Hence, **option 3**.

3. Since the cylinder is melted and recast into a cone, the volume of the two solids should remain the same.

Volume of the original cylinder = Volume of the new cone

The radius of the original cylinder is the same as the radius of the new cone.

$$\therefore \pi r^2 h_1 = 1/3 \times \pi r^2 h_2$$

$$\therefore h_2 = 3h_1$$

Increase in the height of the solid = $h_2 - h_1$

$$= 3h_1 - h_1 = 2h_1$$

\therefore Percentage increase = $(2h_1 \times 100)/h_1$

$$= 200\%$$

Hence, **option 1**.

4. For a hemisphere,

$$\text{Total Surface Area (TSA)} = 3\pi r^2$$

\therefore Total surface area of a hemisphere with radius 28 cm = $3\pi \times (28)^2 = 7392 \text{ cm}^2$

Hence, **option 4**.

5. When a body is immersed in a liquid, the volume of liquid displaced is equal to the volume of the body.

\therefore Volume of water displaced = Volume of the spherical ball

Radius of the sphere = 21 cm

$$\therefore \text{Volume of spherical ball} = (4/3) \times \pi r^3$$

$$= (4/3) \times (22/7) \times (21)^3 = 38808 \text{ cm}^3$$

Hence, **option 1**.

6. Since the box is to be completely wrapped, the amount of paper required is equal to the total surface area of the cube

$$\text{Total surface area of cube} = 6 \times (s)^2$$

The total surface area of a cube with edge 10 cm

$$= 6 \times (10)^2 = 600 \text{ cm}^2$$

\therefore The entire surface of the box is wrapped, 600 cm² of gift wrapper is required.

Cost of 1 cm² of the wrapper = Rs. 2

\therefore Cost of 600 cm² of the wrapper = Rs. 1,200

Hence, **option 3**.

7. Area of the four walls

= Lateral Surface Area of the rectangular room

$$= 2 \times (l + b) \times h$$

$$= 2 \times (15 + 10) \times 12 = 600 \text{ ft}^2$$

Area of the door = $6 \times 4 = 24 \text{ sq.ft}$

Area of the two windows = $2 \times (5 \times 5)$

$$= 50 \text{ sq.ft}$$

Area of the walls to be painted

$$= (\text{Area of the 4 walls}) -$$

(Area of the door) - (Area of the two windows)

$$= 600 - 24 - 50 = 526 \text{ ft}^2$$

\therefore Expenditure incurred (at the rate of Rs. 14 per sq. ft)

$$= 526 \times 14 = \text{Rs. } 7,364$$

Hence, **option 1**.

8. When a concrete coating of thickness 0.25 m is put on the inner wall, we get a concrete ring.

This can also be visualised as two concentric cylinders such that the radius of the outer cylinder is 2 m while the radius of the inner cylinder is 1.75 m.

\therefore Volume of concrete coating = $\pi(r_2^2 - r_1^2) \times h$ where r_1 and r_2 are the inner and outer radii respectively and h is the height of the cylinder.

\therefore Volume of concrete coating

$$= \pi \times (2^2 - 1.75^2) \times 7$$

$$= (22/7) \times 3.75 \times 0.25 \times 7$$

$$= 20.625 \text{ m}^3$$

\therefore Cost of laying the concrete layer (at Rs. 900 per m³)

$$= 20.625 \times 900 = \text{Rs. } 18,562.5$$

The option closest to this is option 1 i.e. Rs. 18,562.

Hence, **option 1**.

9. Since the tank is half filled with water, the volume of water filled is half the volume of the tank.

Hence, the volume remaining to be filled is also equal to half the volume of the tank.

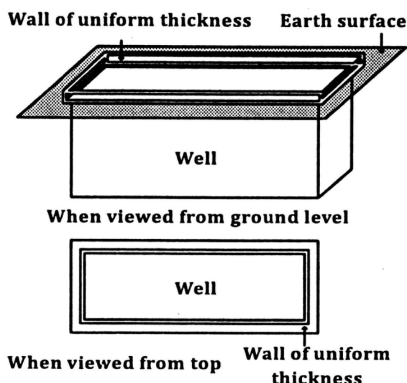
Volume of tank still to be filled (in m³) = Area of the cross section of circular pipe (in m²) \times Rate of flow of water (in m/s) \times time (in seconds)

$$\therefore 11 \times 4 \times (4/2) = \pi \times (0.2)^2 \times 7 \times t$$

$$\therefore t = 100 \text{ seconds}$$

Hence, **option 3**.

10.



Volume of the earth removed from the well
 $= 30 \times 40 \times 20 = 24000 \text{ m}^3$

Since the outer wall has a uniform thickness of 1m, the width of the part including the wall becomes $30 + 1 + 1 = 32 \text{ m}$.

Similarly, the length of the part including the wall becomes $40 + 1 + 1 = 42 \text{ m}$

Volume of the wall = volume of the cuboidal shell

$$= \text{Cross sectional area of the wall} \times \text{Height}$$

$$= (32 \times 42 - 30 \times 40) \times 0.5 = 672 - 600$$

$$= 72 \text{ m}^3$$

Volume of the earth left = Volume of earth removed by the well - Volume of the wall
 $= 24000 - 72 = 23928 \text{ m}^3$

Hence, **option 4**.

11. Area of square = $6 \times 6 \text{ cm}^2 = 36 \text{ cm}^2$

Let the base of right angled triangle = b

$$\therefore \text{altitude} = 2 \times \text{base} = 2b$$

According to the question,

Area of triangle = area of the square

$$\therefore \frac{1}{2} \times b \times 2b = 36$$

$$b^2 = 36$$

$$b = 6 \text{ cm}$$

$$\therefore \text{Altitude} = 2 \times b = 2 \times 6 = 12 \text{ cm}$$

Hence, **option 2**.

12. Let the initial length and breadth be l and b respectively.

When the length is decreased by 20% and breadth is increased by 20%, a square of area 144 cm^2 is obtained.

