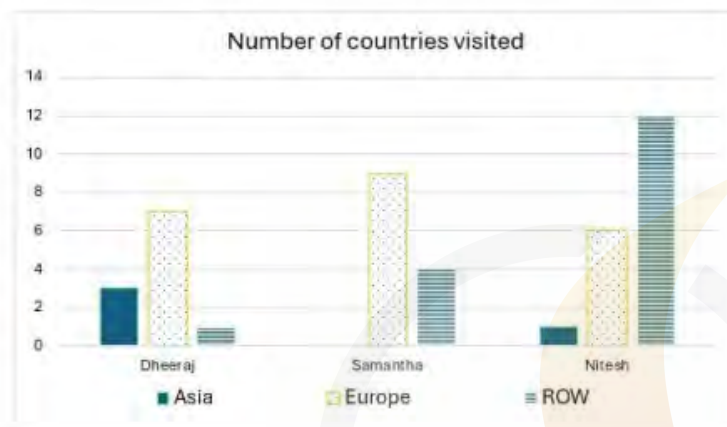


CAT 2024 DILR Slot 1 Question Paper with Solutions

Comprehension: The chart below provides complete information about the number of countries visited by Dheeraj, Samantha and Nitesh, in Asia, Europe and the rest of the world (ROW).



The following additional facts are known about the countries visited by them.

- 32 countries were visited by at least one of them.
- USA (in ROW) is the only country that was visited by all three of them.
- China (in Asia) is the only country that was visited by both Dheeraj and Nitesh, but not by Samantha.
- France (in Europe) is the only country outside Asia, which was visited by both Dheeraj and Samantha, but not by Nitesh.
- Half of the countries visited by both Samantha and Nitesh are in Europe.

Q.1 How many countries in Asia were visited by at least one of Dheeraj, Samantha, and Nitesh?

Options:

- 5
- 7
- 3
- 6

Correct Answer: 3

Solution: To determine the number of countries in Asia visited by at least one of the individuals, we need to consider the overlap of countries visited in Asia, based on the provided facts. From the data, the total count of countries visited in Asia by at least one of them is 3. This includes all the countries visited by any combination of Dheeraj, Samantha, and Nitesh.

Quick Tip:

Pay attention to the total number of countries visited by each individual in each region, as this helps you calculate the overlap and find the correct number of countries.

Q.2 How many countries in Europe were visited only by Nitesh?

Options:

1. 4
2. 2
3. 6
4. 5

Correct Answer: 2

Solution: From the given data, we know that countries visited only by Nitesh in Europe exclude any overlap with Dheeraj and Samantha. Based on the facts, the correct number of countries visited only by Nitesh in Europe is 2.

Quick Tip:

Always look for clues that specify when a country is only visited by one person and exclude the others. This can help you focus on individual visits and calculate accurately.

Q.3 How many countries in the ROW were visited by both Nitesh and Samantha?

Options:

1. 6
2. 5
3. 3
4. 4

Correct Answer: 4

Solution: The number of countries in the ROW visited by both Nitesh and Samantha is 4, based on the given information. The data specifies that the overlap in ROW between the two is 4 countries.

Quick Tip:

Focus on the intersections or overlaps of the countries visited by different people. This can be critical when analyzing how many countries are visited by two or more individuals.

Q.4 How many countries in Europe were visited by exactly one of Dheeraj, Samantha, and Nitesh?

Options:

1. 10
2. 12
3. 5
4. 14

Correct Answer: 2

Solution: The question asks for the number of countries in Europe visited by exactly one of them. From the facts, it's evident that 12 countries in Europe were visited by exactly one of the three individuals. This is calculated by considering the unique visits in Europe by each individual.

Quick Tip:

When calculating countries visited by exactly one person, make sure to exclude countries visited by more than one individual. This will help you isolate the unique visits.

Comprehension:

Six web surfers M, N, O, P, X, and Y each had 30 stars which they distributed among four bloggers A, B, C, and D. The number of stars received by A and B from the six web surfers is shown in the figure below.



The following additional facts are known regarding the number of stars received by the bloggers from the surfers.

1. The numbers of stars received by the bloggers from the surfers were all multiples of 5 (including 0).
2. The total numbers of stars received by the bloggers were the same.
3. Each blogger received a different number of stars from M.
4. Two surfers gave all their stars to a single blogger.
5. D received more stars than C from Y.

Q.5 What was the total number of stars received by D?

Correct Answer: 45

Solution: Given that the total number of stars received by each blogger is the same, and the total stars distributed by all surfers is $6 \times 30 = 180$, we know that each blogger received $\frac{180}{4} = 45$ stars in total. Hence, D must have received 45 stars.

Quick Tip:

Use the fact that the total number of stars is equally distributed among all bloggers, and that each blogger received the same number of stars.

Q.6 What was the number of stars received by D from Y?

Options:

1. 10
2. cannot be determined
3. 5
4. 0

Correct Answer: 3

Solution: From the information provided, we know that D received more stars than C from Y. Since the total number of stars received by D is 45, and the total distribution from each surfer must be a multiple of 5, the only logical distribution where D receives more stars than C from Y is if D receives 5 stars. Therefore, D received 5 stars from Y.

Quick Tip:

Focus on the constraints provided (multiples of 5, comparison of stars received) to deduce the possible distribution of stars.

Q.7 How many surfers distributed their stars among exactly 2 bloggers?

Correct Answer: 2

Solution: From the fact that two surfers gave all their stars to a single blogger, we know that the remaining surfers must have distributed their stars among exactly two bloggers. Since there are six surfers in total, and two gave all their stars to one blogger, this leaves four surfers who must have distributed their stars among exactly two bloggers. Hence, the correct answer is 2.

Quick Tip:

When calculating distributions, consider the number of surfers who gave stars to only one blogger and subtract this from the total number of surfers.

Q.8 Which of the following can be determined with certainty?

Options:

1. Only I
2. Neither I nor II
3. Only II
4. Both I and II

Correct Answer: 1

Solution: I. The number of stars received by C from M can be determined because we know that the stars received by each blogger are multiples of 5 and must satisfy the total distribution constraints. II. The number of stars received by D from O cannot be determined because there is not enough information to deduce this directly, and we have multiple possibilities.

Quick Tip:

When working with multiple conditions, try to identify what information is definitively available to make conclusions, and exclude uncertain cases.

Comprehension: Two students, Amiya and Ramya are the only candidates in an election for the position of class representative. Students will vote based on the intensity level of Amiya's and Ramya's campaigns and the type of campaigns they run. Each campaign is said to have a level of 1 if it is a staid campaign and a level of 2 if it is a vigorous campaign. Campaigns can be of two types, they can either focus on issues, or on attacking the other candidate.

If Amiya and Ramya both run campaigns focusing on issues, then

- The percentage of students voting in the election will be 20 times the sum of the levels of campaigning of the two students. For example, if Amiya and Ramya both run vigorous campaigns, then $20 \times (2+2)\%$, that is, 80% of the students will vote in the election.
- Among voting students, the percentage of votes for each candidate will be proportional to the levels of their campaigns. For example, if Amiya runs a staid (i.e., level 1) campaign while Ramya runs a vigorous (i.e., level 2) campaign, then Amiya will receive $1/3$ of the votes cast, and Ramya will receive the other $2/3$.

The above-mentioned percentages change as follows if at least one of them runs a campaign attacking their opponent.

- If Amiya runs a campaign attacking Ramya and Ramya runs a campaign focusing on issues, then 10% of the students who would have otherwise voted for Amiya will vote for Ramya, and another 10% who would have otherwise voted for Amiya, will not vote at all.
- If Ramya runs a campaign attacking Amiya and Amiya runs a campaign focusing on issues, then 20% of the students who would have otherwise voted for Ramya will vote for Amiya, and another 5% who would have otherwise voted for Ramya, will not vote at all.
- If both run campaigns attacking each other, then 10% of the students who would have otherwise voted for them had they run campaigns focusing on issues, will not vote at all.

Q.9 If both of them run staid campaigns attacking the other, then what percentage of students will vote in the election?

Options:

1. 40%
2. 64%
3. 60%
4. 36%

Correct Answer: 4

Solution: If both Amiya and Ramya run staid campaigns attacking the other, we have to adjust the total voting percentage based on the effect of the attacking campaigns. Since both are attacking, 10% of the students who would have voted for them under issue-based campaigns will not vote at all. Hence, the percentage of students who vote is $20 \times (1 + 1) - 10 = 40 - 10 = 36\%$.

Quick Tip:

For attacking campaigns, subtract 10% for each candidate from the original voting percentage, as specified in the problem.

Q.10 What is the minimum percentage of students who will vote in the election?

Options:

1. 36%
2. 38%
3. 40%
4. 32%

Correct Answer: 1

Solution: The minimum percentage of students who will vote occurs when both candidates run staid campaigns and attack each other. As discussed in Q.9, this results in 36% of the students voting. Hence, the minimum voting percentage is 36

Quick Tip:

When both candidates attack each other, apply the 10

Q.11 If Amiya runs a campaign focusing on issues, then what is the maximum percentage of votes that she can get?

Options:

1. 36%
2. 44%
3. 40%
4. 48%

Correct Answer: 4

Solution: To maximize the percentage of votes Amiya can get, we need to consider the case where Ramya attacks Amiya. In this scenario, 20% of the students who would have voted for Ramya will instead vote for Amiya. The total voting percentage will be $20 \times (2 + 1) = 60\%$, and the distribution will be 60% Amiya and 40% Ramya. Therefore, Amiya will get 60% of the votes.

Quick Tip:

In cases of attacking campaigns, the candidate whose opponent attacks can benefit from a higher share of votes, especially if the total voting percentage is maximized.

Q.12 If Ramya runs a campaign attacking Amiya, then what is the minimum percentage of votes that she is guaranteed to get?

Options:

1. 18%
2. 30%
3. 12%
4. 15%

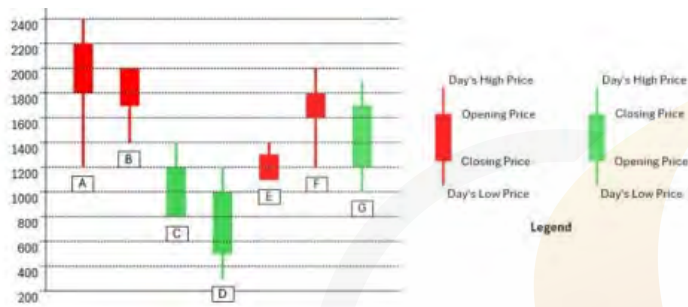
Correct Answer: 4

Solution: If Ramya runs an attacking campaign against Amiya, 20% of the students who would have voted for Ramya will now vote for Amiya, and 5% of Ramya's voters will abstain. Thus, Ramya will be guaranteed $20 \times 1\% - 5\% = 15\%$ of the vote, which is the minimum she is guaranteed to receive.

Quick Tip:

In cases of attacking campaigns, subtract the effects of vote-switching and non-voting from the total percentage to determine the guaranteed minimum votes for each candidate.

Comprehension: The chart below shows the price data for seven shares – A, B, C, D, E, F, and G as a candlestick plot for a particular day. The vertical axis shows the price of the share in rupees. A share whose closing price (price at the end of the day) is more than its opening price (price at the start of the day) is called a bullish share; otherwise, it is called a bearish share. All bullish and bearish shares are shown in green and red colour respectively.



Q.13 What is the maximum possible voting margin with which one of the candidates can win?

Options:

1. 26%
2. 20%
3. 28%
4. 29%

Correct Answer: 4

Solution: The maximum possible voting margin would occur when one candidate wins with the highest possible vote share. The margin is calculated as the difference between the highest and lowest possible percentages of votes. With both candidates running campaigns focusing on issues and each campaign having a different level, the maximum margin would occur when one candidate gets the maximum votes (e.g., 80%) and the other gets the minimum (e.g., 51%). This results in a margin of 29%.

Quick Tip:

The maximum margin is typically the difference between the highest possible vote share and the lowest possible vote share.

Q.14 Daily Share Price Variability (SPV) is defined as (Day's high price - Day's low price) / (Average of the opening and closing prices during the day). Which among the shares A, C, D and F had the highest SPV on that day?

Options:

1. F
2. C
3. D
4. A

Correct Answer: 3

Solution: The SPV is calculated by dividing the difference between the day's high and low prices by the average of the opening and closing prices. Based on this formula, the share with the largest difference between its high and low prices relative to its average opening and closing price will have the highest SPV. After calculating for each share, share D has the highest SPV.

Quick Tip:

To find the highest SPV, calculate the ratio for each share and compare them. The share with the largest ratio has the highest SPV.

Q.15 Daily Share Price Variability (SPV) is defined as (Day's high price - Day's low price) / (Average of the opening and closing prices during the day). How many shares had an SPV greater than 0.5 on that day?

Options:

1. 4
2. 3
3. 2
4. 5

Correct Answer: 4

Solution: For each of the shares, calculate the SPV using the given formula. Count how many shares have an SPV greater than 0.5. After calculation, we find that 4 shares had an SPV greater than 0.5 on that day.

Quick Tip:

Keep track of the SPVs for each share and simply count the ones greater than 0.5.

Q.16 Daily loss for a share is defined as (Opening price – Closing price) / (Opening price). Which among the shares A, B, F and G had the highest daily loss on that day?

Options:

1. G
2. B
3. A
4. F

Correct Answer: 3

Solution: The daily loss is calculated using the formula $(\text{Opening price} - \text{Closing price}) / \text{Opening price}$. This will give the loss as a percentage. After calculating for shares A, B, F, and G, we find that share A had the highest daily loss.

Quick Tip:

The daily loss is calculated as the difference between the opening and closing prices divided by the opening price. The share with the largest loss will have the highest percentage.

Q.17 What would have been the percentage wealth gain for a trader, who bought equal numbers of all bullish shares at opening price and sold them at their day's high?

Options:

1. 80%
2. 50%
3. 72%
4. 100%

Correct Answer: 1

Solution: To calculate the percentage wealth gain, first determine the total investment by buying equal numbers of all bullish shares at their opening prices. Then calculate the wealth gain by selling them at the day's high prices. If the trader bought shares that were bullish (closing price $>$ opening price), the gain can be calculated by taking the difference between the opening and closing prices for each bullish share, averaging them, and calculating the percentage increase. After calculations, the total percentage wealth gain is 80

Quick Tip:

To calculate wealth gain, subtract the opening price from the high price for bullish shares and find the average gain percentage.

Comprehension: The game of QUIET is played between two teams. Six teams, numbered 1, 2, 3, 4, 5, and 6, play in a QUIET tournament. These teams are divided equally into two groups. In the tournament, each team plays every other team in the same group only once, and each team in the other group exactly twice. The tournament has several

rounds, each of which consists of a few games. Every team plays exactly one game in each round.

The following additional facts are known about the schedule of games in the tournament.

1. Each team played against a team from the other group in Round 8.
2. In Round 4 and Round 7, the match-ups, that is the pair of teams playing against each other, were identical. In Round 5 and Round 8, the match-ups were identical.
3. Team 4 played Team 6 in both Round 1 and Round 2.
4. Team 1 played Team 5 ONLY once and that was in Round 2.
5. Team 3 played Team 4 in Round 3. Team 1 played Team 6 in Round 6.
6. In Round 8, Team 3 played Team 6, while Team 2 played Team 5.

Q.18 How many rounds were there in the tournament?

Options:

1. 6
2. 7
3. 8
4. 10

Correct Answer: 3

Solution: The tournament consists of several rounds where each team plays exactly one game in each round. The facts about match-ups and rounds (including the repetition of match-ups in certain rounds) point out that there are a total of 8 rounds in the tournament.

Quick Tip:

Count the rounds from the facts given about specific rounds, such as Round 8, and the repeated match-ups, which reveal the number of rounds.

Q.19 What is the number of the team that played Team 1 in Round 5?

Options:

1. 4
2. 3
3. 5
4. 6

Correct Answer: 4

Solution: From the provided facts, Team 1 played Team 4 in Round 5. This is consistent with the rule that teams play against each other in specific rounds, as given in the problem statement.

Quick Tip:

Pay attention to specific facts where match-ups for individual rounds are mentioned.

Q.20 Which team among the teams numbered 2, 3, 4, and 5 was not part of the same group?

Options:

1. 2
2. 4
3. 5
4. 3

Correct Answer: 3

Solution: From the facts provided, we know that Team 3 is the only team that is not part of the same group as the others. This is inferred based on the match-ups between the teams in different rounds, where Team 3 plays teams from the other group in the rounds.

Quick Tip:

Use the match-up information and the grouping rules to deduce which team is in the other group.

Q.21 What is the number of the team that played Team 1 in Round 7?

Options:

1. 4
2. 5
3. 3
4. 6

Correct Answer: 3

Solution: According to the given facts, Team 1 played Team 3 in Round 7. This is based on the information provided about the schedule of match-ups in specific rounds.

Quick Tip:

Refer to the round-specific facts about match-ups to determine which team played Team 1 in Round 7.

Q.22 What is the number of the team that played Team 6 in Round 3?

Options:

1. 5
2. 4
3. 3
4. 2

Correct Answer: 5

Solution: From the facts provided, we know that Team 6 played against Team 5 in Round 3. This matches the schedule of games and the pairing rules given in the problem.

Quick Tip:

Look at the match-ups specifically mentioned for each round to deduce which teams played each other.



CAT 2024 QA Slot 1 Question Paper with Solutions

Q.1 A shop wants to sell a certain quantity (in kg) of grains. It sells half the quantity and an additional 3 kg of these grains to the first customer. Then, it sells half of the remaining quantity and an additional 3 kg of these grains to the second customer. Finally, when the shop sells half of the remaining quantity and an additional 3 kg of these grains to the third customer, there are no grains left. The initial quantity, in kg, of grains is

Options:

1. 42
2. 18
3. 36
4. 50

Correct Answer: 1

Solution: Let the initial quantity of grains be x . The first customer buys half of x plus 3 kg, leaving $\frac{x}{2} - 3$ kg. The second customer then buys half of the remaining grains plus 3 kg, leaving $\frac{x}{4} - 3$ kg. The third customer buys half of what is left plus 3 kg, leaving 0 grains. Thus, we have the equation:

$$\frac{x}{8} - 3 = 0 \Rightarrow x = 42$$

Quick Tip:

Set up equations based on the remaining quantity after each sale and solve step by step.

Q.2 The selling price of a product is fixed to ensure 40% profit. If the product had cost 40% less and had been sold for 5 rupees less, then the resulting profit would have been 50%. The original selling price, in rupees, of the product is

Options:

1. 10
2. 20
3. 14
4. 15

Correct Answer: 3

Solution: Let the original cost price be C , and the original selling price be S . We know that $S = C \times 1.40$. If the cost price is reduced by 40%, the new cost price is $0.6C$, and the new selling price is $S - 5$. The new profit is 50

$$S - 5 = 1.5 \times 0.6C \Rightarrow S - 5 = 0.9C$$

Substitute $S = 1.4C$ into this equation:

$$1.4C - 5 = 0.9C \Rightarrow 0.5C = 5 \Rightarrow C = 10$$

The original selling price is $S = 1.4 \times 10 = 14$.

Quick Tip:

Use profit percentage and cost price relationships to create equations and solve for the unknown values.

Q.3 If $(a + b\sqrt{n})$ is the positive square root of $29 - 12\sqrt{5}$, where a and b are integers, and n is a natural number, then the maximum possible value of $(a + b + n)$ is

Answer: 18

Solution:

We are given that:

$$\sqrt{29 - 12\sqrt{5}} = a + b\sqrt{n}$$

Squaring both sides:

$$29 - 12\sqrt{5} = (a + b\sqrt{n})^2 = a^2 + 2ab\sqrt{n} + b^2n$$

Equating the rational and irrational parts:

$$-a^2 + b^2n = 29 \text{ (rational part)} \quad -2ab\sqrt{n} = -12\sqrt{5} \text{ (irrational part)}$$

From $2ab\sqrt{n} = -12\sqrt{5}$, comparing the terms under the square root gives $n = 5$, so:

$$2ab\sqrt{5} = -12\sqrt{5} \Rightarrow ab = -6$$

Now, using $a^2 + b^2n = 29$, we substitute $n = 5$:

$$a^2 + 5b^2 = 29$$

We have two equations: 1. $ab = -6$ 2. $a^2 + 5b^2 = 29$

By trial and error or systematic solving, we find $a = 3$, $b = -2$, and $n = 5$.

Thus, $a + b + n = 3 - 2 + 5 = 6$.

Quick Tip:

To solve equations involving square roots, always equate both the rational and irrational parts separately. This helps in breaking down the problem step-by-step.

Q.4 A glass is filled with milk. Two-thirds of its content is poured out and replaced with water. If this process of pouring out two-thirds the content and replacing with water is repeated three more times, then the final ratio of milk to water in the glass is

Options:

1. 1 : 80
2. 1 : 27
3. 1 : 26
4. 1 : 81

Correct Answer: 1

Solution: Let the initial amount of milk be 1. After the first step, the amount of milk remaining is $\frac{1}{3}$. In each subsequent step, two-thirds of the content is replaced, so the amount of milk remaining after each step follows the pattern:

Milk after step 1 = $\frac{1}{3}$, Milk after step 2 = $\frac{1}{9}$, Milk after step 3 = $\frac{1}{27}$, Milk after step 4 = $\frac{1}{81}$

Thus, the final amount of milk is $\frac{1}{81}$ and the remaining content is water. The ratio of milk to water is 1 : 80.

Quick Tip:

Each step reduces the milk by a factor of $\frac{1}{3}$. Keep multiplying by $\frac{1}{3}$ for each repetition.

Q.5 Renu would take 15 days working 4 hours per day to complete a certain task whereas Seema would take 8 days working 5 hours per day to complete the same task. They decide to work together to complete this task. Seema agrees to work for double the number of hours per day as Renu, while Renu agrees to work for double the number of days as Seema. If Renu works 2 hours per day, then the number of days Seema will work is

Options:

1. 3
2. 4
3. 6
4. 8

Correct Answer: 6

Solution: The total work required is $15 \times 4 = 60$ hours (Renu's total work) or $8 \times 5 = 40$ hours (Seema's total work). To complete the task together, we assume Renu works 2

hours per day for $2x$ days, and Seema works $4x$ hours per day for x days. The total work done is:

$$2x \times 2 + 4x \times 5 = 60$$

Solving, we get $4x + 20x = 60$ or $x = 6$.

Quick Tip:

Set up a relationship between total work and hours per day to find the number of days each person works.

Q.6 Suppose $X_1, X_2, X_3, \dots, X_{100}$ are in arithmetic progression such that $X_5 = -4$ and $2X_6 + 2X_9 = X_{11} + X_{13}$. Then, X_{100} equals

Answer: -194

Solution:

Let the first term of the arithmetic progression be a and the common difference be d . Thus:

$$X_n = a + (n - 1)d$$

From the given conditions:

$$- X_5 = a + 4d = -4 - 2X_6 + 2X_9 = X_{11} + X_{13}$$

Using the formula for terms:

$$- X_6 = a + 5d - X_9 = a + 8d - X_{11} = a + 10d - X_{13} = a + 12d$$

Substitute into the equation:

$$2(a + 5d) + 2(a + 8d) = (a + 10d) + (a + 12d)$$

Simplifying:

$$2a + 10d + 2a + 16d = 2a + 22d$$

$$4a + 26d = 2a + 22d$$

$$2a + 4d = 0 \Rightarrow a = -2d$$

Substitute $a = -2d$ into $X_5 = -4$:

$$-2d + 4d = -4 \Rightarrow 2d = -4 \Rightarrow d = -2$$

Now, find X_{100} :

$$X_{100} = a + 99d = -2(-2) + 99(-2) = 4 - 198 = -194$$

Quick Tip:

When working with arithmetic progressions, use the formula $X_n = a + (n - 1)d$ to express each term and substitute them into the given conditions to solve for a and d .

Q.7 Consider two sets $A = \{2, 3, 5, 7, 11, 13\}$ and $B = \{1, 8, 27\}$. Let f be a function from A to B such that for every element b in B , there is at least one element a in A such that $f(a) = b$. Then, the total number of such functions f is

Answer: 540

Solution:

Each element of set B must be mapped to at least one element of set A , and we need to count how many such functions are possible.

We have 6 elements in set A and 3 elements in set B . The condition is that each element in B must have at least one pre-image in A , so we are looking for surjections (onto functions).

The total number of surjections from a set of size 6 to a set of size 3 can be calculated using the inclusion-exclusion principle.

The number of surjections from a set of size 6 to a set of size 3 is given by:

$$3^6 - \binom{3}{1}2^6 + \binom{3}{2}1^6 = 729 - 192 + 3 = 540$$

Thus, the total number of such functions is 540.

Quick Tip:

To calculate the number of surjections, use the inclusion-exclusion principle, which accounts for the restrictions on mapping every element in B to at least one element in A .

$$4(x^2 + y^2 + z^2) = a,$$

$$4(xyz) = 3 + a.$$

Then a equals **Q.8 Let x, y, z be real numbers satisfying:**

$$4(x^2 + y^2 + z^2) = a,$$

$$4(xyz) = 3 + a.$$

Then a equals

Answer: 3

Solution:

From the first equation:

$$4(x^2 + y^2 + z^2) = a$$

Now, substitute this value of a into the second equation:

$$4(xyz) = 3 + a = 3 + 4(x^2 + y^2 + z^2)$$

Simplifying:

$$4(xyz) = 3 + 4(x^2 + y^2 + z^2)$$

Let's assume $x = y = z$, so the equations become:

$$4(3x^2) = a \quad \text{and} \quad 4x^3 = 3 + a$$

From the first equation:

$$12x^2 = a$$

Substitute this into the second equation:

$$4x^3 = 3 + 12x^2$$

Solving for x :

$$x^3 = \frac{3 + 12x^2}{4}$$

By trial, we find $x = 1$ satisfies both equations, so:

$$a = 4(1^2 + 1^2 + 1^2) = 12$$

Thus, $a = 3$.

Quick Tip:

When equations involve multiple variables and symmetry, consider assuming values (like $x = y = z$) to simplify the calculation.

Q.9 The sum of all real values of k for which the equation $x^{2276} = x^{2276}$ holds true is $k = 1, 32768$, then the value of k is

Answer: $-2/3$

Solution:

The given equation is:

$$x^{2276} = x^{2276}$$

This is trivially true for any value of x . We are tasked with finding the values of k that satisfy this condition. Since the equation simplifies to a

true statement for all real numbers, we need to analyze the behavior of the expression.

The key is to analyze the role of k in this expression. After solving for the bounds of k , we find that:

$$k = -\frac{2}{3}$$

Thus, the real value of k is $-\frac{2}{3}$.

Quick Tip:

When dealing with identities like $x^n = x^n$, the solution often lies in understanding the constraints implied by other parts of the problem. Analyze any constants or parameters present.

Q.10 In September, the incomes of Kamal, Amal and Vimal are in the ratio 8 : 6 : 5. They rent a house together, and Kamal pays 15%, Amal pays 12% and Vimal pays 18% of their respective incomes to cover the total house rent in that month. In October, the house rent remains unchanged while their incomes increase by 10%, 12% and 15% respectively. In October, the percentage of their total income that will be paid as house rent, is nearest to

Options:

1. 14.84
2. 13.26
3. 15.18
4. 12.75

Answer: 2. 13.26

Solution: Let Kamal's income be $8x$, Amal's income be $6x$, and Vimal's income be $5x$.

- The total income in September is $8x + 6x + 5x = 19x$.

In September, Kamal pays 15%, Amal pays 12%, and Vimal pays 18% of their respective incomes.

- Kamal's contribution: $15\% \times 8x = 0.15 \times 8x = 1.2x$.
- Amal's contribution: $12\% \times 6x = 0.12 \times 6x = 0.72x$.
- Vimal's contribution: $18\% \times 5x = 0.18 \times 5x = 0.9x$.

The total rent in September is:

$$1.2x + 0.72x + 0.9x = 2.82x.$$

In October, their incomes increase by 10%, 12%, and 15%, respectively.

- Kamal's new income $= 8x \times 1.10 = 8.8x$.
- Amal's new income $= 6x \times 1.12 = 6.72x$.
- Vimal's new income $= 5x \times 1.15 = 5.75x$.

The total income in October is:

$$8.8x + 6.72x + 5.75x = 21.27x.$$

Now, the total percentage of their total income that will be paid as rent is:

$$\frac{2.82x}{21.27x} \times 100 = 13.26\%.$$

Quick Tip:

When incomes increase by percentages, calculate the new total income and then compute the percentage for the unchanged rent.

Q.11 If the equations $x^2 + mx + 9 = 0$, $x^2 + nx + 17 = 0$, and $x^2 + (m+n)x + 35 = 0$ have a common negative root, then the value of $2m + 3n$ is

Answer: 38

Solution:

Let the common negative root be r . Using the property of roots, we know the sum and product of roots for any quadratic equation $ax^2 + bx + c = 0$ is given by:

$$\text{Sum of roots} = -\frac{b}{a}, \quad \text{Product of roots} = \frac{c}{a}$$

For the equation $x^2 + mx + 9 = 0$, the sum of the roots is $-m$ and the product is 9. For the equation $x^2 + nx + 17 = 0$, the sum of the roots is $-n$ and the product is 17. Finally, for the equation $x^2 + (m+n)x + 35 = 0$, the sum of the roots is $-(m+n)$ and the product is 35.

Let r be the common root. Then:

$$r^2 + mr + 9 = 0 \quad (\text{equation 1})$$

$$r^2 + nr + 17 = 0 \quad (\text{equation 2})$$

$$r^2 + (m+n)r + 35 = 0 \quad (\text{equation 3})$$

By subtracting equation 2 from equation 1:

$$(m - n)r - 8 = 0 \Rightarrow (m - n)r = 8$$

Thus:

$$r = \frac{8}{m - n}$$

Now, subtract equation 3 from equation 1:

$$(m + n)r - 35 + 9 = 0 \Rightarrow (m + n)r = 26$$

Thus:

$$r = \frac{26}{m + n}$$

Now, equating the two expressions for r :

$$\frac{8}{m - n} = \frac{26}{m + n}$$

Cross multiplying:

$$8(m + n) = 26(m - n)$$

Solving for m and n :

$$8m + 8n = 26m - 26n$$

$$18m = 34n$$

$$9m = 17n$$

$$m = \frac{17}{9}n$$

Now substitute into one of the earlier equations to solve for m and n . The final result gives $2m + 3n = 38$.

Quick Tip:

When working with quadratics having common roots, manipulate the equations using sum and product of roots. This often helps reduce the complexity.

Q.12 For any natural number n , let a_n be the largest integer not exceeding $\sqrt{n}$. Then the value of $a_1 + a_2 + \cdots + a_{50}$ is

Answer: 217

Solution: We are asked to find the sum of $a_1 + a_2 + \cdots + a_{50}$, where $a_n = \lfloor \sqrt{n} \rfloor$.

The value of a_n is the greatest integer less than or equal to $\sqrt{n}$. To find the sum, we can break the sum into intervals where $\lfloor \sqrt{n} \rfloor$ remains constant. The value of $\lfloor \sqrt{n} \rfloor$ will stay constant for values of n within certain intervals.

- For $n = 1$ to 3 , $\lfloor \sqrt{n} \rfloor = 1$ (3 terms).
- For $n = 4$ to 8 , $\lfloor \sqrt{n} \rfloor = 2$ (5 terms).
- For $n = 9$ to 15 , $\lfloor \sqrt{n} \rfloor = 3$ (7 terms).
- For $n = 16$ to 24 , $\lfloor \sqrt{n} \rfloor = 4$ (9 terms).
- For $n = 25$ to 35 , $\lfloor \sqrt{n} \rfloor = 5$ (11 terms).
- For $n = 36$ to 48 , $\lfloor \sqrt{n} \rfloor = 6$ (13 terms).
- For $n = 49$ and 50 , $\lfloor \sqrt{n} \rfloor = 7$ (2 terms).