Let the side of the square be ' s '.

$$s^2 = 144$$

$$s = 12 \text{ cm}$$

$$\therefore 0.8l = 12$$

$$\therefore l = 15 \text{ cm}$$

$$\text{Also, } 1.2b = 12$$

$$\therefore b = 10 \text{ cm}$$

$$\therefore \text{Area of rectangle} = l \times b$$

$$= 15 \times 10 = 150 \text{ cm}^2$$

Hence, **option 4**.

13. External radius = 25m

Width = 4m

Internal radius = $(25 - 4) \text{ m} = 21 \text{ m}$

Area of the circular path = $\pi(25^2 - 21^2)$

$$= \frac{22}{7} \times 4 \times 46 = 578.28 \text{ cm}^2$$

Hence, **option 1**.

14. The length of diagonal is 6 m and 15 m.

$$\text{Area} = \frac{1}{2} \times 6 \times 15 \text{ cm}^2 = 45 \text{ cm}^2$$

Hence, **option 3**.

15. Let the initial side be ' s '.

$$\text{Area} = s^2$$

$$\text{Perimeter} = 4s$$

If the side is increased by 20%, new side = $1.2s$

$$\text{New area} = (1.2s)^2 = 1.44s^2$$

$$\text{New perimeter} = 4 \times 1.2s = 4.8s$$

$$\text{Increase in area} = \frac{1.44s^2 - s^2}{s^2} \times 100 \%$$

$$= 44\%$$

$$\text{Increase in perimeter} = \frac{4.8s - 4s}{4s} \times 100\%$$

$$= 20\%$$

Hence, **option 5**.

SEQUENCES, PROGRESSIONS AND SERIES

PRACTICE TEST I

1. Each term can be written as $n^2 + 1$

Thus, 1st term = $1^2 + 1$, 2nd term = $2^2 + 1$, 3rd term

= $3^2 + 1$ and so on

Thus, the next term would be $6^2 + 1 = 37$

Hence, **option 5**.

2. The difference between the 1st and 2nd term is 1.

The difference between the 2nd and 3rd term is 2.

The difference between the 3rd and 4th term is 3.

The difference between the 4th and 5th term is 4.

Therefore, the difference between the 5th and 6th term should be 5.

Hence, the 6th term should be $14 + 5 = 19$

Hence, **option 2**.

$$3. a_{n+1} = 2a_n - 1$$

$$\therefore a_5 = 2a_4 - 1$$

$$= 2(2a_3 - 1) - 1 \quad (\text{Substituting } a_4 = 2a_3 - 1)$$

$$= 4a_3 - 3$$

$$= 4(2a_2 - 1) - 3 \quad (\text{Substituting } a_3 = 2a_2 - 1)$$

$$= 8a_2 - 7$$

$$= 8(2a_1 - 1) - 7 \quad (\text{Substituting } a_2 = 2a_1 - 1)$$

$$= 16a_1 - 15$$

$$\therefore a_5 = 16a_1 - 15 = 17$$

$$\therefore a_1 = 2$$

Hence, **option 2**.

4. The first two terms of the A.P. are 3 and 5 respectively.

Hence, $a = 3$ and $d = 2$

The n^{th} term of an A.P. (T_n) is $a + (n - 1)d$,

$$\therefore \text{The } 5^{\text{th}} \text{ term of the A.P.} = T_5 = 3 + 2(5 - 1)$$

$$= 11$$

Hence, **option 5**.

5. The first child in the line gets 4 chocolates and every subsequent child gets 3 chocolates more than the previous one.

Therefore, the number of chocolates received by each child forms an arithmetic progression with $a = 4$ and

$$d = 3.$$

$$\therefore \text{The last child i.e. the } 10^{\text{th}} \text{ child gets } 4 + 3(10 - 1)$$

$$= 31 \text{ chocolates}$$

Therefore, the total number of chocolates distributed

$$\text{by Ramesh is: } \frac{n}{2} [a + T_n] = \frac{10}{2} [4 + 31]$$

$$= 175$$

Hence, **option 5**.

6. Let the four terms of the A.P be $(a - 3d)$, $(a - d)$, $(a + d)$ and $(a + 3d)$ respectively.

Adding all these terms, we get,

$$4a = 124$$

$$\therefore a = 31$$

$$\text{Also, } (a - 3d)(a + 3d) = (a - d)(a + d) - 128$$

$$\therefore a^2 - 9d^2 = (a^2 - d^2) - 128$$

$$\therefore 8d^2 = 128$$

$$\therefore d = \pm 4$$

Consider $d = +4$

Hence, the 4 numbers are 19, 27, 35 and 43.

Consider $d = -4$

Hence, the 4 numbers are 43, 35, 27 and 19.

Therefore, the smallest number in either case is 19.

Hence, **option 2**.

$$7. T_3 + T_7 = 8$$

$$\therefore (a + 2d) + (a + 6d) = 8$$

$$\therefore 2a + 8d = 8$$

The sum of the first nine terms of the progression is given by $(n/2) \times [2a + (n - 1)d]$
i.e. $(9/2) \times [2a + 8d]$

$$\text{i.e. } (9/2) \times 8 = 36$$

Hence, **option 3**.

8. The n^{th} term of a G.P. is given by $T_n = ar^{n-1}$, where a is the first term of the G.P. and r is the common ratio.

Here, $a = 5$ and $r = 2$

$$\therefore \text{The } 6^{\text{th}} \text{ term of the G.P.} = 5 \times 2^{(6-1)}$$

$$= 5 \times 2^5$$

$$= 5 \times 32$$

$$= 160$$

Hence, **option 2**.

9. Since 10, b and 40 are in G.P., b is their geometric mean.

$$b = \sqrt{10 \times 40}$$

$$\therefore b = \pm 20$$

Hence, **option 5**.