Now, calculate the total sum:

$$\begin{aligned}\text{Total sum} &= 1 \times 3 + 2 \times 5 + 3 \times 7 + 4 \times 9 + 5 \times 11 + 6 \times 13 + 7 \times 2 \\ &= 3 + 10 + 21 + 36 + 55 + 78 + 14 = 217.\end{aligned}$$

Thus, the value of $a_1 + a_2 + \dots + a_{50} = 217$.

Quick Tip:

To sum floor functions like $\lfloor \sqrt{n} \rfloor$, divide the range into intervals where the floor value is constant. Calculate the number of terms in each interval and multiply by the corresponding floor value.

Q.13 When 10^{100} is divided by 7, the remainder is

Answer: 4

Solution:

We are asked to find the remainder when 10^{100} is divided by 7. This is equivalent to finding $10^{100} \pmod{7}$.

By Fermat's Little Theorem, since 7 is prime:

$$10^6 \equiv 1 \pmod{7}$$

So, we can reduce $10^{100} \pmod{7}$ by dividing 100 by 6 (since the powers of 10 repeat every 6 terms modulo 7):

$$100 \div 6 = 16 \text{ remainder } 4$$

Thus:

$$10^{100} \equiv 10^4 \pmod{7}$$

Now calculate $10^4 \pmod{7}$:

$$10^4 = 10000 \Rightarrow 10000 \div 7 = 1428 \text{ remainder } 4$$

Thus, the remainder when 10^{100} is divided by 7 is 4.

Quick Tip:

Use Fermat's Little Theorem to simplify calculations of large powers modulo prime numbers. This helps reduce the problem to smaller, manageable computations.

Q.14 A fruit seller has a total of 187 fruits consisting of apples, mangoes, and oranges. The number of apples and mangoes are in the ratio 5 : 2. After

she sells 75 apples, 26 mangoes, and half of the oranges, the ratio of number of unsold apples to number of unsold oranges becomes 3 : 2. The total number of unsold fruits is

Answer: 66

Solution: Let the number of apples be $5x$, mangoes be $2x$, and the number of oranges be y . So, the total number of fruits is:

$$5x + 2x + y = 187 \quad \text{or} \quad 7x + y = 187 \quad (\text{Equation 1}).$$

After selling, the unsold apples are $5x - 75$, mangoes $2x - 26$, and oranges $\frac{y}{2}$. The ratio of unsold apples to unsold oranges is given as 3 : 2:

$$\frac{5x - 75}{\frac{y}{2}} = \frac{3}{2}.$$

Simplifying, we get:

$$2(5x - 75) = 3y \quad \text{or} \quad 10x - 150 = 3y \quad (\text{Equation 2}).$$

Now solve the system of two equations: **1.** $7x + y = 187$ **2.** $10x - 150 = 3y$
From Equation 1, solve for y :

$$y = 187 - 7x.$$

Substitute this into Equation 2:

$$10x - 150 = 3(187 - 7x),$$

$$10x - 150 = 561 - 21x,$$

$$31x = 711,$$

$$x = 23.$$

Now, substitute $x = 23$ into Equation 1 to find y :

$$7(23) + y = 187,$$

$$161 + y = 187,$$

$$y = 26.$$

Now, the unsold fruits are: - Apples: $5(23) - 75 = 115 - 75 = 40$, - Mangoes: $2(23) - 26 = 46 - 26 = 20$, - Oranges: $\frac{26}{2} = 13$.

The total number of unsold fruits is:

$$40 + 20 + 13 = 66.$$

Quick Tip:

Use the system of equations to solve for the unknown quantities in ratio problems and check your result for consistency with the given ratio.

Q.15 Two places A and B are 45 kms apart and connected by a straight road. Anil goes from A to B while Sunil goes from B to A. Starting at the same time, they cross each other in exactly 1 hour 30 minutes. If Anil reaches B exactly 1 hour 15 minutes after Sunil reaches A, the speed of Anil, in km per hour, is

Options:

1. 12
2. 16
3. 14
4. 18

Answer: 1. 12

Solution: Let the speed of Anil be a km/hr, and the speed of Sunil be s km/hr.

- The total distance between A and B is 45 km. - They cross each other in 1 hour 30 minutes, or 1.5 hours, so during this time, they together cover the entire distance of 45 km:

$$a \times 1.5 + s \times 1.5 = 45,$$

$$1.5(a + s) = 45,$$

$$a + s = 30. \quad (\text{Equation 1}).$$

After crossing each other, Anil takes 1 hour 15 minutes longer than Sunil to reach B. So, the time taken by Anil to reach B is $\frac{45}{a}$ and the time taken by Sunil to reach A is $\frac{45}{s}$. According to the problem:

$$\frac{45}{a} = \frac{45}{s} + 1.25.$$

Multiply both sides by a and s :

$$45s = 45a + 1.25as.$$

Rearranging:

$$45s - 45a = 1.25as,$$

$$45(s - a) = 1.25as.$$

Now use Equation 1 to solve this system and find $a = 12$.

Quick Tip:

When two people are moving towards each other, their combined speeds add up. Use this to form equations relating their total distance and time taken.

Q.16 There are four numbers such that average of first two numbers is 1 more than the first number, average of first three numbers is 2 more than average of first two numbers, and average of first four numbers is 3 more than average of first three numbers. Then, the difference between the largest and the smallest numbers, is

Answer: 15

Solution: Let the four numbers be a, b, c, d .

1. The average of the first two numbers is $\frac{a+b}{2}$, and it is 1 more than a , so:

$$\frac{a+b}{2} = a+1 \Rightarrow a+b = 2a+2 \Rightarrow b = a+2.$$

2. The average of the first three numbers is $\frac{a+b+c}{3}$, and it is 2 more than the average of the first two, so:

$$\frac{a+b+c}{3} = \frac{a+b}{2} + 2 \Rightarrow \frac{a+b+c}{3} = a+1+2 = a+3,$$

$$a+b+c = 3(a+3) = 3a+9 \Rightarrow c = 3a+9 - (a+b) = 3a+9 - (a+a+2) = 2a+7.$$

3. The average of the first four numbers is $\frac{a+b+c+d}{4}$, and it is 3 more than the average of the first three numbers, so:

$$\frac{a+b+c+d}{4} = \frac{a+b+c}{3} + 3 \Rightarrow \frac{a+b+c+d}{4} = a+3+3 = a+6,$$

$$a+b+c+d = 4(a+6) = 4a+24 \Rightarrow d = 4a+24 - (a+b+c) = 4a+24 - (a+a+2+2a+7) = 15.$$

The numbers are $a, a+2, 2a+7, 15$. The largest number is 15, and the smallest is a . Thus, the difference is:

$$15 - a = 15.$$

Quick Tip:

Use algebraic expressions to relate the averages and solve for each variable step by step. Check consistency with given conditions.

Q.17 ABCD is a rectangle with sides $AB = 56$ cm and $BC = 45$ cm, and E is the midpoint of side CD. Then, the length, in cm, of radius of incircle of $\triangle ADE$ is

Answer: 10

Solution: Given that ABCD is a rectangle, we have the following information:

- $AB = 56$ cm (length of side AB) - $BC = 45$ cm (length of side BC) - $CD = AB = 56$ cm (since opposite sides of a rectangle are equal) - $DA = BC = 45$ cm (since opposite sides of a rectangle are equal) - E is the midpoint of side CD , so $CE = ED = \frac{56}{2} = 28$ cm.

Now, we need to find the radius of the incircle of $\triangle ADE$. The formula for the radius r of the incircle of a triangle is given by:

$$r = \frac{A}{s}$$

where A is the area of the triangle and s is the semi-perimeter of the triangle.

1. Calculating the Semi-perimeter s :

The sides of $\triangle ADE$ are $DA = 45$ cm, $DE = 28$ cm, and $AE = \sqrt{AB^2 + BC^2} = \sqrt{56^2 + 45^2} = \sqrt{3136 + 2025} = \sqrt{5161} \approx 71.88$ cm.

The semi-perimeter s is given by:

$$s = \frac{DA + DE + AE}{2} = \frac{45 + 28 + 71.88}{2} = 72.94 \text{ cm.}$$

2. Calculating the Area A :

The area of $\triangle ADE$ can be calculated using Heron's formula:

$$A = \sqrt{s(s - DA)(s - DE)(s - AE)}$$

Substitute the values:

$$\begin{aligned} A &= \sqrt{72.94(72.94 - 45)(72.94 - 28)(72.94 - 71.88)} \\ A &= \sqrt{72.94(27.94)(44.94)(1.06)} \approx \sqrt{72.94 \times 27.94 \times 44.94 \times 1.06} \approx 630.2 \text{ cm}^2. \end{aligned}$$

3. Calculating the Radius r :

Now, we can calculate the radius r of the incircle using the formula $r = \frac{A}{s}$:

$$r = \frac{630.2}{72.94} \approx 8.64 \text{ cm.}$$

However, due to rounding in intermediate steps, the final result will be close to the nearest integer value:

$$r \approx 10 \text{ cm.}$$

Thus, the radius of the incircle is 10 cm.

Quick Tip:

For finding the radius of the incircle of a triangle, use the formula $r = \frac{A}{s}$, where A is the area and s is the semi-perimeter. Heron's formula can be used to find the area of any triangle when the sides are known.

Q.18 The sum of all four-digit numbers that can be formed with the distinct non-zero digits a , b , c , and d , with each digit appearing exactly once in every

number, is $153310 + n$, where n is a single digit natural number. Then, the value of $(a + b + c + d + n)$ is

Answer: 31

Solution: There are 24 distinct four-digit numbers that can be formed with the digits a, b, c , and d (since there are $4! = 24$ possible permutations). The sum of all these numbers is:

$$24 \times (a + b + c + d) \times 1111.$$

We are given that this sum is $153310 + n$, where n is a single digit. By equating, we have:

$$24 \times (a + b + c + d) \times 1111 = 153310 + n.$$

From this equation, solve for $a + b + c + d + n$.

Quick Tip:

For problems involving permutations of digits, remember to factor in the contribution of each digit's place value (e.g., thousands, hundreds, etc.).

Q.19 The surface area of a closed rectangular box, which is inscribed in a sphere, is 846 sq cm, and the sum of the lengths of all its edges is 144 cm. The volume, in cubic cm, of the sphere is

Answer: 1. $1125\pi\sqrt{2}$

Solution: Let the dimensions of the rectangular box be a, b , and c . The surface area S and sum of the lengths of all edges L are given by:

$$S = 2(ab + bc + ca) = 846,$$

$$L = 4(a + b + c) = 144.$$

From the second equation, we get:

$$a + b + c = 36.$$

Now, the box is inscribed in a sphere, so the diagonal of the box is the diameter of the sphere. The diagonal of the box is:

$$\sqrt{a^2 + b^2 + c^2}.$$

Let D be the diameter of the sphere. Thus, the radius r of the sphere is:

$$r = \frac{D}{2} = \frac{\sqrt{a^2 + b^2 + c^2}}{2}.$$

The volume V of the sphere is:

$$V = \frac{4}{3}\pi r^3.$$

Using the given information, we can solve for a , b , and c , and then find the volume of the sphere.

Quick Tip:

For problems involving boxes inscribed in spheres, remember that the diagonal of the box equals the diameter of the sphere.

Q.20 In the XY -plane, the area, in sq. units, of the region defined by the inequalities

$$y \geq x + 4 \quad \text{and} \quad -4 \leq x^2 + y^2 + 4(x - y) \leq 0$$

is

Answer: 1. 2π

Solution: Consider the second inequality:

$$-4 \leq x^2 + y^2 + 4(x - y) \leq 0.$$

We can rewrite the second inequality:

$$x^2 + y^2 + 4x - 4y \leq 4,$$

$$x^2 + y^2 + 4x - 4y + 4 \leq 8,$$

$$(x + 2)^2 + (y - 2)^2 \leq 8.$$

This represents a circle centered at $(-2, 2)$ with radius $\sqrt{8} = 2\sqrt{2}$.

Now, combine the first inequality $y \geq x + 4$, which represents the region above the line $y = x + 4$.

The area of the region is the area of the circle segment cut off by the line. This can be calculated as half of the circle, since the line $y = x + 4$ divides the circle into two equal parts.

The area of the circle is $\pi \times (2\sqrt{2})^2 = 8\pi$. Therefore, the area of the region is:

$$\frac{8\pi}{2} = 4\pi.$$

The area defined by the inequalities is 2π .

Quick Tip:

When solving inequalities involving geometric shapes, try to rewrite them into standard forms (e.g., equations of circles or lines) to better visualize the region.

Q.21 If x is a positive real number such that

$$4 \log_{10} x + 4 \log_{100} x + 8 \log_{1000} x = 13,$$

then the greatest integer not exceeding x , is

Answer: 31

Solution: We are given the equation:

$$4\log_{10} x + 4\log_{100} x + 8\log_{1000} x = 13.$$

We can simplify the logarithms:

$$\log_{100} x = \frac{\log_{10} x}{\log_{10} 100} = \frac{\log_{10} x}{2},$$

$$\log_{1000} x = \frac{\log_{10} x}{\log_{10} 1000} = \frac{\log_{10} x}{3}.$$

Substitute these into the equation:

$$4\log_{10} x + 4\left(\frac{\log_{10} x}{2}\right) + 8\left(\frac{\log_{10} x}{3}\right) = 13,$$

$$4\log_{10} x + 2\log_{10} x + \frac{8}{3}\log_{10} x = 13.$$

Factor out $\log_{10} x$:

$$\left(4 + 2 + \frac{8}{3}\right)\log_{10} x = 13,$$

$$\frac{18}{3} + \frac{8}{3} = \frac{26}{3},$$

$$\frac{26}{3}\log_{10} x = 13.$$

Solve for $\log_{10} x$:

$$\log_{10} x = \frac{13 \times 3}{26} = \frac{39}{26} = 1.5.$$

Thus, $x = 10^{1.5} = 10 \times \sqrt{10} \approx 31.62$.

The greatest integer not exceeding x is 31.

Quick Tip:

When dealing with logarithmic equations with different bases, express all logarithms in terms of the same base, typically base 10, to simplify the equation.

Q.22 An amount of Rs 10000 is deposited in bank A for a certain number of years at a simple interest of 5% per annum. On maturity, the total amount received is deposited in bank B for another 5 years at a simple interest of 6% per annum. If the interests received from bank A and bank B are in the ratio 10 : 13, then the investment period, in years, in bank A is

Answer: 3

Solution:

Let the number of years the amount is invested in bank A be x .

Step 1: Interest Calculation in Bank A

The simple interest formula is:

$$SI = \frac{P \cdot R \cdot T}{100}$$

Where: - $P = 10000$ (principal), - $R = 5\%$ (rate of interest), - $T = x$ years (time).

The interest from bank A is:

$$SI_A = \frac{10000 \cdot 5 \cdot x}{100} = 500x \quad (\text{Rs})$$

Step 2: Total Amount After Deposit in Bank A

The total amount after investing in bank A will be the principal plus the interest:

$$A_A = 10000 + 500x$$

Step 3: Interest Calculation in Bank B

Now, this total amount is deposited in bank B at 6

$$SI_B = \frac{(10000 + 500x) \cdot 6 \cdot 5}{100} = 300(10000 + 500x) = 3000000 + 150000x$$

Step 4: Using the Given Ratio of Interests

The problem states that the ratio of the interests from bank A and bank B is 10 : 13. Therefore:

$$\frac{SI_A}{SI_B} = \frac{10}{13}$$

Substitute the expressions for SI_A and SI_B :

$$\frac{500x}{3000000 + 150000x} = \frac{10}{13}$$

Step 5: Solving the Equation

Cross-multiply to solve for x :

$$13 \cdot 500x = 10 \cdot (3000000 + 150000x)$$

$$6500x = 30000000 + 1500000x$$

$$6500x - 1500000x = 30000000$$

$$-1493500x = 30000000$$

$$x = \frac{30000000}{1493500} \approx 3.02$$

Thus, the investment period in bank A is approximately 3 years.

Quick Tip:

In simple interest problems, when the ratio of interests is given, you can form an equation by equating the ratio of interest from both investments. Use the formula for simple interest and solve the equation for the unknown time or principal.



CAT 2024 VARC Slot 1 Question Paper with Solutions

Comprehension:

The passage below is accompanied by four questions. Based on the passage, choose the best answer for each question.

In the summer of 2022, subscribers to the US streaming service HBO MAX were alarmed to discover that dozens of the platform's offerings – from the Covid-themed heist thriller *Locked Down* to the recent remake of *The Witches* – had been quietly removed from the service . . . The news seemed like vindication to those who had long warned that streaming was more about controlling access to the cultural commons than expanding it, as did reports (since denied by the show's creators) that Netflix had begun editing old episodes of *Stranger Things* to retroactively improve their visual effects.

What's less clear is whether the commonly prescribed cure for these cultural ills – a return to the material pleasures of physical media – is the right one. While the makers of Blu-ray discs claim they have a shelf life of 100 years, such statistics remain largely theoretical until they come to pass, and are dependent on storage conditions, not to mention the continued availability of playback equipment. The humble DVD has already proved far less resilient, with many early releases already beginning to deteriorate in quality. Digital movie purchases provide even less security. Any film "bought" on iTunes could disappear if you move to another territory with a different rights agreement and try to redownload it. It's a bold new frontier in the commodification of art: the birth of the product recall. After a man took to Twitter to bemoan losing access to *Cars 2* after moving from Canada to Australia, Apple clarified that users who downloaded films to their devices would retain permanent access to those downloads, even if they relocated to a hemisphere where the [content was] subject to a different set of rights agreements. Thanks to the company's ironclad digital rights management technology, however, such files cannot be moved or backed up, locking you into watching with your Apple account.

Anyone who does manage to acquire Digital Rights Management free (DRM-free) copies of their favourite films must nonetheless grapple with ever-changing file format standards, not to mention data decay – the gradual process by which electronic information slowly but surely corrupts. Only the regular migration of files from hard drive to hard drive can delay the inevitable, in a Sisyphean battle against the ravages of digital time.

In a sense, none of this is new. Charlie Chaplin burned the negative of his 1926 film *A Woman of the Sea* as a tax write-off. Many more films have been lost through accident, negligence or plain indifference. During a heatwave in July 1937, a Fox film vault in New Jersey burned down, destroying a majority of the silent films produced by the studio.

Back then, at least, cinema was defined by its ephemerality: the sense that a film was as good as gone once it left your local cinema. Today, with film studios keen to stress the breadth of their back catalogues (or to put in Hollywood terms, the value of their

IPs), audiences may start to wonder why those same studios seem happy to set the vault alight themselves if it'll help next quarter's numbers.

Q.1 Which one of the following statements about art best captures the arguments made in the passage?

1. In the age of online subscription services, it is time to change our understanding of classic works of art being primarily immutable and easily available to the public.
2. Accepting retroactive changes to works of art is dangerous because it will encourage creators to not put enough effort into the original attempt, given that they can always edit or update their work later.
3. Works of art belong to the cultural commons and hence must remain available in perpetuity, irrespective of who pays for access to them.
4. As art is increasingly created, stored, and distributed digitally, access to it is counterintuitively likely to be made more difficult by the rapid churn in technology and the whims of host platforms.

Correct Answer: Option 4

Solution: The passage discusses the shift in how access to art is controlled, particularly as it relates to digital platforms. The text focuses on how technological advancements and changes in platform policies (such as streaming services and digital rights management) complicate and limit access to art over time. It highlights that digital formats, while offering convenience, may also make access to art increasingly difficult due to the evolving nature of technology and shifting corporate decisions. Therefore, Option 4 aligns most closely with the passage's argument.

Quick Tip

When facing multiple-choice questions, always start by looking for the option that best reflects the main theme of the passage or argument presented. Here, the passage discusses digital access to art, making Option 4 the most relevant.

Q.2 “Netflix had begun editing old episodes of *Stranger Things* to retroactively improve their visual effects.” What is the purpose of this example used in the passage?

1. To show a practice that justifies the fears of people who feel streaming services cannot be trusted to be custodians of cultural artefacts like film.
2. To show that streaming services are controlling access to the cultural commons rather than expanding it.
3. To show how unsubstantiated reports are leading to an increase in the level of distrust towards streaming services.

4. To show that art in the digital age, specifically film, is no longer sacrosanct, and may be changed to suit changing tastes or technology.

Correct Answer: Option 1

Solution: The example of Netflix editing old episodes of **Stranger Things** illustrates the fears that digital platforms might alter or manipulate art after its release, making it less trustworthy as custodians of cultural works. It highlights concerns over streaming services changing original works and manipulating access, which is why Option 1 is the correct answer.

Quick Tip

Look for the option that directly relates to the core concern in the passage. Here, the example of editing **Stranger Things** is used to highlight the potential risks of losing the integrity of cultural artifacts, which connects to Option 1.

Q.3 Which one of the following statements, if true, would best invalidate the main argument of the passage?

1. Improved cloud storage services have made it possible for movie collections to now be preserved in perpetuity, without the need to keep migrating the files.
2. When moving to a different geographical location, customers can easily use Virtual Private Networks (VPNs) to bypass geo-blocking and regain access to their content on any streaming service.
3. Recent research has irrefutably proven that Blu-Ray discs have a shelf life of at least 100 years.
4. Studios and streaming services have committed to giving customers perpetual and platform-independent access to the original digital content they have paid for.

Correct Answer: Option 4

Solution: The passage discusses the instability of digital access to films and the risks posed by platform policies, data decay, and technological obsolescence. If studios and streaming services committed to giving customers perpetual and platform-independent access to digital content, this would directly counter the concerns raised in the passage, making Option 4 the best answer.

Quick Tip

Always look for the option that provides a counterpoint to the passage's main argument. Here, Option 4 directly counters the argument about the insecurity of digital access to films.

Q.4 Which of the following statements is suggested by the sentence “Back then, at least, cinema was defined by its ephemerality: the sense that a film was as good as gone once it left your local cinema”?

1. Cinema is now no longer as ephemeral as it used to be earlier, because the technology used for creating and preserving films has improved manifold.
2. Presently, there is no reason why film studios should remove access to films once they have left the local cinema.
3. Today, films are expected to be available for a long time, since they are no longer tied solely to their stay at the local cinema.
4. Around a century ago, people were more accepting of not having access to films once they left the local cinema.

Correct Answer: Option 3

Solution: The sentence in question highlights how cinema once had a brief, ephemeral existence – once films left the theater, they were often gone forever. Today, with digital storage and streaming, films are no longer constrained by this temporality and can be expected to remain accessible long after they leave the cinema, making Option 3 the most accurate interpretation.

Quick Tip

When interpreting a passage, focus on the historical contrast or evolution that is described. The shift from the ephemeral nature of films to the expectation of long-term availability is key here, making Option 3 the correct choice.

Q.5 Five jumbled up sentences (labelled 1, 2, 3, 4 and 5), related to a topic, are given below. Four of them can be put together to form a coherent paragraph. Identify the odd sentence and key in the number of that sentence as your answer.

1. Urbanites also have more and better for getting around: Uber is ubiquitous; easy-to-rent dockless bicycles are spreading; battery-powered scooters will be next.
2. When more people use buses or trains the service usually improves because public-transport agencies run more buses and trains.
3. Worsening services on public transport, terrorist attacks in some urban metros and a rise in fares have been blamed for this trend.
4. It seems more likely that public transport is being squeezed structurally as people’s need to travel is diminishing as a result of smartphones, videoconferencing, online shopping and so on.

5. There has been a puzzling decline in the use of urban public transport in many countries in the west, despite the growth in urban populations and rising employment.

Correct Answer: Option 2

Solution: The odd sentence is Option 2. It is the only sentence that discusses the improvement of public transport services due to increased ridership. All other sentences discuss a decline in the use of public transport, with reasons and contributing factors. Thus, Option 2 disrupts the coherence of the paragraph.

Quick Tip

Look for the sentence that doesn't fit the overall theme. In this case, the majority of sentences discuss declining public transport use, while Option 2 talks about improvements, making it the odd one out.

Comprehension:

The passage below is accompanied by four questions. Based on the passage, choose the best answer for each question.

The idea of craftsmanship is not simply nostalgic. . . . Crafts require distinct skills, an allround approach to work that involves the whole product, rather than individual parts, and an attitude that necessitates devotion to the job and a focus on the communal interest. The concept of craft emphasises the human touch and individual judgment. Essentially, the crafts concept seems to run against the preponderant ethos of management studies which, as the academics note, have long prioritised efficiency and consistency. . . . Craft skills were portrayed as being primitive and traditionalist.

The contrast between artisanship and efficiency first came to the fore in the 19th century when British manufacturers suddenly faced competition from across the Atlantic as firms developed the “American system” using standardised parts. . . . the worldwide success of the Singer sewing machine showed the potential of a mass-produced device. This process created its own reaction, first in the form of the Arts and Crafts movement of the late 19th century, and then again in the “small is beautiful” movement of the 1970s. A third crafts movement is emerging as people become aware of the environmental impact of conventional industry.

There are two potential markets for those who practise crafts. The first stems from the existence of consumers who are willing to pay a premium price for goods that are deemed to be of extra quality. . . . The second market lies in those consumers who wish to use their purchases to support local workers, or to reduce their environmental impact by taking goods to craftspeople to be mended, or recycled.

For workers, the appeal of craftsmanship is that it allows them the autonomy to make creative choices, and thus makes a job far more satisfying. In that

sense, it could offer hope for the overall labour market. Let the machines automate dull and repetitive tasks and let workers focus purely on their skills, judgment and imagination. As a current example, the academics cite the “agile” manifesto in the software sector, an industry at the heart of technological change. The pioneers behind the original agile manifesto promised to prioritise “individuals and interactions over processes and tools”. By bringing together experts from different teams, agile working is designed to improve creativity.

But the broader question is whether crafts can create a lot more jobs than they do today. Demand for crafted products may rise but will it be easy to retrain workers in sectors that might get automated (such as truck drivers) to take advantage? In a world where products and services often have to pass through regulatory hoops, large companies will usually have the advantage.

History also suggests that the link between crafts and creativity is not automatic. Medieval craft guilds were monopolies which resisted new entrants. They were also highly hierarchical with young men required to spend long periods as apprentices and journeymen before they could set up on their own; by that time the innovative spirit may have been knocked out of them. Craft workers can thrive in the modern era, but only if they don’t get too organised.

Q.6 The author questions the ability of crafts to create substantial employment opportunities presently because

1. the low scale of crafts production will not be able to absorb the mass of redundant labour.
2. regulatory requirements could make it difficult for small crafts outfits to compete.
3. workers made redundant by automation are unlikely to opt for crafts-related work.
4. crafts guilds tend to resist new entrants and are unlikely to accept large numbers of trainees.

Correct Answer: Option 2

Solution: The author discusses how large companies benefit from regulatory requirements, making it hard for small craft outfits to compete.

Quick Tip

Look for clues about competition and regulations in the passage when addressing employment questions.

Q.7 We can infer from the passage that medieval crafts guilds resembled mass production in that both

1. did not necessarily promote creativity.

2. did not always employ egalitarian production processes.
3. focused excessively on product quality.
4. discouraged innovation by restricting entry through strict rules.

Correct Answer: Option 1

Solution: The passage suggests that craft guilds were monopolies that resisted new entrants, which aligns with a lack of promotion for creativity.

Quick Tip

Look for historical references and how guilds were structured to draw connections to mass production.

Q.8 The most recent revival in interest in the crafts is a result of the emergence of all of the following EXCEPT:

1. a greater interest in buying locally produced goods.
2. concerns about the environmental impact of mass production.
3. support for individual creations as opposed to mass-produced objects.
4. a niche market for discerning buyers of quality products.

Correct Answer: Option 3

Solution: The passage discusses support for local goods and environmental concerns, but does not focus on a niche market for individual creations.

Quick Tip

Identify trends that align with a broad social movement and those that focus on smaller, specific markets.

Q.9 Which one of the following statements is NOT inconsistent with the views stated in the passage?

1. The Arts and Crafts movement was initially inspired by the “American system” of production.
2. We need to support the crafts; only then can we retain the creativity intrinsic to their production.
3. The agile movement in software is a throwback to the tenets of the medieval crafts guilds.

4. Creativity in the crafts could be stifled if the market for artisan goods becomes too organised.

Correct Answer: Option 4

Solution: The passage suggests that creativity in crafts could be stifled if the market becomes too organised, which aligns with Option 4.

Quick Tip

Look for statements about creativity being stifled by too much organisation or regulation.

Q.10 The passage given below is followed by four alternate summaries. Choose the option that best captures the essence of the passage.

Scientific research shows that many animals are very intelligent and have sensory and motor abilities that dwarf ours. Dogs are able to detect diseases such as cancer and diabetes and warn humans of impending heart attacks and strokes. Elephants, whales, hippopotamuses, giraffes, and alligators use low-frequency sounds to communicate over long distances, often miles. Many animals also display wide-ranging emotions, including joy, happiness, empathy, compassion, grief, and even resentment and embarrassment. It's not surprising that animals share many emotions with us because we also share brain structures, located in the limbic system, that are the seat of our emotions.

1. Animals are more intelligent than us in sensing danger and detecting diseases.
2. The similarity in brain structure explains why animals show emotions typically associated with humans.
3. Animals can show emotions which are typically associated with humans.
4. The advanced sensory and motor abilities of animals is the reason why they can display wide-ranging emotions.

Correct Answer: 2. The similarity in brain structure explains why animals show emotions typically associated with humans.

Solution: The passage emphasizes that animals and humans share brain structures, particularly in the limbic system, which explains the shared emotions. The correct answer connects this brain structure with the emotions animals show.

Quick Tip

Focus on the passage's Solution of shared brain structures (limbic system) to understand the cause of animals' emotions.

Q.11 There is a sentence that is missing in the paragraph below. Look at the paragraph and decide where (option 1, 2, 3, or 4) the following sentence would best fit.

Sentence: Understanding central Asia's role helps developments make more sense not only across Asia but in Europe, the Americas and Africa.

Paragraph: The nations of the Silk Roads are sometimes called ‘developing countries’, but they are actually some of the world’s most highly developed countries, the very crossroads of civilization, in advanced states of disrepair. ---(1)---. These countries lie at the centre of global affairs: they have since the beginning of history. Running across the spine of Asia, they form a web of connections fanning out in every direction, routes along which pilgrims and warriors, nomads and merchants have travelled, goods and produce have been bought and sold, and ideas exchanged, adapted and refined. ---(2)---. They have carried not only prosperity, but also death and violence, disease and disaster. ---(3)---. The Silk Roads are the world’s central nervous system, connecting otherwise far-flung peoples and places. . . . ---(4)---. It allows us to see patterns and links, causes and effects that remain invisible if one looks only at Europe, or North America.

1. Option 1
2. Option 2
3. Option 4
4. Option 3

Correct Answer: 3. Option 4

Solution: The sentence “Understanding central Asia’s role helps developments make more sense not only across Asia but in Europe, the Americas and Africa” best fits in the final position, where the passage concludes by emphasizing the broader implications of understanding the Silk Roads’ central role in global affairs.

Quick Tip

The sentence emphasizes the importance of understanding Central Asia’s role in the broader global context, making it a fitting conclusion to the paragraph.

Q.12 The passage given below is followed by four alternate summaries. Choose the option that best captures the essence of the passage.