10. For a G.P., sum of the first n terms can be expressed as S_n .

$$S_n = \frac{a(1 - r^n)}{(1 - r)}$$

where a is the initial term and r is the common ratio of the G.P.

$$\therefore \frac{S_8}{S_4} = \frac{\left[\frac{a(1 - r^8)}{1 - r} \right]}{\left[\frac{a(1 - r^4)}{1 - r} \right]}$$

$$\frac{97}{81} = \frac{[(1 - r^4)(1 + r^4)]}{(1 - r^4)}$$

$$r^4 = \frac{97}{81} - 1$$

$$r^4 = \frac{16}{81}$$

$$r = \pm \frac{2}{3}$$

Hence, **option 4**.

Note: Though it is not known initially whether r is greater than or less than 1, it does not make a difference. This is because in either case, in the R.H.S, the term $(1 - r^n)$ or $(r^n - 1)$ gets cancelled out in the numerator as well as in the denominator leaving behind $1 + r^n$.

11. Let the first term and the common ratio of the required G.P. be a and r respectively.

$$\frac{a}{1 - r} = 45 \quad \dots \text{(i)}$$

$$\frac{a^2}{(1 - r^2)} = 135 \quad \dots \text{(ii)}$$

Dividing (ii) by (i), we get,

$$\frac{a}{1+r} = 3 \quad \dots \text{(iii)}$$

Dividing equation (i) by (iii), we get,

$$\frac{(1+r)}{(1-r)} = 15$$

By Componendo-Dividendo, we get,

$$\frac{1}{r} = \frac{16}{14} = \frac{8}{7}$$

$$\therefore r = \frac{7}{8}$$

Now putting this value of 'r' in equation (iii), we get,

$$\frac{a}{\left(1 + \frac{7}{8}\right)} = 3$$

$$\therefore a = \frac{45}{8}$$

$$\therefore a + r = \frac{7}{8} + \frac{45}{8} = \frac{52}{8} = \frac{13}{2}$$

Hence, **option 1**.

12. Let A , G and H represent the Arithmetic, Geometric and Harmonic mean of the two positive numbers.

$$\text{Now, } G = 6 \text{ and } G = H + 2$$

$$\therefore H = 4$$

The relation between the Arithmetic, Geometric and Harmonic Mean of two numbers is given by

$$A \times H = G^2$$

$$\therefore A \times 4 = 36$$

$$\therefore A = 9$$

Hence, **option 4**.

13. The reciprocal of the terms of an H.P. form an A.P.

Hence, the reciprocals of the first three terms of this H.P. are in A.P.

$$\therefore 5, 7 \text{ and } 9 \text{ are in A.P. such that } a = 5 \text{ and } d = 2.$$

The seventh term of this A.P. using the formula

$$a + d(n-1) = 5 + 2(7-1) = 17$$

$$\therefore \text{The 7th term of the H.P. is } 1/17.$$

Hence, **option 1**.

14. The given series is the series of sum of squares of the first 20 natural numbers. sum to n terms of square of a series is given by

$$n \times \frac{(n+1) \times (2n+1)}{6}$$

Thus, sum to first 20 terms is given by

$$20 \times \frac{(20+1) \times (40+1)}{6}$$

i.e. 2870

Hence, **option 2**.

15. Consider the formulae: $(1^3 + 2^3 + 3^3 + \dots + n^3)$

$$= \left[\frac{n(n+1)}{2} \right]^2 \text{ and } (1 + 2 + 3 + \dots + n)$$

$$= \frac{n(n+1)}{2}$$

Hence, observe that the value of the numerator is the square of the value of the denominator.

$$X = \frac{(1^3 + 2^3 + 3^3 + \dots + 199^3)}{(1 + 2 + 3 + \dots + 199)} = \frac{199 \times 200}{2}$$

$$= 19900$$

Hence, **option 1**.

PERMUTATIONS AND COMBINATIONS

PRACTICE TEST I

- Since the number required is odd, the digit in the units place has to be 1 or 3 or 5 or 7 or 9. Hence, in this problem, start selecting from the units digit.
 - \therefore The units place can be selected in 5 ways.
 - Since there is no repetition, the remaining three places can be selected from the remaining six digits in $6 \times 5 \times 4$ ways.
 - \therefore The total number of four digit odd numbers that can be formed = $5 \times 6 \times 5 \times 4 = 600$.
 - Hence, **option 4**.
- There are 7 digits given. Hence, the first digit of the number can be selected in 7 ways. Since repetition is allowed, the second digit can also be selected in 7 ways. Similarly, the third and fourth digit can also be selected in 7 ways each.
 - \therefore The number of four-digit numbers that can be formed using the given digits is $7 \times 7 \times 7 \times 7 = 2401$
 - Hence, **option 3**.

Alternatively,
Here, we have 7 distinct digits out of which 4 need to be selected at a time such that repetition is allowed.
So, $n = 7$ and $r = 4$
 \therefore Number of four-digit numbers possible = $7^4 = 2401$
Hence, **option 3**.

3. Number of letters in the word DRIVE = 5
All the letters of this word are distinct.
 \therefore Number of ways in which letters of the word DRIVE can be arranged = $5!$
Hence, **option 1**.

4. Number of letters in the word KETTLE = 6
Observe that the letters E and T are repeated in the word.
Number of times T is repeated = 2
Number of times E is repeated = 2

$$\therefore \text{Total number of possible words} = \frac{6!}{2! \times 2!}$$

$$= 180$$

\therefore 180 words can be formed using all the letters of the word KETTLE.

Hence, **option 3**.

5. Number of letters in the word BLASTED = 7
Since all 7 letters are distinct, number of ways in which these 7 letters can be arranged = $7!$
Now, B and E should never be together.
Hence, find the number of ways in which they are together and subtract these from the total number of arrangements where B and E are together.

Considering B and E to be one entity, there are 6 letters (including B and E as one group) to be arranged.

These 6 letters can be arranged among themselves in ${}^6P_6 = 6!$ ways

Also, B and E can be arranged among themselves in ${}^2P_2 = 2!$ ways

\therefore Total number of arrangements in which B and E are together = $6! \times 2!$

\therefore The number of ways in which B and E are never together = $7! - (6! \times 2!)$

$$= 5040 - (720 \times 2)$$

$$= 5040 - 1440 = 3600$$

Hence, **option 2**.

6. Each letter can be posted in the 8 letter boxes in 8 ways.

There is no restriction regarding the number of letters one can post in a box.

Hence, this is similar to a case of creating a 5 digit number out of 8 possible digits where repetition is allowed.

\therefore 5 letters can be posted in 8 letter boxes in $8 \times 8 \times 8 \times 8 \times 8$ ways = 8^5 ways

Hence, **option 2**.

7. 3 boys can be selected from 6 in ${}^6C_3 = 20$ ways
5 girls can be selected from 8 in ${}^8C_5 = 56$ ways
 \therefore The committee of 3 boys and 5 girls can be formed in $20 \times 56 = 1120$ ways.

Hence, **option 1**.

Note: An easy way to calculate a combination is to look at the value of r and consider only r terms in the numerator as well as denominator.

For instance, consider 8C_5 .

$${}^8C_5 = {}^8C_3$$

Here, $r = 3$

So, in the numerator, start from 8 and take the first three terms in the descending order i.e. 8, 7 and 6.

Similarly, in the denominator, start from 3 and take the first three terms in the descending order i.e. 3, 2 and 1. (This is nothing but $3!$).

$$\therefore {}^8C_5 = {}^8C_3 = \frac{8 \times 7 \times 6}{3 \times 2 \times 1} = 56$$

8. Since no two boys must be next to each others, the boys must be placed between the girls.

This can be done as follows.

_ G _ G _ G _ G _ G _

The 5 girls can be arranged in ${}^5P_5 = 5!$ ways

After arranging 5 girls, there are 6 places left for the boys.

\therefore 5 boys can be arranged in 6 places in ${}^6P_5 = 6!$ ways

\therefore The total number of arrangements possible = $5! \times 6!$

Hence, **option 3**.

9. A necklace is a circular arrangement in which the anticlockwise and clockwise arrangements appear the same.

Hence, the total number of arrangements created by the 7 beads has to be divided by 2
 n objects can be arranged in a circular arrangement in $(n - 1)!$ ways.

The beads can be arranged in $\frac{(7 - 1)!}{2}$

$$= \frac{6!}{2} = \frac{720}{2} = 360 \text{ ways}$$

\therefore A circular necklace with 7 different beads can be designed in 360 ways.

Hence, **option 3**.

10. There are eight papers.

The two English papers can be arranged between themselves in 2P_2 ways = 2 ways

But these two English papers can be taken consecutively in the schedule of eight papers in 7 ways.

Thus, the total number of ways of arranging two consecutive English papers are :-

$$7 \times 2 = 14 \text{ ways}$$

The remaining 6 papers can be arranged in ${}^6P_6 = 720$ ways

Thus, by fundamental principle, the eight papers can be arranged in :-
 $= 720 \times 14 = 10080$ ways

Hence, **option 2.**

PRACTICE TEST II

1. This problem is analogous to arranging n objects, p of which are similar and of one type, q others are similar and of a second type, and so on.

Then, the number of ways of arranging these objects is $n!/(p! \times q! \times \dots)$.

Here, the total number of objects is $15 + 10 + 3 = 28$, out of which, 15 are of one type (green), 10 are of another type (red) and 3 are of a third type (blue).

Hence, the number of ways to arrange them in a straight line

$$= (15 + 10 + 3)! / (15! \times 10! \times 3!) \\ = 28! / (15! \times 10! \times 3!)$$

Hence, **option 4.**

2. Let the total number of people present in the room be n .

Since two people are required for a handshake, the problem is of selecting 2 out of n people.

2 out of n people can be selected in nC_2 ways.

i.e. Total number of handshakes = nC_2

$$\therefore {}^nC_2 = 190$$

$$\frac{n!}{(n-2)! \times 2!} = 190$$

$$\frac{n(n-1)}{2} = 190$$

$$\therefore n(n-1) = 380$$

$$\therefore n = 20 \text{ or } n = -19$$

Since the number of people present in the room cannot be negative, $n = 20$.

Hence, **option 2.**

3. The number of circular arrangements for 5 stones would be $(5-1)! = 4!$

But in a ring, the clockwise and anticlockwise arrangements are the same.

Hence, any arrangement of stones and its mirror image are one and the same.

$$\therefore \text{Actual number of permutations} = 4! / 2 = 12$$

\therefore A circular ring can be formed using 5 stones of different colours in 12 ways.

Hence, **option 2.**

4. Number of queens in a pack of cards = 4

$$\therefore \text{Number of ways to select one queen} = {}^4C_1 \\ = 4 \text{ ways}$$

Number of spades in a pack of cards = 13

$$\therefore \text{Number of ways to select one spade} = {}^{13}C_1 \\ = 13 \text{ ways}$$

But the set of spades and the set of queens have one card in common i.e. the queen of spades.

\therefore It is included in both the sets i.e. counted twice and hence, it needs to be subtracted once while adding both the sets.

\therefore Number of ways to select either a queen or a spade is given by

$$= 4 + 13 - 1 = 16$$

\therefore There are 16 ways in which a queen or a spade can be selected from a pack of cards.

Hence, **option 2.**

5. A committee of 3 people having at least two boys implies that the committee can be formed by either 2 boys and 1 girl or all 3 boys.

Case I: 2 boys and 1 girl

This committee can be selected from 4 boys and 5 girls in ${}^4C_2 \times {}^5C_1 = 6 \times 5 = 30$ ways

Case II: All 3 members are boys

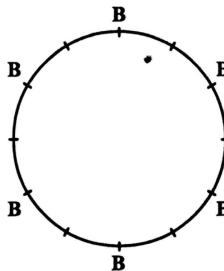
This committee can be selected from 4 boys and 5 girls in ${}^4C_3 = 4$ ways

\therefore Total number of ways to form the committee

$$= 30 + 4 = 34$$

Hence, **option 4.**

6.