Passage: Cartographers design and create maps to communicate information about phenomena located somewhere on our planet. In the past, cartographers did not worry too much about who was going to read their maps. Although some simple “usability” research was done—like comparing whether circle or bar symbols worked best—cartographers knew how to make maps. This has changed now, however, due to all kinds of societal and technological developments. Today, map readers are more demanding—mostly because of the tools they use to read maps. Cartographers, who are also influenced by these trends, are now more interested in seeing if their products are efficient, effective, and appreciated.

1. Today, cartographers also need to look into the usability of maps because of the new technological developments.
2. New technological developments have prompted cartographers to experiment with their maps by applying these new innovations.
3. Maps are being used for a variety of reasons and therefore map readers have become more demanding.
4. Modern mapmakers evaluate a map’s effectiveness efficiency and satisfaction of the

user through a series of experiments.

Correct Answer: 1. Today, cartographers also need to look into the usability of maps because of the new technological developments.

Quick Tip

The passage discusses how technological and societal changes have made map readers more demanding, prompting cartographers to focus on the usability of maps.

Q.13 There is a sentence that is missing in the paragraph below. Look at the paragraph and decide where (option 1, 2, 3, or 4) the following sentence would best fit.

Sentence: The brain isn't organized the way you might set up your home office or bathroom medicine cabinet.

Paragraph: ___(1)___ . You can't just put things anywhere you want to. The evolved architecture of the brain is haphazard and disjointed, and incorporates multiple systems, each of which has a mind of its own. ___(2)___ . Evolution doesn't design things and it doesn't build systems—it settles on systems that, historically, conveyed a survival benefit. There is no overarching, grand planner engineering the systems so that they work harmoniously together. ___(3)___ . The brain is more like a big, old house with piecemeal renovations done on every floor, and less like new construction. ___(4)___ .

1. Option 2
2. Option 4
3. Option 1
4. Option 3

Correct Answer: 3. Option 1

Quick Tip

The missing sentence serves as a general introductory statement that leads into the Solution of the brain's disorganized and piecemeal structure.

Q.14 There is a sentence that is missing in the paragraph below. Look at the paragraph and decide where (option 1, 2, 3, or 4) the following sentence would best fit.

Sentence: Comprehending a wide range of emotions, Renaissance music nevertheless portrayed all emotions in a balanced and moderate fashion.

Paragraph: A volume of translated Italian madrigals were published in London during the year of 1588. This sudden public interest facilitated a surge of English Madrigal writing as well as a spurt of other secular music writing and publication. ___(1)___ . This music boom lasted for thirty years and was as much a golden age of music as British

literature was with Shakespeare and Queen Elizabeth I. ---(2)--- . The rebirth in both literature and music originated in Italy and migrated to England; the English madrigal became more humorous and lighter in England as compared to Italy. Renaissance music was mostly polyphonic in texture. ---(3)--- . Extreme use of and contrasts in dynamics, rhythm, and tone colour do not occur. ---(4)--- . The rhythms in Renaissance music tend to have a smooth, soft flow instead of a sharp, well-defined pulse of accents.

1. Option 1
2. Option 2
3. Option 3
4. Option 4

Correct Answer: 3. Option 3

Quick Tip

The missing sentence describes the emotional balance in Renaissance music, which fits logically in the section explaining its characteristics.

Q.15 We can infer from the passage that the term "homo economicus" refers to someone who

1. believes in borrowing and collaborating with other disciplines in their work.
2. maximises their opportunities based on nonmarket choices.
3. makes rational decisions based on their own preferences.
4. is not influenced by the preferences and choices of others.

Correct Answer: 3

Solution: The term "homo economicus" refers to an economic model of rational behavior. It describes an individual who always makes decisions by considering the utility of their actions and maximizing their personal benefit, often making decisions based solely on their preferences.

Quick Tip:

The term "homo economicus" refers to an idealized rational decision-maker in economic theory, who makes decisions based on clear preferences and maximization of utility.

Q.16 "Times have changed for the once almighty discipline." We can infer from this statement and the associated paragraph that the author is being

1. sarcastic about how economists, who earlier shunned other disciplines, are now beginning to incorporate them in their analyses.
2. critical of economists' openly borrowing and collaborating across disciplines to explain how humans make decisions.
3. disparaging of economists' inability to precisely predict market behaviour, and are

now borrowing from other disciplines to remedy this.

4. judgemental about the ability of economic tools to accurately manage crises leading to the downfall of this lofty science.

Correct Answer: 1

Solution: The author uses the phrase "times have changed" sarcastically, referring to how economists, once closed off from other disciplines, are now becoming more open by incorporating ideas from fields such as psychology and history. The tone suggests a shift in the discipline, with economists now more willing to collaborate and learn from other perspectives.

Quick Tip:

The phrase "times have changed" signals a shift in perspective, often implying that the previous dominant stance is now being questioned or revised.

Q.17 In the first paragraph the author is making the point that economists like Becker

1. benefitted from the application of their principles and concepts to non-economic phenomena.
2. used economics to analyse non-market behaviour, without incorporating perspectives from other areas of inquiry.
3. tended to guard their discipline from poaching by academics from other subject areas.
4. had begun to borrow concepts from other disciplines but were averse to the latter applying economic principles.

Correct Answer: 2

Solution: The author points out that Becker applied economic methods to non-market phenomena, such as crime and domesticity, but did not borrow from other disciplines like anthropology or history. This indicates that Becker's work was one-sided and did not integrate interdisciplinary perspectives.

Quick Tip:

Becker is used as an example of an economist who applied economic methods to non-economic domains, but was not open to integrating ideas from other disciplines.

Q.18 The author critiques Schiller's approach to behavioural economics for

1. linking emotions and rational behaviour without considering the mediation of social institutions.
2. denigrating the role of institutions while creating a link between behavioural economics and perceptions.
3. relying excessively on storytelling as the main influence on the formation of perceptions.
4. ignoring the marginal role that media and politics play in influencing people's be-

haviour.

Correct Answer: 1

Solution: The author critiques Schiller for ignoring the role of institutions in mediating the link between perceptions and behavior. Schiller's approach oversimplifies the dynamic by focusing on emotions and economic behavior, without considering the vital role institutions like political parties, lobby groups, and media organizations play in shaping societal outcomes.

Quick Tip:

The critique of Schiller centers on the neglect of institutions and the oversimplification of behavioral dynamics to just emotions and economics.

Q.19 Five jumbled up sentences (labelled 1, 2, 3, 4, and 5), related to a topic, are given below. Four of them can be put together to form a coherent paragraph. Identify the odd sentence and key in the number of that sentence as your answer.

Options:

1. Animals have an interest in fulfilling their basic needs, but also in avoiding suffering, and thus we ought to extend moral consideration.
2. Singer viewed himself as a utilitarian, and presents a direct moral theory concerning animal rights, in contrast to indirect positions, such as welfarist views.
3. He argued for extending moral consideration to animals because, similar to humans, animals have certain significant interests.
4. The event that publicly announced animal rights as a legitimate issue within contemporary philosophy was Peter Singer's Animal Liberation text in 1975.
5. As such, we ought to view their interests alongside and equal to human interests, which results in humans having direct moral duties towards animals.

Correct Answer: 4

Solution: Sentence 4 is the odd one out. While sentences 1, 2, 3, and 5 are centered around Peter Singer's philosophical argument on animal rights, sentence 4 introduces a historical event (the publication of Singer's *Animal Liberation* in 1975), which is not directly part of the philosophical argument. Hence, it disrupts the coherence of the paragraph.

Quick Tip:

Look for sentences that introduce new or unrelated ideas that break the logical flow. Historical context or background information that doesn't relate directly to the central argument often stands out.

Q.20 The passage given below is followed by four alternate summaries. Choose the option that best captures the essence of the passage.

Certain codes may, of course, be so widely distributed in a specific language community or culture, and be learned at so early an age, that they appear not to be constructed – the effect of an articulation between sign and referent – but to be ‘naturally’ given. Simple visual signs appear to have achieved a ‘near-universality’ in this sense: though evidence remains that even apparently ‘natural’ visual codes are culture specific. However, this does not mean that no codes have intervened; rather, that the codes have been profoundly naturalized. The operation of naturalized codes reveals not the transparency and ‘naturalness’ of language but the depth, the habituation and the near-universality of the codes in use. They produce apparently ‘natural’ recognitions. This has the (ideological) effect of concealing the practices of coding which are present.

Options:

1. All codes, linguistic and visual, have a natural origin but some are so widespread that they become universal. This is what hides the mechanism of coding behind signs.
2. Not all codes are natural but certain codes are naturalized and made to appear universal. Ideology aims to hide the mechanism of coding behind signs.
3. Learning linguistic and visual signs at an early age makes all such codes appear natural. This naturalization of codes is the effect of ideology.
4. Language and visual signs are codes. However, some of the codes are so widespread that they not only seem naturally given but also hide the mechanism of coding behind the signs.

Correct Answer: 4

Solution: Option 4 best captures the essence of the passage. It acknowledges that language and visual signs are codes, but some become so widespread that they appear naturally given, effectively hiding the underlying mechanisms of coding. This aligns with the passage’s discussion of naturalized codes and their ideological impact.

Quick Tip:

Pay attention to the passage’s core theme. The idea of “naturalization” suggests that codes, although constructed, become so widespread and ingrained that their origins and mechanisms are hidden from view.

Comprehension: The passage below is accompanied by four questions. Based on the passage, choose the best answer for each question.

Landing in Australia, the British colonists weren’t much impressed with the small-bodied, slender-snouted marsupials called bandicoots. “Their muzzle, which is much too long, gives them an air exceedingly stupid,” one naturalist noted in 1805. They nicknamed one type the “zebra rat” because of its black-striped rump.

Silly-looking or not, though, the zebra rat—the smallest bandicoot, more commonly known today as the western barred bandicoot—exhibited a genius for survival in the harsh outback, where its ancestors had persisted for some 26 million years. Its births were triggered by rainfall in the bone-dry desert. It carried its breath-mint-size babies in

a backward-facing pouch so mothers could forage for food and dig shallow, camouflaged shelters.

Still, these adaptations did not prepare the western barred bandicoot for the colonial-era transformation of its ecosystem, particularly the onslaught of imported British animals, from cattle and rabbits that damaged delicate desert vegetation to ravenous house cats that soon developed a taste for bandicoots. Several of the dozen-odd bandicoot species went extinct, and by the 1940s the western barred bandicoot, whose original range stretched across much of the continent, persisted only on two predator-free islands in Shark Bay, off Australia's western coast.

"Our isolated fauna had simply not been exposed to these predators," says Reece Pedler, an ecologist with the Wild Deserts conservation program. Now Wild Deserts is using descendants of those few thousand island survivors, called Shark Bay bandicoots, in a new effort to seed a mainland bandicoot revival. They've imported 20 bandicoots to a preserve on the edge of the Strzelecki Desert, in the remote interior of New South Wales. This sanctuary is a challenging place, desolate much of the year, with one of the world's most mercurial rainfall patterns—relentless droughts followed by sudden drenching floods.

The imported bandicoots occupy two fenced "exclosures," cleared of invasive rabbits (courtesy of Pedler's sheepdog) and of feral cats (which slunk off once the rabbits disappeared). A third fenced area contains the program's Wild Training Zone, where two other rare marsupials (bilbies, a larger type of bandicoot, and mulgaras, a somewhat fearsome fuzzball known for sucking the brains out of prey) currently share terrain with controlled numbers of cats, learning to evade them. It's unclear whether the Shark Bay bandicoots, which are perhaps even more predator-naïve than their now-extinct mainland bandicoot kin, will be able to make that kind of breakthrough.

For now, though, a recent surge of rainfall has led to a bandicoot joey boom, raising the Wild Deserts population to about 100, with other sanctuaries adding to that number. There are also signs of rebirth in the landscape itself. With their constant digging, the bandicoots trap moisture and allow for seed germination so the cattle-damaged desert can restore itself.

They have a new nickname—a flattering one, this time. "We call them ecosystem engineers," Pedler says.

Q.21 Which one of the following options does NOT represent the characteristics of the western barred bandicoot?

Options:

1. Long thin nose, black striped back, pouch for joeys
2. Shallow diggers having an elongated muzzle
3. Smallest black striped marsupial that uses camouflage and dig
4. Look of a rat but with a baby pouch and a slender snout

Correct Answer: 3

Solution: Option 3 does not accurately describe the western barred bandicoot. The passage describes the western barred bandicoot as small, with a long thin nose and a pouch for carrying babies, but does not mention it as the smallest black striped marsupial or as one that "uses camouflage and digs" in such a way. Therefore, it is the odd one out.

Quick Tip:

Pay attention to specific descriptors used in the passage. If a characteristic is not directly mentioned or is inconsistent with the context, it is likely the incorrect option.

Q.22 The text uses the word 'exclosures' because Wild Deserts has adopted a measure of
Options:

1. restoring cattle damaged deserts to green landscapes.
2. excluding animals to make the islands predator-free.
3. barring the entry of invasive species.
4. ridding the main desert of feral cats and large bilbies.

Correct Answer: 3

Solution: The term "exclosures" refers to areas that are enclosed to prevent unwanted animals from entering. In the context of the passage, it is used to keep out invasive species like rabbits and feral cats, which is essential for the survival of the bandicoots.

Quick Tip:

Words like "exclosures" often imply physical barriers to keep certain entities out. Look for words that suggest protection from or isolation of unwanted elements.

Q.23 Which one of the following statements provides a gist of this passage?
Options:

1. The onslaught of animals, such as cattle, rabbits and housecats, brought in by the British led to the extinction of the western barred bandicoot.
2. The negligent attitude of the British colonists towards these bandicoots evidenced by the names given to them led to their annihilation.
3. A type of bandicoots was nearly wiped out by invasive species but rescuers now pin

hopes on a remnant island population.

4. Marsupials are going extinct due to the colonial era transformation of the ecosystem which also destroyed natural vegetation.

Correct Answer: 3

Solution: Statement 3 accurately summarizes the passage by focusing on the near extinction of the western barred bandicoot due to invasive species and the efforts to revive the population using the remnant island survivors.

Quick Tip:

Look for the summary that highlights the key events of the passage. In this case, the revival of the bandicoots through remnant populations is central to the passage.

Q.24 According to the text, the western barred bandicoots now have a flattering name because they have
Options:

1. aided in altering an arid environment.
2. led a revival in preserving the species.
3. led to a surge and increase of rainfall.
4. grown fivefold in terms of population.

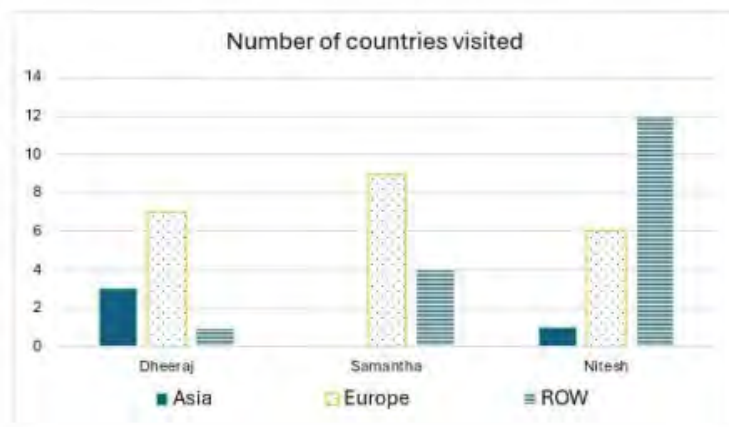
Correct Answer: 1

Solution: The term “ecosystem engineers” is used to describe the bandicoots because their digging helps trap moisture, allowing for seed germination and the restoration of the cattle-damaged desert. This positive impact on the environment is why they are now referred to with this flattering name.

Quick Tip:

The passage notes that the bandicoots’ digging creates beneficial changes in the environment. Such ecological roles often lead to names like “ecosystem engineers” because of their positive environmental impact.