To arrange 6 boys and 6 girls around a circular table such that no two girls are together, arrange the boys and girls alternately.

\therefore 6 boys are arranged as given in the figure and the 6 girls can be arranged in the 6 empty slots in between.

The 6 boys can be arranged amongst themselves in

$$(n-1)! = 5! \text{ ways}$$

The 6 girls can be arranged in the remaining 6 slots in ${}^6P_6 = 6!$ ways

[Here, do not check for circular arrangements as that has already been taken care of. Since the boys have already occupied the chairs, the

at least 1 member has to be selected from each group.

Case II:

Number of women = 3

Hence, there is only one possibility i.e. 1 woman is selected from each group.

Total number of ways = ${}^2C_1 \times {}^5C_1 \times {}^4C_1 = 40$

\therefore Total number of ways in which the committee can be selected = $10 + 24 + 80 + 40 = 154$

Hence, **option 4**.

PROBABILITY

PRACTICE TEST I

- There are 4 balls in the urn.
Here, 1 ball can be drawn out of 4 balls in ${}^4C_1 = 4$ ways
Hence, $n(S) = 4$.
Similarly, 1 red ball can be drawn out of 2 red balls in ${}^2C_1 = 2$ ways
Hence, $n(E) = 2$.
 \therefore The probability of getting a red ball = $n(E)/n(S) = 2/4 = 1/2$
Hence, **option 2**.
 - Jack draws 2 cards without replacement.
Thus when he draws the first card, the probability of getting Ace of Spades is $1/52$ (since there is only one Ace of Spades in the whole pack).
Now there are only 51 cards remaining.
Thus the probability of getting King of Spades on a second draw is $1/51$ (using the same logic given above).
 \therefore The probability of getting Ace of Spades on the first draw and King of Spades on the second draw is given
by $\frac{1}{52} \times \frac{1}{51} = \frac{1}{2652}$
Hence, **option 4**.
 - Let H denote heads and T denote tails.
Thus the sample space for the toss of three coins is given by
 $S \equiv \{HHH, HHT, HTH, HTT, THH, THT, TTH, TTT\}$
Out of these 8 possibilities, there are only three ways of getting one heads and two tails $\{HTT, THT, TTH\}$.
 \therefore The probability of getting one head and two tails on a toss of three coins is $3/8$.
Hence, **option 1**.
- Alternatively,*
Since each throw has only two outcomes, the throw of 3 coins will have $2 \times 2 \times 2 = 8$ outcomes.
Also a single heads can be obtained on a throw of 3 coins in ${}^3C_1 = 3$ ways.
 \therefore The probability of getting one heads and two tails is $3/8$.
Hence, **option 1**.
- Since two dice are thrown, the total possible outcomes = $6 \times 6 = 36$
 $\therefore n(S) = 36$
Let A be the event that the sum of the numbers which appear on the top face is even.
 \therefore The sum of the numbers can be 2, 4, 6 and so on up to 12.
Consider sum = 2
 $\therefore A \equiv \{(1, 1)\}$
Consider sum = 4
 $\therefore A \equiv \{(1, 3), (2, 2), (3, 1)\}$
Consider sum = 6
 $\therefore A \equiv \{(1, 5), (2, 4), (3, 3), (4, 2), (5, 1)\}$
Consider sum = 8
 $\therefore A \equiv \{(2, 6), (3, 5), (4, 4), (5, 3), (6, 2)\}$
Consider sum = 10
 $\therefore A \equiv \{(4, 6), (5, 5), (6, 4)\}$
Consider sum = 12
 $\therefore A \equiv \{(6, 6)\}$
Hence, $n(A) = 1 + 3 + 5 + 5 + 3 + 1 = 18$
 $\therefore P(A) = 18/36 = 1/2$
Hence, **option 2**.
- Alternatively,*
The sum of any two numbers is even when either both numbers are even or both numbers are odd.
From (1, 1) to (1, 6), there will be 3 cases where both numbers will be odd.
The same logic will apply for (3, 1) to (3, 6) and (5, 1) to (5, 6).
Hence, there are $3 + 3 + 3 = 9$ cases where both numbers are even.
From (2, 1) to (2, 6), there will be 3 cases where both numbers will be even.
The same logic will apply for (4, 1) to (4, 6) and (6, 1) to (6, 6).
Hence, there are $3 + 3 + 3 = 9$ cases where both numbers are even.
 $n(A) =$ Cases where both numbers are even + Cases where both numbers are odd.
Hence, $n(A) = 9 + 9 = 18$
 $\therefore P(A) = 18/36 = 1/2$
Hence, **option 2**.

six chairs for the girls can be distinguished from one another according to their position relative to the boys. Now, this is a simple permutation of arranging 6 people in 6 slots.]

∴ Total number of arrangements = $5! \times 6!$

Hence, **option 3**.

7. Consider the 3 Hindi books as 1 entity, the 3 History books as 1 entity and the 3 Science books as 1 entity.

These 3 sets of books can be arranged amongst themselves in ${}^3P_3 = 3!$ ways

The 3 Hindi books can be arranged amongst themselves in ${}^3P_3 = 3!$ ways

The 3 History books can be arranged amongst themselves in ${}^3P_3 = 3!$ ways

The 3 Science books can be arranged amongst themselves in ${}^3P_3 = 3!$ ways

∴ The total number of arrangements

$$= 3! \times 3! \times 3! \times 3!$$

$$= 6 \times 6 \times 6 \times 6 = 1296$$

∴ The 9 books can be arranged amongst themselves in 1296 ways if the 3 Hindi books, the 3 History books and the 3 Science books are kept together.

Hence, **option 1**.

8. Here, one chair is of a different colour and the position of all the other chairs can be specified with respect to that one green chair.

This is equivalent to numbering the green chair as 1 and other chairs in clockwise (or anti-clockwise) direction as 2, 3, 4, 5 and 6.

So, now 6 people can be allotted 6 different numbers in ${}^6P_6 = 6! = 720$ ways

∴ 720 arrangements can be made for 6 people.

The relevance of the green chair is that it makes this arrangement linear in spite of its circular nature.

Hence, **option 1**.

Alternatively,

Consider the positions on the circle to be numbered as 1, 2, 3, 4, 5 and 6.

Let the green chair be numbered 1. So, the blue chairs will be numbered from 2 to 6.

5 people can sit on those 5 blue chairs in 5! ways and the sixth person is forced to sit in the green chair in 1 way.

Thus, if the green chair is numbered 1, the 6 people can be arranged in 5! ways.

However, the green chair can be any of the 6 chairs. Thus it can take six values. For each of those values, the total number of arrangements is 5!.

So, total number of arrangements = $6 \times 5! = 6!$
= 720

Hence, **option 1**.

9. 0, 1 or 2 vertices of the triangle can be chosen from the collinear points.

Thus, if all three vertices of the triangle are chosen from the non-collinear points, they can be chosen in 5C_3 ways i.e. 10 ways

If 1 vertex is selected from the 5 collinear points and 2 vertices are selected from the 5 non-collinear points, the total number of triangles that can be formed = ${}^5C_1 \times {}^5C_2$
= $5 \times 10 = 50$

Finally, if 1 vertex is selected from the 5 non-collinear points and 2 vertices are selected from the 5 collinear points, the total number of triangles that can be formed = ${}^5C_1 \times {}^5C_2$
= $5 \times 10 = 50$

Thus, total number of triangles possible

$$= 10 + 50 + 50 = 110$$

Hence, **option 2**.

Alternatively,

Find all the triangles possible and subtract the number of triangles that cannot be made.

A triangle cannot be formed from three points if all of them are collinear.

If all the 10 points are non-collinear, then the total number of possible triangles = ${}^{10}C_3 = 120$
Of these, triangles cannot be formed with sets of 3 collinear points.

∴ Number of triangles that cannot be formed because of the 5 points being collinear = 5C_3
= 10

∴ Total number of triangles that can be formed

$$= 120 - 10 = 110$$

Hence, **option 2**.

10. **Case I:**

Number of women = 2

Consider all the following possibilities.

Possibility 1:

1 woman each from group 1 and group 2 and a man from group 3

$$\text{Total number of groups} = {}^2C_1 \times {}^5C_1 \times {}^1C_1 = 10$$

Possibility 2:

1 woman each from group 1 and group 3 and a man from group 2

$$\text{Total number of ways} = {}^2C_1 \times {}^3C_1 \times {}^4C_1 = 24$$

Possibility 3:

1 woman each from group 2 and group 3 and a man from group 1

$$\text{Total number of ways} = {}^4C_1 \times {}^5C_1 \times {}^4C_1 = 80$$

Here, the possibility that both women may be from one group cannot be considered because

5. Let A be the event that at least one of the two cards is an Ace.

This implies that either only one card is an Ace or both cards are Aces.

A' is the event that none of the cards is an Ace.

In such case, it is often easier to find out the probability for the case where none of the cards is an Ace and subtract it from the total cases possible.

There are 4 Aces in a pack of cards

Hence, two non-ace cards can be picked in ${}^{48}C_2$ ways.

Two cards can be picked in ${}^{52}C_2$ ways.

$$\therefore P(A') = \frac{{}^{48}C_2}{{}^{52}C_2}$$

$$\therefore P(A') = \frac{48 \times 47}{52 \times 51} = \frac{188}{221}$$

\therefore The probability that at least one of the two cards is an ace is

$$\therefore P(A) = 1 - \frac{188}{221} = \frac{33}{221}$$

Hence, **option 4**.

6. Total cards = 52

2 cards can be drawn from 52 cards in ${}^{52}C_2$ ways.

Let A be an event when 2 non-spade cards are drawn from a pack of 52 cards.

There are 13 spades in a pack of 52 cards.

Hence there are 39 non-spade cards.

2 cards can be drawn from 39 cards in ${}^{39}C_2$ ways.

$$\therefore n(A) = {}^{39}C_2$$

$$\therefore P(A) = \frac{{}^{39}C_2}{{}^{52}C_2} = \frac{39 \times 38}{52 \times 51} = \frac{19}{34}$$

Hence, **option 1**.

7. There are 8C_3 ways of picking 3 numbers out of eight.

To get 17 as the sum out of these combinations, there are four possibilities (8, 7, 2), (8, 6, 3), (8, 5, 4) and (7, 6, 4).

Since the 3 numbers have to be distinct, a combination such as (7, 7, 3) or (6, 5, 6) cannot be selected.

\therefore The probability of picking 3 numbers from the first 8 natural numbers such that their sum is 17

$$= 4/({}^8C_3) = 4/56 = 1/14$$

Hence, **option 3**.

8. If, out of 3 balls, at least 2 are different in colour it means that all three balls cannot be of the same colour.

Probability that at least 2 balls are of different colours

= 1 - Probability that all balls are of same colour

= 1 - [Probability that all balls are red + Probability that all balls are white + Probability that all balls are blue]

3 balls can be selected out of 20 balls in ${}^{20}C_3$ ways

= 1140 ways

3 red balls can be selected out of 9 balls in 9C_3 ways

= 84 ways

\therefore Probability that all 3 balls are red

= 84/1140

3 white balls can be selected out of 6 white balls in

6C_3 ways = 20 ways

\therefore Probability that all 3 balls are white

= 20/1140

3 blue balls can be selected out of 5 blue balls in

5C_3 ways = 10 ways

\therefore Probability that all 3 balls are blue

= 10/1140

\therefore Probability that at least 2 balls are of different colors

$$= 1 - \frac{84}{1140} - \frac{20}{1140} - \frac{10}{1140}$$

$$= 1 - \frac{114}{1140} = \frac{9}{10}$$

Hence, **option 4**.