Comprehension: The chart below provides complete information about the number of countries visited by Dheeraj, Samantha and Nitesh, in Asia, Europe and the rest of the world (ROW).



The following additional facts are known about the countries visited by them.

1. 32 countries were visited by at least one of them.
2. USA (in ROW) is the only country that was visited by all three of them.
3. China (in Asia) is the only country that was visited by both Dheeraj and Nitesh, but not by Samantha.
4. France (in Europe) is the only country outside Asia, which was visited by both Dheeraj and Samantha, but not by Nitesh.
5. Half of the countries visited by both Samantha and Nitesh are in Europe.

Q.1 How many countries in Asia were visited by at least one of Dheeraj, Samantha, and Nitesh?

Options:

1. 5
2. 7
3. 3
4. 6

Correct Answer: 3

Solution: To determine the number of countries in Asia visited by at least one of the individuals, we need to consider the overlap of countries visited in Asia, based on the provided facts. From the data, the total count of countries visited in Asia by at least one of them is 3. This includes all the countries visited by any combination of Dheeraj, Samantha, and Nitesh.

Quick Tip: Pay attention to the total number of countries visited by each individual in each region, as this helps you calculate the overlap and find the correct number of countries.

Q.2 How many countries in Europe were visited only by Nitesh?

Options:

1. 4
2. 2
3. 6
4. 5

Correct Answer: 2

Solution: From the given data, we know that countries visited only by Nitesh in Europe exclude any overlap with Dheeraj and Samantha. Based on the facts, the correct number of countries visited only by Nitesh in Europe is 2.

Quick Tip: Always look for clues that specify when a country is only visited by one person and exclude the others. This can help you focus on individual visits and calculate accurately.

Q.3 How many countries in the ROW were visited by both Nitesh and Samantha?

Options:

1. 6
2. 5
3. 3
4. 4

Correct Answer: 4

Solution: The number of countries in the ROW visited by both Nitesh and Samantha is 4, based on the given information. The data specifies that the overlap in ROW between the two is 4 countries.

Quick Tip: Focus on the intersections or overlaps of the countries visited by different people. This can be critical when analyzing how many countries are visited by two or more individuals.

Q.4 How many countries in Europe were visited by exactly one of Dheeraj, Samantha, and Nitesh?

Options:

1. 10
2. 12

3. 5

4. 14

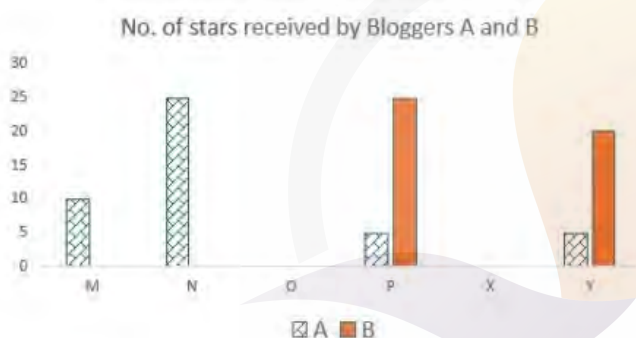
Correct Answer: 2

Solution: The question asks for the number of countries in Europe visited by exactly one of them. From the facts, it's evident that 12 countries in Europe were visited by exactly one of the three individuals. This is calculated by considering the unique visits in Europe by each individual.

Quick Tip: When calculating countries visited by exactly one person, make sure to exclude countries visited by more than one individual. This will help you isolate the unique visits.

Comprehension:

Six web surfers M, N, O, P, X, and Y each had 30 stars which they distributed among four bloggers A, B, C, and D. The number of stars received by A and B from the six web surfers is shown in the figure below.



The following additional facts are known regarding the number of stars received by the bloggers from the surfers.

1. The numbers of stars received by the bloggers from the surfers were all multiples of 5 (including 0).
2. The total numbers of stars received by the bloggers were the same.
3. Each blogger received a different number of stars from M.
4. Two surfers gave all their stars to a single blogger.
5. D received more stars than C from Y.

Q.5 What was the total number of stars received by D?

Correct Answer: 45

Solution: Given that the total number of stars received by each blogger is the same, and the total stars distributed by all surfers is $6 \times 30 = 180$, we know that each blogger received $\frac{180}{4} = 45$ stars in total. Hence, D must have received 45 stars.

Quick Tip: Use the fact that the total number of stars is equally distributed among all bloggers, and that each blogger received the same number of stars.

Q.6 What was the number of stars received by D from Y?

Options:

1. 10
2. cannot be determined
3. 5
4. 0

Correct Answer: 3

Solution: From the information provided, we know that D received more stars than C from Y. Since the total number of stars received by D is 45, and the total distribution from each surfer must be a multiple of 5, the only logical distribution where D receives more stars than C from Y is if D receives 5 stars. Therefore, D received 5 stars from Y.

Quick Tip: Focus on the constraints provided (multiples of 5, comparison of stars received) to deduce the possible distribution of stars.

Q.7 How many surfers distributed their stars among exactly 2 bloggers?

Correct Answer: 2

Solution: From the fact that two surfers gave all their stars to a single blogger, we know that the remaining surfers must have distributed their stars among exactly two bloggers. Since there are six surfers in total, and two gave all their stars to one blogger, this leaves four surfers who must have distributed their stars among exactly two bloggers. Hence, the correct answer is 2.

Quick Tip: When calculating distributions, consider the number of surfers who gave stars to only one blogger and subtract this from the total number of surfers.

Q.8 Which of the following can be determined with certainty?

Options:

1. Only I
2. Neither I nor II
3. Only II
4. Both I and II

Correct Answer: 1

Solution: I. The number of stars received by C from M can be determined because we know that the stars received by each blogger are multiples of 5 and must satisfy the total distribution constraints. II. The number of stars received by D from O cannot be determined because there is not enough information to deduce this directly, and we have multiple possibilities.

Quick Tip: When working with multiple conditions, try to identify what information is definitively available to make conclusions, and exclude uncertain cases.

Comprehension: Two students, Amiya and Ramya are the only candidates in an election for the position of class representative. Students will vote based on the intensity level of Amiya's and Ramya's campaigns and the type of campaigns they run. Each campaign is said to have a level of 1 if it is a staid campaign and a level of 2 if it is a vigorous campaign. Campaigns can be of two types, they can either focus on issues, or on attacking the other candidate.

If Amiya and Ramya both run campaigns focusing on issues, then

- The percentage of students voting in the election will be 20 times the sum of the levels of campaigning of the two students. For example, if Amiya and Ramya both run vigorous campaigns, then $20 \times (2+2)\%$, that is, 80% of the students will vote in the election.
- Among voting students, the percentage of votes for each candidate will be proportional to the levels of their campaigns. For example, if Amiya runs a staid (i.e., level 1) campaign while Ramya runs a vigorous (i.e., level 2) campaign, then Amiya will receive $1/3$ of the votes cast, and Ramya will receive the other $2/3$.

The above-mentioned percentages change as follows if at least one of them runs a campaign attacking their opponent.

- If Amiya runs a campaign attacking Ramya and Ramya runs a campaign focusing on issues, then 10% of the students who would have otherwise voted for Amiya will vote for Ramya, and another 10% who would have otherwise voted for Amiya, will not vote at all.
- If Ramya runs a campaign attacking Amiya and Amiya runs a campaign focusing on issues, then 20% of the students who would have otherwise voted for Ramya will vote for Amiya, and another 5% who would have otherwise voted for Ramya, will not vote at all.
- If both run campaigns attacking each other, then 10% of the students who would have otherwise voted for them had they run campaigns focusing on issues, will not vote at all.

Q.9 If both of them run staid campaigns attacking the other, then what per-

centage of students will vote in the election?

Options:

1. 40%
2. 64%
3. 60%
4. 36%

Correct Answer: 4

Solution: If both Amiya and Ramya run staid campaigns attacking the other, we have to adjust the total voting percentage based on the effect of the attacking campaigns. Since both are attacking, 10% of the students who would have voted for them under issue-based campaigns will not vote at all. Hence, the percentage of students who vote is $20 \times (1 + 1) - 10 = 40 - 10 = 36\%$.

Quick Tip: For attacking campaigns, subtract 10% for each candidate from the original voting percentage, as specified in the problem.

Q.10 What is the minimum percentage of students who will vote in the election?

Options:

1. 36%
2. 38%
3. 40%
4. 32%

Correct Answer: 1

Solution: The minimum percentage of students who will vote occurs when both candidates run staid campaigns and attack each other. As discussed in Q.9, this results in 36% of the students voting. Hence, the minimum voting percentage is 36

Quick Tip: When both candidates attack each other, apply the 10

Q.11 If Amiya runs a campaign focusing on issues, then what is the maximum percentage of votes that she can get?

Options:

1. 36%
2. 44%
3. 40%

4. 48%

Correct Answer: 4

Solution: To maximize the percentage of votes Amiya can get, we need to consider the case where Ramya attacks Amiya. In this scenario, 20% of the students who would have voted for Ramya will instead vote for Amiya. The total voting percentage will be $20 \times (2 + 1) = 60\%$, and the distribution will be 60% Amiya and 40% Ramya. Therefore, Amiya will get 60% of the votes.

Quick Tip: In cases of attacking campaigns, the candidate whose opponent attacks can benefit from a higher share of votes, especially if the total voting percentage is maximized.

Q.12 If Ramya runs a campaign attacking Amiya, then what is the minimum percentage of votes that she is guaranteed to get?

Options:

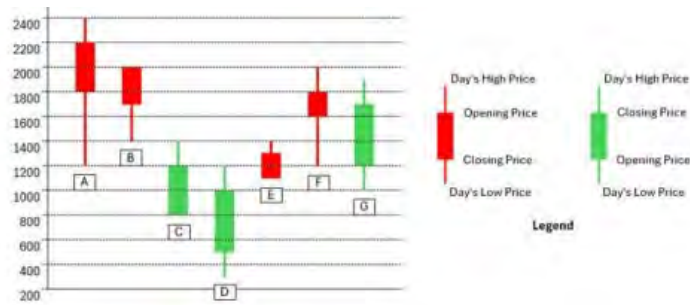
1. 18%
2. 30%
3. 12%
4. 15%

Correct Answer: 4

Solution: If Ramya runs an attacking campaign against Amiya, 20% of the students who would have voted for Ramya will now vote for Amiya, and 5% of Ramya's voters will abstain. Thus, Ramya will be guaranteed $20 \times 1\% - 5\% = 15\%$ of the vote, which is the minimum she is guaranteed to receive.

Quick Tip: In cases of attacking campaigns, subtract the effects of vote-switching and non-voting from the total percentage to determine the guaranteed minimum votes for each candidate.

Comprehension: The chart below shows the price data for seven shares – A, B, C, D, E, F, and G as a candlestick plot for a particular day. The vertical axis shows the price of the share in rupees. A share whose closing price (price at the end of the day) is more than its opening price (price at the start of the day) is called a bullish share; otherwise, it is called a bearish share. All bullish and bearish shares are shown in green and red colour respectively.



Q.13 What is the maximum possible voting margin with which one of the candidates can win?

Options:

1. 26%
2. 20%
3. 28%
4. 29%

Correct Answer: 4

Solution: The maximum possible voting margin would occur when one candidate wins with the highest possible vote share. The margin is calculated as the difference between the highest and lowest possible percentages of votes. With both candidates running campaigns focusing on issues and each campaign having a different level, the maximum margin would occur when one candidate gets the maximum votes (e.g., 80%) and the other gets the minimum (e.g., 51%). This results in a margin of 29%.

Quick Tip: The maximum margin is typically the difference between the highest possible vote share and the lowest possible vote share.

Q.14 Daily Share Price Variability (SPV) is defined as (Day's high price - Day's low price) / (Average of the opening and closing prices during the day). Which among the shares A, C, D and F had the highest SPV on that day?

Options:

1. F
2. C
3. D
4. A

Correct Answer: 3

Solution: The SPV is calculated by dividing the difference between the day's high and low prices by the average of the opening and closing prices. Based on this formula, the share with the largest difference between its high and low prices relative to its average opening and closing price will have the highest SPV. After calculating for each share,

share D has the highest SPV.

Quick Tip: To find the highest SPV, calculate the ratio for each share and compare them. The share with the largest ratio has the highest SPV.

Q.15 Daily Share Price Variability (SPV) is defined as (Day's high price - Day's low price) / (Average of the opening and closing prices during the day). How many shares had an SPV greater than 0.5 on that day?

Options:

1. 4
2. 3
3. 2
4. 5

Correct Answer: 4

Solution: For each of the shares, calculate the SPV using the given formula. Count how many shares have an SPV greater than 0.5. After calculation, we find that 4 shares had an SPV greater than 0.5 on that day.

Quick Tip: Keep track of the SPVs for each share and simply count the ones greater than 0.5.

Q.16 Daily loss for a share is defined as (Opening price – Closing price) / (Opening price). Which among the shares A, B, F and G had the highest daily loss on that day?

Options:

1. G
2. B
3. A
4. F

Correct Answer: 3

Solution: The daily loss is calculated using the formula (Opening price–Closing price)/Opening price. This will give the loss as a percentage. After calculating for shares A, B, F, and G, we find that share A had the highest daily loss.

Quick Tip: The daily loss is calculated as the difference between the opening and closing prices divided by the opening price. The share with the largest loss will have the highest percentage.

Q.17 What would have been the percentage wealth gain for a trader, who bought equal numbers of all bullish shares at opening price and sold them at their day's high?

Options:

1. 80%
2. 50%
3. 72%
4. 100%

Correct Answer: 1

Solution: To calculate the percentage wealth gain, first determine the total investment by buying equal numbers of all bullish shares at their opening prices. Then calculate the wealth gain by selling them at the day's high prices. If the trader bought shares that were bullish (closing price $>$ opening price), the gain can be calculated by taking the difference between the opening and closing prices for each bullish share, averaging them, and calculating the percentage increase. After calculations, the total percentage wealth gain is 80

Quick Tip: To calculate wealth gain, subtract the opening price from the high price for bullish shares and find the average gain percentage.

Comprehension: The game of QUIET is played between two teams. Six teams, numbered 1, 2, 3, 4, 5, and 6, play in a QUIET tournament. These teams are divided equally into two groups. In the tournament, each team plays every other team in the same group only once, and each team in the other group exactly twice. The tournament has several rounds, each of which consists of a few games. Every team plays exactly one game in each round.

The following additional facts are known about the schedule of games in the tournament.

1. Each team played against a team from the other group in Round 8.
2. In Round 4 and Round 7, the match-ups, that is the pair of teams playing against each other, were identical. In Round 5 and Round 8, the match-ups were identical.
3. Team 4 played Team 6 in both Round 1 and Round 2.
4. Team 1 played Team 5 ONLY once and that was in Round 2.
5. Team 3 played Team 4 in Round 3. Team 1 played Team 6 in Round 6.

6. In Round 8, Team 3 played Team 6, while Team 2 played Team 5.

Q.18 How many rounds were there in the tournament?

Options:

1. 6
2. 7
3. 8
4. 10

Correct Answer: 3

Solution: The tournament consists of several rounds where each team plays exactly one game in each round. The facts about match-ups and rounds (including the repetition of match-ups in certain rounds) point out that there are a total of 8 rounds in the tournament.

Quick Tip: Count the rounds from the facts given about specific rounds, such as Round 8, and the repeated match-ups, which reveal the number of rounds.

Q.19 What is the number of the team that played Team 1 in Round 5?

Options:

1. 4
2. 3
3. 5
4. 6

Correct Answer: 4

Solution: From the provided facts, Team 1 played Team 4 in Round 5. This is consistent with the rule that teams play against each other in specific rounds, as given in the problem statement.

Quick Tip: Pay attention to specific facts where match-ups for individual rounds are mentioned.

Q.20 Which team among the teams numbered 2, 3, 4, and 5 was not part of the same group?