9. Odds in favour of India winning the match

= 3:2

\therefore Probability that India wins the match = $3/(3+2) = 3/5 = 0.6$

Probability of a tie = 0.2

Probability of Pakistan winning the match

= 1 - 0.6 - 0.2 = 0.2

For India to win the series, they need to have either

i) 3 wins for India

ii) 2 wins and 1 loss for India

iii) 2 wins for India and one tie OR

iv) 1 win for India and 2 ties

Probability of 3 wins = $0.6 \times 0.6 \times 0.6 = 0.216$

Probability of 2 wins and 1 loss

= $0.6 \times 0.6 \times 0.2 = 0.072$

The two wins can come out of 3 matches in 3C_2 ways = 3 ways

\therefore Total probability of 2 wins and 1 loss

$$= 3 \times 0.072 = 0.216$$

$$\text{Probability of 2 wins and 1 tie} = 0.6 \times 0.6 \times 0.2 = 0.072$$

The two wins can come out of 3 matches in 3C_2 ways = 3 ways

∴ Total probability of 2 wins and 1 tie

$$= 3 \times 0.072 = 0.216$$

$$\text{Probability of 1 win and 2 ties} = 0.6 \times 0.2 \times 0.2 = 0.024$$

The one win can come out of 3 matches in 3C_1 ways = 3 ways

∴ Total probability of 1 win and 2 ties

$$= 3 \times 0.024 = 0.072$$

∴ Total probability of India winning the series

$$= 0.216 + 0.216 + 0.072 = 0.72$$

Hence, **option 3**.

$$10. P(\text{White}|\text{Black}) = \frac{P(\text{Black and White})}{P(\text{Black})}$$

$$= \frac{0.34}{0.47} = 0.72$$

$$= 72\%$$

Hence, **option 1**.

DATA SUFFICIENCY

PRACTICE TEST I

1. Let the cost of the vehicle be C and its length be L .

$$\therefore C \propto L$$

∴ $C = kL$, where k is the constant of proportionality

When $L = 2$ m,

$$C = 2k$$

Now, let the cost of the vehicle of length 1 m be C_1 .

$$\therefore C_1 = k$$

Also, let the cost of the vehicle of length 1.5 m be C_2 .

$$\therefore C_2 = 1.5 \times k$$

Using statement A alone:

$$C_2 - C_1 = 10000$$

$$\therefore 1.5 \times k - k = 10000$$

$$\therefore 0.5 \times k = 10000$$

$$\therefore k = 20000$$

$$\therefore \text{Cost of 2 m long vehicle is } C = 2 \times 20000$$

$$= \text{Rs. } 40,000$$

∴ The question can be answered using statement A alone.

Using statement B alone:

$$C_1 + C_2 = 45000$$

$$\therefore k + 1.5 \times k = 45000$$

$$\therefore 2.5 \times k = 45000$$

$$\therefore k = 18000$$

$$\therefore \text{Cost of 2 m long vehicle is } C = 2 \times 18000$$

$$= \text{Rs. } 36,000$$

∴ The question can be answered using statement B alone.

∴ The question using either of the statements alone.

Hence, **option 3**.

2. Using statement A alone:

The data given is for Beenal, Amit and Surekha.

There is no mention of Lekha.

Hence, the question cannot be answered using statement A alone.

Using statement B alone:

The data given is for Lekha and Amit.

There is no mention of Surekha.

Hence, the question cannot be answered using statement B alone.

Using both the statements A and B together:

Amit is Surekha's husband and Lekha's brother.

∴ Lekha is Surekha's sister-in-law.

Hence, the question can be answered using both the statements together.

Hence, **option 4**.

3. Using Statement A alone:

Since the people are arranged in alphabetical order, they sit as shown below.

Aman, Mini, Raman, Tiny, Vini.

Thus, Raman is sitting in the middle.

∴ The question can be answered using statement A alone.

Using Statement B alone:

Raman has the longest name.

Hence, Raman is sitting in between Mini and Tiny.

Hence, Raman can sit at any position apart from the extreme ends.

Since the seating arrangement of the remaining friends is unknown, it is not possible to identify the person sitting in the middle.

∴ The question cannot be statement B alone.

Hence, **option 1**.

4. Using statement A alone:

Worst case for A: A picks all 4 Jacks to score a total of 44 points.

Best case for B/C/D: Any one of B/C/D picks 1 Ace and 3 Kings to score a total of $1 + 3 \times 9 = 40$ points

∴ Even in the best case for B/C/D and the worst case for A, A is a winner. This statement

alone gives us the answer to the required question.

∴ The question can be answered using statement A alone.

Using statement B alone:

Best case for A: 3 Aces and 1 King = $3 + 13$
= 16 points

Possible cases for B, C or D:

Case 1: Any one of B/C/D can score more than 16, in which case A will not be the winner.

Case 2: B, C and D all score less than 16. [For example, B, C and D pick the cards (2, 2, 4, 4), (2, 2, 4, 4) and (3, 3, 3, 3)]. In this case, A will be the winner.

∴ Using statement B, player A may or may not be a winner.

∴ The question cannot be answered using statement B alone.

Hence, **option 1**.

5. Using statement A alone:

John winning the race depends on the value of a .

If a is greater than 1, then John wins the race.

If a is less than or equal to 1, then John does not win the race.

∴ The question cannot be answered using statement A alone.

Using statement B alone:

You cannot get any answer to the problem with statement B alone as we do not know what a means.

∴ The question cannot be answered using statement B alone.

Using statements A and B together:

Since n is a proper fraction greater than 0 and $a \times n < n$, hence $a < 1$.

Hence, John's speed is less than Jim's speed.

∴ The question can be answered using statements A and B together.

Hence, **option 4**.

6. Using statement A alone:

When the roots of the quadratic equation are 3 and 4, the equation can be written as,

$$(x - 3)(x - 4) = 0$$

$$\therefore x^2 - 7x + 12 = 0$$

But here, b and c are interchanged.