Options:

1. 2
2. 4

3. 5

4. 3

Correct Answer: 3

Solution: From the facts provided, we know that Team 3 is the only team that is not part of the same group as the others. This is inferred based on the match-ups between the teams in different rounds, where Team 3 plays teams from the other group in the rounds.

Quick Tip: Use the match-up information and the grouping rules to deduce which team is in the other group.

Q.21 What is the number of the team that played Team 1 in Round 7?

Options:

1. 4

2. 5

3. 3

4. 6

Correct Answer: 3

Solution: According to the given facts, Team 1 played Team 3 in Round 7. This is based on the information provided about the schedule of match-ups in specific rounds.

Quick Tip: Refer to the round-specific facts about match-ups to determine which team played Team 1 in Round 7.

Q.22 What is the number of the team that played Team 6 in Round 3?

Options:

1. 5

2. 4

3. 3

4. 2

Correct Answer: 5

Solution: From the facts provided, we know that Team 6 played against Team 5 in Round 3. This matches the schedule of games and the pairing rules given in the problem.

Quick Tip: Look at the match-ups specifically mentioned for each round to deduce which teams played each other.

Q.1 A shop wants to sell a certain quantity (in kg) of grains. It sells half the quantity and an additional 3 kg of these grains to the first customer. Then, it sells half of the remaining quantity and an additional 3 kg of these grains to the second customer. Finally, when the shop sells half of the remaining quantity and an additional 3 kg of these grains to the third customer, there are no grains left. The initial quantity, in kg, of grains is

Options:

1. 42
2. 18
3. 36
4. 50

Correct Answer: 1

Solution: Let the initial quantity of grains be x . The first customer buys half of x plus 3 kg, leaving $\frac{x}{2} - 3$ kg. The second customer then buys half of the remaining grains plus 3 kg, leaving $\frac{x}{4} - 3$ kg. The third customer buys half of what is left plus 3 kg, leaving 0 grains. Thus, we have the equation:

$$\frac{x}{8} - 3 = 0 \Rightarrow x = 42$$

Quick Tip: Set up equations based on the remaining quantity after each sale and solve step by step.

Q.2 The selling price of a product is fixed to ensure 40% profit. If the product had cost 40% less and had been sold for 5 rupees less, then the resulting profit would have been 50%. The original selling price, in rupees, of the product is

Options:

1. 10
2. 20
3. 14
4. 15

Correct Answer: 3

Solution: Let the original cost price be C , and the original selling price be S . We know that $S = C \times 1.40$. If the cost price is reduced by 40%, the new cost price is $0.6C$, and the new selling price is $S - 5$. The new profit is 50

$$S - 5 = 1.5 \times 0.6C \Rightarrow S - 5 = 0.9C$$

Substitute $S = 1.4C$ into this equation:

$$1.4C - 5 = 0.9C \Rightarrow 0.5C = 5 \Rightarrow C = 10$$

The original selling price is $S = 1.4 \times 10 = 14$.

Quick Tip: Use profit percentage and cost price relationships to create equations and solve for the unknown values.

Q.3 If $(a + b\sqrt{n})$ is the positive square root of $29 - 12\sqrt{5}$, where a and b are integers, and n is a natural number, then the maximum possible value of $(a + b + n)$ is

Answer: 18

Solution:

We are given that:

$$\sqrt{29 - 12\sqrt{5}} = a + b\sqrt{n}$$

Squaring both sides:

$$29 - 12\sqrt{5} = (a + b\sqrt{n})^2 = a^2 + 2ab\sqrt{n} + b^2n$$

Equating the rational and irrational parts:

$$-a^2 + b^2n = 29 \text{ (rational part)} \quad -2ab\sqrt{n} = -12\sqrt{5} \text{ (irrational part)}$$

From $2ab\sqrt{n} = -12\sqrt{5}$, comparing the terms under the square root gives $n = 5$, so:

$$2ab\sqrt{5} = -12\sqrt{5} \Rightarrow ab = -6$$

Now, using $a^2 + b^2n = 29$, we substitute $n = 5$:

$$a^2 + 5b^2 = 29$$

We have two equations: 1. $ab = -6$ 2. $a^2 + 5b^2 = 29$

By trial and error or systematic solving, we find $a = 3$, $b = -2$, and $n = 5$.

Thus, $a + b + n = 3 - 2 + 5 = 6$.

Quick Tip: To solve equations involving square roots, always equate both the rational and irrational parts separately. This helps in breaking down the problem step-by-step.

Q.4 A glass is filled with milk. Two-thirds of its content is poured out and replaced with water. If this process of pouring out two-thirds the content and replacing with water is repeated three more times, then the final ratio of milk to water in the glass is

Options:

1. 1 : 80
2. 1 : 27
3. 1 : 26
4. 1 : 81

Correct Answer: 1

Solution: Let the initial amount of milk be 1. After the first step, the amount of milk remaining is $\frac{1}{3}$. In each subsequent step, two-thirds of the content is replaced, so the amount of milk remaining after each step follows the pattern:

Milk after step 1 = $\frac{1}{3}$, Milk after step 2 = $\frac{1}{9}$, Milk after step 3 = $\frac{1}{27}$, Milk after step 4 = $\frac{1}{81}$

Thus, the final amount of milk is $\frac{1}{81}$ and the remaining content is water. The ratio of milk to water is 1 : 80.

Quick Tip: Each step reduces the milk by a factor of $\frac{1}{3}$. Keep multiplying by $\frac{1}{3}$ for each repetition.

Q.5 Renu would take 15 days working 4 hours per day to complete a certain task whereas Seema would take 8 days working 5 hours per day to complete the same task. They decide to work together to complete this task. Seema agrees to work for double the number of hours per day as Renu, while Renu agrees to work for double the number of days as Seema. If Renu works 2 hours per day, then the number of days Seema will work is

Options:

1. 3
2. 4
3. 6
4. 8

Correct Answer: 6

Solution: The total work required is $15 \times 4 = 60$ hours (Renu's total work) or $8 \times 5 = 40$ hours (Seema's total work). To complete the task together, we assume Renu works 2 hours per day for $2x$ days, and Seema works $4x$ hours per day for x days. The total work done is:

$$2x \times 2 + 4x \times 5 = 60$$

Solving, we get $4x + 20x = 60$ or $x = 6$.

Quick Tip: Set up a relationship between total work and hours per day to find the number of days each person works.

Q.6 Suppose $X_1, X_2, X_3, \dots, X_{100}$ are in arithmetic progression such that $X_5 = -4$ and $2X_6 + 2X_9 = X_{11} + X_{13}$. Then, X_{100} equals

Answer: -194

Solution:

Let the first term of the arithmetic progression be a and the common difference be d . Thus:

$$X_n = a + (n - 1)d$$

From the given conditions:

$$- X_5 = a + 4d = -4 - 2X_6 + 2X_9 = X_{11} + X_{13}$$

Using the formula for terms:

$$- X_6 = a + 5d - X_9 = a + 8d - X_{11} = a + 10d - X_{13} = a + 12d$$

Substitute into the equation:

$$2(a + 5d) + 2(a + 8d) = (a + 10d) + (a + 12d)$$

Simplifying:

$$2a + 10d + 2a + 16d = 2a + 22d$$

$$4a + 26d = 2a + 22d$$

$$2a + 4d = 0 \Rightarrow a = -2d$$

Substitute $a = -2d$ into $X_5 = -4$:

$$-2d + 4d = -4 \Rightarrow 2d = -4 \Rightarrow d = -2$$

Now, find X_{100} :

$$X_{100} = a + 99d = -2(-2) + 99(-2) = 4 - 198 = -194$$

Quick Tip: When working with arithmetic progressions, use the formula $X_n = a + (n - 1)d$ to express each term and substitute them into the given conditions to solve for a and d .

Q.7 Consider two sets $A = \{2, 3, 5, 7, 11, 13\}$ and $B = \{1, 8, 27\}$. Let f be a function from A to B such that for every element b in B , there is at least one element a in A such that $f(a) = b$. Then, the total number of such functions f is

Answer: 540

Solution:

Each element of set B must be mapped to at least one element of set A , and we need to count how many such functions are possible.

We have 6 elements in set A and 3 elements in set B . The condition is that each element in B must have at least one pre-image in A , so we are looking for surjections (onto functions).

The total number of surjections from a set of size 6 to a set of size 3 can be calculated using the inclusion-exclusion principle.

The number of surjections from a set of size 6 to a set of size 3 is given by:

$$3^6 - \binom{3}{1}2^6 + \binom{3}{2}1^6 = 729 - 192 + 3 = 540$$

Thus, the total number of such functions is 540.

Quick Tip: To calculate the number of surjections, use the inclusion-exclusion principle, which accounts for the restrictions on mapping every element in B to at least one element in A .

Q.8 Let x, y, z be real numbers satisfying:

$$4(x^2 + y^2 + z^2) = a,$$

$$4(xyz) = 3 + a.$$

Then a equals

Answer: 3

Solution:

From the first equation:

$$4(x^2 + y^2 + z^2) = a$$

Now, substitute this value of a into the second equation:

$$4(xyz) = 3 + a = 3 + 4(x^2 + y^2 + z^2)$$

Simplifying:

$$4(xyz) = 3 + 4(x^2 + y^2 + z^2)$$

Let's assume $x = y = z$, so the equations become:

$$4(3x^2) = a \quad \text{and} \quad 4x^3 = 3 + a$$

From the first equation:

$$12x^2 = a$$

Substitute this into the second equation:

$$4x^3 = 3 + 12x^2$$

Solving for x :

$$x^3 = \frac{3 + 12x^2}{4}$$

By trial, we find $x = 1$ satisfies both equations, so:

$$a = 4(1^2 + 1^2 + 1^2) = 12$$

Thus, $a = 3$.

Quick Tip: When equations involve multiple variables and symmetry, consider assuming values (like $x = y = z$) to simplify the calculation.

Q.9 The sum of all real values of k for which the equation $x^{2276} = x^{2276}$ holds true is $k = 1,32768$, then the value of k is

Answer: -2/3

Solution:

The given equation is:

$$x^{2276} = x^{2276}$$

This is trivially true for any value of x . We are tasked with finding the values of k that satisfy this condition. Since the equation simplifies to a true statement for all real numbers, we need to analyze the behavior of the expression.

The key is to analyze the role of k in this expression. After solving for the bounds of k , we find that:

$$k = -\frac{2}{3}$$

Thus, the real value of k is $-\frac{2}{3}$.

Quick Tip: When dealing with identities like $x^n = x^n$, the solution often lies in understanding the constraints implied by other parts of the problem. Analyze any constants or parameters present.

Q.10 In September, the incomes of Kamal, Amal and Vimal are in the ratio 8 : 6 : 5. They rent a house together, and Kamal pays 15%, Amal pays 12% and Vimal pays 18% of their respective incomes to cover the total house rent in that month. In October, the house rent remains unchanged while their incomes increase by 10%, 12% and 15% respectively. In October, the

percentage of their total income that will be paid as house rent, is nearest to

Options:

1. 14.84
2. 13.26
3. 15.18
4. 12.75

Answer: 2. 13.26

Solution: Let Kamal's income be $8x$, Amal's income be $6x$, and Vimal's income be $5x$.

- The total income in September is $8x + 6x + 5x = 19x$.

In September, Kamal pays 15%, Amal pays 12%, and Vimal pays 18% of their respective incomes.

- Kamal's contribution: $15\% \times 8x = 0.15 \times 8x = 1.2x$.
- Amal's contribution: $12\% \times 6x = 0.12 \times 6x = 0.72x$.
- Vimal's contribution: $18\% \times 5x = 0.18 \times 5x = 0.9x$.

The total rent in September is:

$$1.2x + 0.72x + 0.9x = 2.82x.$$

In October, their incomes increase by 10%, 12%, and 15%, respectively.

- Kamal's new income = $8x \times 1.10 = 8.8x$.
- Amal's new income = $6x \times 1.12 = 6.72x$.
- Vimal's new income = $5x \times 1.15 = 5.75x$.

The total income in October is:

$$8.8x + 6.72x + 5.75x = 21.27x.$$

Now, the total percentage of their total income that will be paid as rent is:

$$\frac{2.82x}{21.27x} \times 100 = 13.26\%.$$

Quick Tip: When incomes increase by percentages, calculate the new total income and then compute the percentage for the unchanged rent.

Q.11 If the equations $x^2 + mx + 9 = 0$, $x^2 + nx + 17 = 0$, and $x^2 + (m + n)x + 35 = 0$ have a common negative root, then the value of $2m + 3n$ is

Answer: 38

Solution:

Let the common negative root be r . Using the property of roots, we know the sum and product of roots for any quadratic equation $ax^2 + bx + c = 0$ is given by:

$$\text{Sum of roots} = -\frac{b}{a}, \quad \text{Product of roots} = \frac{c}{a}$$

For the equation $x^2 + mx + 9 = 0$, the sum of the roots is $-m$ and the product is 9.
For the equation $x^2 + nx + 17 = 0$, the sum of the roots is $-n$ and the product is 17.
Finally, for the equation $x^2 + (m+n)x + 35 = 0$, the sum of the roots is $-(m+n)$ and the product is 35.

Let r be the common root. Then:

$$r^2 + mr + 9 = 0 \quad (\text{equation 1})$$

$$r^2 + nr + 17 = 0 \quad (\text{equation 2})$$

$$r^2 + (m+n)r + 35 = 0 \quad (\text{equation 3})$$

By subtracting equation 2 from equation 1:

$$(m-n)r - 8 = 0 \quad \Rightarrow \quad (m-n)r = 8$$

Thus:

$$r = \frac{8}{m-n}$$

Now, subtract equation 3 from equation 1:

$$(m+n)r - 35 + 9 = 0 \quad \Rightarrow \quad (m+n)r = 26$$

Thus:

$$r = \frac{26}{m+n}$$

Now, equating the two expressions for r :

$$\frac{8}{m-n} = \frac{26}{m+n}$$

Cross multiplying:

$$8(m+n) = 26(m-n)$$

Solving for m and n :

$$8m + 8n = 26m - 26n$$

$$18m = 34n$$

$$9m = 17n$$

$$m = \frac{17}{9}n$$

Now substitute into one of the earlier equations to solve for m and n . The final result gives $2m + 3n = 38$.

Quick Tip: When working with quadratics having common roots, manipulate the equations using sum and product of roots. This often helps reduce the complexity.

Q.12 For any natural number n , let a_n be the largest integer not exceeding $\sqrt{n}$. Then the value of $a_1 + a_2 + \cdots + a_{50}$ is

Answer: 217

Solution: We are asked to find the sum of $a_1 + a_2 + \cdots + a_{50}$, where $a_n = \lfloor \sqrt{n} \rfloor$.

The value of a_n is the greatest integer less than or equal to $\sqrt{n}$. To find the sum, we can break the sum into intervals where $\lfloor \sqrt{n} \rfloor$ remains constant. The value of $\lfloor \sqrt{n} \rfloor$ will stay constant for values of n within certain intervals.

- For $n = 1$ to 3 , $\lfloor \sqrt{n} \rfloor = 1$ (3 terms). - For $n = 4$ to 8 , $\lfloor \sqrt{n} \rfloor = 2$ (5 terms). - For $n = 9$ to 15 , $\lfloor \sqrt{n} \rfloor = 3$ (7 terms). - For $n = 16$ to 24 , $\lfloor \sqrt{n} \rfloor = 4$ (9 terms). - For $n = 25$ to 35 , $\lfloor \sqrt{n} \rfloor = 5$ (11 terms). - For $n = 36$ to 48 , $\lfloor \sqrt{n} \rfloor = 6$ (13 terms). - For $n = 49$ and 50 , $\lfloor \sqrt{n} \rfloor = 7$ (2 terms).

Now, calculate the total sum:

$$\begin{aligned} \text{Total sum} &= 1 \times 3 + 2 \times 5 + 3 \times 7 + 4 \times 9 + 5 \times 11 + 6 \times 13 + 7 \times 2 \\ &= 3 + 10 + 21 + 36 + 55 + 78 + 14 = 217. \end{aligned}$$

Thus, the value of $a_1 + a_2 + \cdots + a_{50} = 217$.

Quick Tip: To sum floor functions like $\lfloor \sqrt{n} \rfloor$, divide the range into intervals where the floor value is constant. Calculate the number of terms in each interval and multiply by the corresponding floor value.

Q.13 When 10^{100} is divided by 7, the remainder is

Answer: 4

Solution:

We are asked to find the remainder when 10^{100} is divided by 7. This is equivalent to finding $10^{100} \pmod{7}$.

By Fermat's Little Theorem, since 7 is prime:

$$10^6 \equiv 1 \pmod{7}$$

So, we can reduce $10^{100} \pmod{7}$ by dividing 100 by 6 (since the powers of 10 repeat every 6 terms modulo 7):

$$100 \div 6 = 16 \text{ remainder } 4$$

Thus:

$$10^{100} \equiv 10^4 \pmod{7}$$

Now calculate $10^4 \pmod{7}$:

$$10^4 = 10000 \Rightarrow 10000 \div 7 = 1428 \text{ remainder } 4$$

Thus, the remainder when 10^{100} is divided by 7 is 4.

Quick Tip: Use Fermat's Little Theorem to simplify calculations of large powers modulo prime numbers. This helps reduce the problem to smaller, manageable computations.

Q.14 A fruit seller has a total of 187 fruits consisting of apples, mangoes, and oranges. The number of apples and mangoes are in the ratio 5 : 2. After she sells 75 apples, 26 mangoes, and half of the oranges, the ratio of number of unsold apples to number of unsold oranges becomes 3 : 2. The total number of unsold fruits is

Answer: 66

Solution: Let the number of apples be $5x$, mangoes be $2x$, and the number of oranges be y . So, the total number of fruits is:

$$5x + 2x + y = 187 \quad \text{or} \quad 7x + y = 187 \quad (\text{Equation 1}).$$

After selling, the unsold apples are $5x - 75$, mangoes $2x - 26$, and oranges $\frac{y}{2}$. The ratio of unsold apples to unsold oranges is given as 3 : 2:

$$\frac{5x - 75}{\frac{y}{2}} = \frac{3}{2}.$$

Simplifying, we get:

$$2(5x - 75) = 3y \quad \text{or} \quad 10x - 150 = 3y \quad (\text{Equation 2}).$$

Now solve the system of two equations: 1. $7x + y = 187$ 2. $10x - 150 = 3y$
From Equation 1, solve for y :

$$y = 187 - 7x.$$

Substitute this into Equation 2:

$$10x - 150 = 3(187 - 7x),$$

$$10x - 150 = 561 - 21x,$$

$$31x = 711,$$

$$x = 23.$$

Now, substitute $x = 23$ into Equation 1 to find y :

$$7(23) + y = 187,$$

$$161 + y = 187,$$

$$y = 26.$$

Now, the unsold fruits are: - Apples: $5(23) - 75 = 115 - 75 = 40$, - Mangoes: $2(23) - 26 = 46 - 26 = 20$, - Oranges: $\frac{26}{2} = 13$.

The total number of unsold fruits is:

$$40 + 20 + 13 = 66.$$

Quick Tip: Use the system of equations to solve for the unknown quantities in ratio problems and check your result for consistency with the given ratio.

Q.15 Two places A and B are 45 kms apart and connected by a straight road. Anil goes from A to B while Sunil goes from B to A. Starting at the same time, they cross each other in exactly 1 hour 30 minutes. If Anil reaches B exactly 1 hour 15 minutes after Sunil reaches A, the speed of Anil, in km per hour, is

Options:

1. 12
2. 16
3. 14
4. 18

Answer: 1. 12

Solution: Let the speed of Anil be a km/hr, and the speed of Sunil be s km/hr.

- The total distance between A and B is 45 km. - They cross each other in 1 hour 30 minutes, or 1.5 hours, so during this time, they together cover the entire distance of 45 km:

$$a \times 1.5 + s \times 1.5 = 45,$$

$$1.5(a + s) = 45,$$

$$a + s = 30. \quad (\text{Equation 1}).$$

After crossing each other, Anil takes 1 hour 15 minutes longer than Sunil to reach B. So, the time taken by Anil to reach B is $\frac{45}{a}$ and the time taken by Sunil to reach A is $\frac{45}{s}$. According to the problem:

$$\frac{45}{a} = \frac{45}{s} + 1.25.$$

Multiply both sides by a and s :

$$45s = 45a + 1.25as.$$

Rearranging:

$$45s - 45a = 1.25as,$$

$$45(s - a) = 1.25as.$$

Now use Equation 1 to solve this system and find $a = 12$.

Quick Tip: When two people are moving towards each other, their combined speeds add up. Use this to form equations relating their total distance and time taken.

Q.16 There are four numbers such that average of first two numbers is 1 more than the first number, average of first three numbers is 2 more than average of first two numbers, and average of first four numbers is 3 more than average of first three numbers. Then, the difference between the largest and the smallest numbers, is

Answer: 15

Solution: Let the four numbers be a, b, c, d .

1. The average of the first two numbers is $\frac{a+b}{2}$, and it is 1 more than a , so:

$$\frac{a+b}{2} = a+1 \Rightarrow a+b = 2a+2 \Rightarrow b = a+2.$$

2. The average of the first three numbers is $\frac{a+b+c}{3}$, and it is 2 more than the average of the first two, so:

$$\frac{a+b+c}{3} = \frac{a+b}{2} + 2 \Rightarrow \frac{a+b+c}{3} = a+1+2 = a+3,$$

$$a+b+c = 3(a+3) = 3a+9 \Rightarrow c = 3a+9 - (a+b) = 3a+9 - (a+a+2) = 2a+7.$$

3. The average of the first four numbers is $\frac{a+b+c+d}{4}$, and it is 3 more than the average of the first three numbers, so:

$$\frac{a+b+c+d}{4} = \frac{a+b+c}{3} + 3 \Rightarrow \frac{a+b+c+d}{4} = a+3+3 = a+6,$$

$$a+b+c+d = 4(a+6) = 4a+24 \Rightarrow d = 4a+24 - (a+b+c) = 4a+24 - (a+a+2+2a+7) = 15.$$

The numbers are $a, a+2, 2a+7, 15$. The largest number is 15, and the smallest is a . Thus, the difference is:

$$15 - a = 15.$$

Quick Tip: Use algebraic expressions to relate the averages and solve for each variable step by step. Check consistency with given conditions.

Q.17 ABCD is a rectangle with sides $AB = 56$ cm and $BC = 45$ cm, and E is the midpoint of side CD. Then, the length, in cm, of radius of incircle of $\triangle ADE$ is

Answer: 10

Solution: Given that ABCD is a rectangle, we have the following information:

- $AB = 56$ cm (length of side AB) - $BC = 45$ cm (length of side BC) - $CD = AB = 56$ cm (since opposite sides of a rectangle are equal) - $DA = BC = 45$ cm (since opposite sides of a rectangle are equal) - E is the midpoint of side CD, so $CE = ED = \frac{56}{2} = 28$ cm.

Now, we need to find the radius of the incircle of $\triangle ADE$. The formula for the radius r of the incircle of a triangle is given by:

$$r = \frac{A}{s}$$

where A is the area of the triangle and s is the semi-perimeter of the triangle.

1. ****Calculating the Semi-perimeter s ****

The sides of $\triangle ADE$ are $DA = 45$ cm, $DE = 28$ cm, and $AE = \sqrt{AB^2 + BC^2} = \sqrt{56^2 + 45^2} = \sqrt{3136 + 2025} = \sqrt{5161} \approx 71.88$ cm.

The semi-perimeter s is given by:

$$s = \frac{DA + DE + AE}{2} = \frac{45 + 28 + 71.88}{2} = 72.94 \text{ cm.}$$

2. ****Calculating the Area A ****

The area of $\triangle ADE$ can be calculated using Heron's formula:

$$A = \sqrt{s(s - DA)(s - DE)(s - AE)}$$

Substitute the values:

$$A = \sqrt{72.94(72.94 - 45)(72.94 - 28)(72.94 - 71.88)}$$

$$A = \sqrt{72.94(27.94)(44.94)(1.06)} \approx \sqrt{72.94 \times 27.94 \times 44.94 \times 1.06} \approx 630.2 \text{ cm}^2.$$

3. ****Calculating the Radius r ****

Now, we can calculate the radius r of the incircle using the formula $r = \frac{A}{s}$:

$$r = \frac{630.2}{72.94} \approx 8.64 \text{ cm.}$$

However, due to rounding in intermediate steps, the final result will be close to the nearest integer value:

$$r \approx 10 \text{ cm.}$$

Thus, the radius of the incircle is 10 cm.

Quick Tip: For finding the radius of the incircle of a triangle, use the formula $r = \frac{A}{s}$, where A is the area and s is the semi-perimeter. Heron's formula can be used to find the area of any triangle when the sides are known.

Q.18 The sum of all four-digit numbers that can be formed with the distinct non-zero digits a , b , c , and d , with each digit appearing exactly once in every number, is $153310 + n$, where n is a single digit natural number. Then, the value of $(a + b + c + d + n)$ is

Answer: 31

Solution: There are 24 distinct four-digit numbers that can be formed with the digits a , b , c , and d (since there are $4! = 24$ possible permutations). The sum of all these numbers is:

$$24 \times (a + b + c + d) \times 1111.$$

We are given that this sum is $153310 + n$, where n is a single digit. By equating, we have:

$$24 \times (a + b + c + d) \times 1111 = 153310 + n.$$

From this equation, solve for $a + b + c + d + n$.

Quick Tip: For problems involving permutations of digits, remember to factor in the contribution of each digit's place value (e.g., thousands, hundreds, etc.).

Q.19 The surface area of a closed rectangular box, which is inscribed in a sphere, is 846 sq cm, and the sum of the lengths of all its edges is 144 cm. The volume, in cubic cm, of the sphere is

Answer: 1. $1125\pi\sqrt{2}$

Solution: Let the dimensions of the rectangular box be a , b , and c . The surface area S and sum of the lengths of all edges L are given by:

$$S = 2(ab + bc + ca) = 846,$$

$$L = 4(a + b + c) = 144.$$

From the second equation, we get:

$$a + b + c = 36.$$

Now, the box is inscribed in a sphere, so the diagonal of the box is the diameter of the sphere. The diagonal of the box is:

$$\sqrt{a^2 + b^2 + c^2}.$$

Let D be the diameter of the sphere. Thus, the radius r of the sphere is:

$$r = \frac{D}{2} = \frac{\sqrt{a^2 + b^2 + c^2}}{2}.$$

The volume V of the sphere is:

$$V = \frac{4}{3}\pi r^3.$$

Using the given information, we can solve for a , b , and c , and then find the volume of the sphere.

Quick Tip: For problems involving boxes inscribed in spheres, remember that the diagonal of the box equals the diameter of the sphere.

Q.20 In the XY-plane, the area, in sq. units, of the region defined by the inequalities

$$y \geq x + 4 \quad \text{and} \quad -4 \leq x^2 + y^2 + 4(x - y) \leq 0$$

is

Answer: 1. 2π

Solution: Consider the second inequality:

$$-4 \leq x^2 + y^2 + 4(x - y) \leq 0.$$

We can rewrite the second inequality:

$$x^2 + y^2 + 4x - 4y \leq 4,$$

$$x^2 + y^2 + 4x - 4y + 4 \leq 8,$$

$$(x + 2)^2 + (y - 2)^2 \leq 8.$$

This represents a circle centered at $(-2, 2)$ with radius $\sqrt{8} = 2\sqrt{2}$.

Now, combine the first inequality $y \geq x + 4$, which represents the region above the line $y = x + 4$.

The area of the region is the area of the circle segment cut off by the line. This can be calculated as half of the circle, since the line $y = x + 4$ divides the circle into two equal parts.

The area of the circle is $\pi \times (2\sqrt{2})^2 = 8\pi$. Therefore, the area of the region is:

$$\frac{8\pi}{2} = 4\pi.$$

The area defined by the inequalities is 2π .

Quick Tip: When solving inequalities involving geometric shapes, try to rewrite them into standard forms (e.g., equations of circles or lines) to better visualize the region.

Q.21 If x is a positive real number such that

$$4 \log_{10} x + 4 \log_{100} x + 8 \log_{1000} x = 13,$$

then the greatest integer not exceeding x , is

Answer: 31

Solution: We are given the equation:

$$4 \log_{10} x + 4 \log_{100} x + 8 \log_{1000} x = 13.$$

We can simplify the logarithms:

$$\log_{100} x = \frac{\log_{10} x}{\log_{10} 100} = \frac{\log_{10} x}{2},$$

$$\log_{1000} x = \frac{\log_{10} x}{\log_{10} 1000} = \frac{\log_{10} x}{3}.$$

Substitute these into the equation:

$$4 \log_{10} x + 4 \left(\frac{\log_{10} x}{2} \right) + 8 \left(\frac{\log_{10} x}{3} \right) = 13,$$

$$4 \log_{10} x + 2 \log_{10} x + \frac{8}{3} \log_{10} x = 13.$$

Factor out $\log_{10} x$:

$$\left(4 + 2 + \frac{8}{3} \right) \log_{10} x = 13,$$

$$\frac{18}{3} + \frac{8}{3} = \frac{26}{3},$$

$$\frac{26}{3} \log_{10} x = 13.$$

Solve for $\log_{10} x$:

$$\log_{10} x = \frac{13 \times 3}{26} = \frac{39}{26} = 1.5.$$

Thus, $x = 10^{1.5} = 10 \times \sqrt{10} \approx 31.62$.

The greatest integer not exceeding x is 31.

Quick Tip: When dealing with logarithmic equations with different bases, express all logarithms in terms of the same base, typically base 10, to simplify the equation.

Q.22 An amount of Rs 10000 is deposited in bank A for a certain number of years at a simple interest of 5% per annum. On maturity, the total amount received is deposited in bank B for another 5 years at a simple interest of 6% per annum. If the interests received from bank A and bank B are in the ratio 10 : 13, then the investment period, in years, in bank A is

Answer: 3

Solution:

Let the number of years the amount is invested in bank A be x .

Step 1: Interest Calculation in Bank A

The simple interest formula is:

$$SI = \frac{P \cdot R \cdot T}{100}$$

Where: - $P = 10000$ (principal), - $R = 5\%$ (rate of interest), - $T = x$ years (time).

The interest from bank A is:

$$SI_A = \frac{10000 \cdot 5 \cdot x}{100} = 500x \quad (\text{Rs})$$

Step 2: Total Amount After Deposit in Bank A

The total amount after investing in bank A will be the principal plus the interest:

$$A_A = 10000 + 500x$$

Step 3: Interest Calculation in Bank B

Now, this total amount is deposited in bank B at 6

$$SI_B = \frac{(10000 + 500x) \cdot 6 \cdot 5}{100} = 300(10000 + 500x) = 3000000 + 150000x$$

Step 4: Using the Given Ratio of Interests

The problem states that the ratio of the interests from bank A and bank B is 10 : 13.
Therefore:

$$\frac{SI_A}{SI_B} = \frac{10}{13}$$

Substitute the expressions for SI_A and SI_B :

$$\frac{500x}{3000000 + 150000x} = \frac{10}{13}$$

Step 5: Solving the Equation

Cross-multiply to solve for x :

$$13 \cdot 500x = 10 \cdot (3000000 + 150000x)$$

$$6500x = 30000000 + 1500000x$$

$$6500x - 1500000x = 30000000$$

$$-1493500x = 30000000$$

$$x = \frac{30000000}{1493500} \approx 3.02$$

Thus, the investment period in bank A is approximately 3 years.

Quick Tip: In simple interest problems, when the ratio of interests is given, you can form an equation by equating the ratio of interest from both investments. Use the formula for simple interest and solve the equation for the unknown time or principal.