Hence, $c = -7$ and $b = 12$.

∴ The actual quadratic equation is $x^2 + 12x - 7 = 0$

Now, one can find the roots of this quadratic equation.

∴ The question can be answered using statement A alone.

Using statement B alone:

When the roots of the equation are 2 and 6, the equation can be written as,

$$(x - 2)(x - 6) = 0$$

$$\therefore x^2 - 8x + 12 = 0$$

But here, a and c are interchanged.

Hence, in this case, $a = 1$ and $c = 12$

∴ The actual quadratic equation is $12x^2 - 8x + 1 = 0$

Now, one can find roots of this quadratic equation.

∴ The question can be answered using statement B alone.

∴ Hence, the question can be answered using either of the statements alone.

Hence, **option 3**.

7. P and Q sit next to each other.

Hence, P can be to the right or left of Q.

Using statement A alone:

P sits next to Q on one side of Q. If R also sits next to Q, then S has to be opposite Q. Thus, the person opposite S is Q.

∴ The question can be answered using statement A alone.

Using statement B alone:

P sits next to Q on one side of Q. If P also sits next to R, then S has to be opposite P. Thus, the person opposite S is P.

∴ The question can be answered using statement B alone.

∴ The question can be answered using either of the statements alone.

Hence, **option 3**.

8. Using statement A alone:

Though the upstream and downstream distance is known, the speeds of the boat and stream are not known.

∴ The speeds of the boat and the stream are not known, one cannot find the time required.

∴ The question cannot be answered using statement A alone.

Using statement B alone:

Though the speed of the stream and boat are known, the distances are not known.

∴ Distance is not known, one cannot find the time required.

∴ The question cannot be answered using statement B alone.

Using both statements A and B together:

∴ Speed of the stream is more than the speed of the boat, the boat will not be able to travel upstream.

But, Rajesh needs to travel 6 km upstream.

The boat cannot do this and so Rajesh will never reach Kotla.

∴ Rajesh will not reach Kotla from Chennai in 5 hours.

∴ Statement A and B together are sufficient to answer the question.

Hence, **option 3**.

9. From Statement A alone.

- - - - R

1 2 3 4 5

From Statement B alone.

- - - S V

1 2 3 4 5

From Statement A and B together.

R - - S V

1 2 3 4 5

So the only possible arrangement as per height is R__SV

∴ Raju is the shortest, he is not taller than Chimu.

∴ The question can be answered using statements A and B together.

Hence, **option 3**.

10. The last digit of $(abcd)^{994}$ will depend only on the value of d .

Using statement A alone:

∴ $(abcd)$ is a power of 6 and the last digit of any power of 6 is 6,

∴ $d = 6$

Hence, $abcd$ will also end in 6.

Hence, the last digit of $(abcd)^{994}$ will be 6.

∴ The question can be answered using statement A alone.

Using statement B alone:

∴ $(abcd) \times 2$ is divisible by 10, ∴ $(abcd)$ will be divisible 5.

∴ d can be 5 or 0.

If $d = 5$, the last digit of $(abcd)^{994}$ will be 5 and if $d = 0$, the corresponding last digit will be 0.

Hence, the last digit cannot be found.

∴ The question cannot be answered using statement B alone.

Hence, **option 1**.

11. $AB \parallel CD$

∴ $\angle OCD = \angle OBA$... (i) (Alternate angles)

Also, since $OA = OB$

∴ $m \angle OBA = m \angle OAB = 50^\circ$... (ii)

From (i) and (ii),

$m \angle OCD = 50^\circ$

Hence, all the three statements are required to find $\angle OCD$.

If A is not given, the concept of alternate angles cannot be used.

If C is not given, $\angle OAB$ cannot be proved to be equal to $\angle OBA$

If B is not given, the value cannot be found even after knowing everything else.

Hence, **option 4**.

12. Using statements A and B:

Let Ryan's present age be x .

∴ Sujit's present age is $(x + 5)$

10 years ago,

$(x - 5) = 15$

∴ $x = 25$ years.

i.e. Ryan's age = 25 years and Sujit's present age

$= (x + 5) = 30$ years.

Hence, C is not required.

Using statements B and C:

Let Ryan's present age be x .

Now, using statement B, as shown above,

$x = 25$ years.

Let Sujit's present age be y .

∴ 5 years hence,

$(25 + 5) + (y + 5) = 65$

∴ $y = 30$ years.

Hence, A is not required.

Using statements A and C:

Let Ryan's present age be x .

∴ Sujit's present age is $(x + 5)$

∴ 5 years hence,

$(x + 5) + (x + 10) = 65$

∴ $2x = 50$

∴ $x = 25$

i.e. Ryan's age = 25 years and Sujit's age

$= (x + 5) = 30$ years.

Hence, B is not required.

The solution can be found using any of the two statements.

i.e. any one of the three statements can be dispensed with.

Hence, **option 3**.

13. From the question statement, the number of students who attended the seminar on Monday = 52

From statements A and C:

Average of the number of students who attended the seminar on Monday, Tuesday and Wednesday = 53

and

The number of students who attended the seminar on Tuesday = 59

\therefore Number of students who attended the seminar on Wednesday = $(53 \times 3) - (52 + 59)$
 $= 159 - 111 = 48$

Statement B does not give information required to answer the question.

Hence, **option 3**.

14. To find the probability that a ball drawn is of a particular colour, it is necessary to know the number of balls of that colour and the total number of balls in the bag.

This is given in statements A and B.

The data in statement C is unrelated.

Hence, only statements A and B are required.

Hence, **option 4**.

15. From statement I,

Sum of age of C and F is 60 years

i.e. $C + F = 60$

From statement II,

Average age of A, B, D, E and G is 30 years

$\therefore A + B + D + E + G = 30 \times 5 = 150$

Average age = $(60 + 150)/7 = 30$ years

Thus, statements I and II are sufficient to answer the given question.

Statement III is not required at all.

Hence, **option 2**.