CAT Quantitative Aptitude

Sample Paper – 16

Duration: 40 Minutes **Maximum Marks: 66**

Instructions

- This paper contains **22 MCQ questions (single-correct)**, modelled on the Quantitative Aptitude section of **CAT**.
- Each correct answer carries **+3 marks**. There is a penalty of -1 **mark per wrong MCQ**; **0** marks for unattempted questions.
- Only **one** option is correct per question. Choose carefully.
- **No personal calculators** are permitted; a basic on-screen calculator is provided in the actual CAT exam.
- **Rough sheets** are provided at the test centre; use them freely for calculations.
- Syllabus level: **Arithmetic, Algebra, Geometry & Mensuration, and Modern Mathematics** at the level of the CAT Quantitative Aptitude section.

Questions (Q1 – Q22)

Q1. How many perfect cubes lie strictly between 100 and 1,000?

(A) 5

(B) 4

(C) 6

(D) 3

Q2. Find the smallest positive integer that leaves remainder 3 when divided by 7 and remainder 2 when divided by 5.

(A) 12

(B) 22

(C) 17

(D) 37

Q3. At what rate per cent per annum simple interest will Rs. 2,500 double itself in 8 years?

(A) 10%

(B) 12.5%

(C) 15%

(D) 20%

Q4. A's income is 25% more than B's income. By what percentage is B's income less than A's?

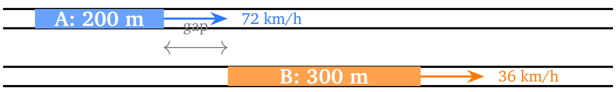
(A) 25%

(B) 22%

(C) 18%

(D) 20%

Q5. Train A (length 200 m) runs at 72 km/h. Train B (length 300 m) runs at 36 km/h in the same direction on a parallel track. How many seconds does Train A take to completely overtake Train B?



(A) 30 s

(B) 40 s

(C) 50 s

(D) 60 s

Q6. Three solutions of acid-water with concentrations 30%, 20%, and 10% are mixed in volumes 10 L, 20 L and 30 L respectively. What is the acid concentration in the resulting mixture?

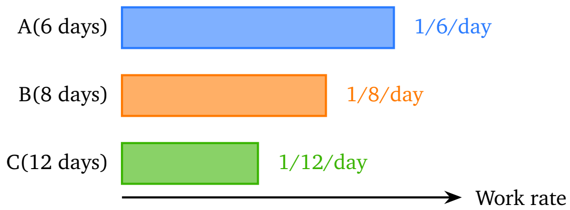
(A) $16\frac{2}{3}\%$

(B) 20%

(C) 15%

(D) 18%

Q7. A, B and C can individually complete a job in 6, 8 and 12 days respectively. If all three work together, what fraction of the job is completed in 2 days?



(A) $\frac{1}{2}$

(B) $\frac{2}{3}$

(C) $\frac{5}{8}$

(D) $\frac{3}{4}$

Q8. A batsman's average after 10 innings is 50. He scores 6 runs in his 11th innings. Find his new batting average.

(A) 48

(B) 46

(C) 44

(D) 42

Q9. A trader marks an article at 40% above cost price and then gives a discount of 25%. What is the trader's profit or loss percentage?

(A) 10% profit

(B) 15% loss

(C) 5% profit

(D) 5% loss

Q10. Rs. 360 is divided among A, B and C in the ratio 3 : 5 : 4. Find A's share.

(A) Rs. 90

(B) Rs. 150

(C) Rs. 120

(D) Rs. 100

Q11. Find the sum to infinity of the geometric series with first term 4 and common ratio $\frac{1}{2}$.

(A) 6

(B) 4

(C) 10

(D) 8

Q12. One root of the equation $x^2 - 4x + k = 0$ is triple the other. Find the value of k.

(A) 2

(B) 3

(C) 4

(D) 6

Q13. Evaluate: $\log_3 9 + \log_3 27 + \log_3 81$.

(A) 9

(B) 7

(C) 12

(D) 6

Q14. The sum of the first n terms of a series is given by $S_n = \dfrac{n(3n+1)}{2}$. Find S_{10}.

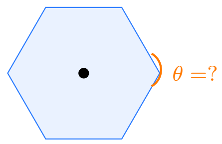
(A) 135

(B) 145

(C) 155

(D) 165

Q15. Find each interior angle of a regular hexagon.



Regular Hexagon

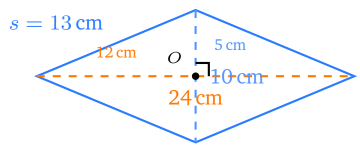
(A) 90°

(B) 100°

(C) 108°

(D) 120°

Q16. The diagonals of a rhombus are 10 cm and 24 cm. Find the perimeter of the rhombus.



(A) 52 cm

(B) 48 cm

(C) 56 cm

(D) 60 cm

Q17. Find the area of a circular ring with outer radius 7 cm and inner radius 3.5 cm (use $\pi = 22/7$).

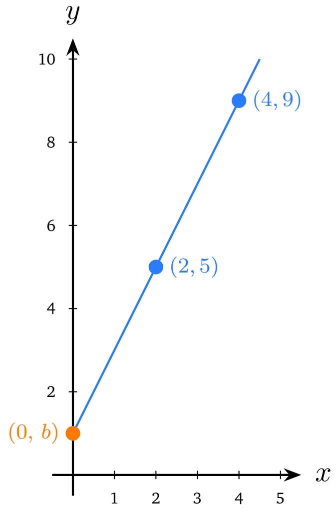
(A) $154\,\text{cm}^2$

(B) $115.5\,\text{cm}^2$

(C) $77\,\text{cm}^2$

(D) $231\,\text{cm}^2$

Q18. A straight line passes through the points $(2, 5)$ and $(4, 9)$. Find the y-intercept of this line.



(A) -1

(B) 2

(C) 1

(D) 3

Q19. The curved surface of a hemispherical dome has a radius of 7 m. Find the cost to whitewash the inside at Rs. 5 per sq. m (use $\pi = 22/7$).

(A) Rs. 770

(B) Rs. 1,078

(C) Rs. 1,100

(D) Rs. 1,540

Q20. How many 4-digit even numbers can be formed using the digits $\{1, 2, 3, 4, 5, 6\}$ without repetition?

(A) 120

(B) 180

(C) 240

(D) 360

Q21. A card is drawn at random from a well-shuffled pack of 52 cards. Find the probability that it is a face card (Jack, Queen or King).

(A) $\frac{3}{13}$

(B) $\frac{1}{13}$

(C) $\frac{4}{13}$

(D) $\frac{1}{4}$

Q22. A committee of 2 people is to be selected from a group of 4 men and 3 women. Find the probability that at least one woman is selected.

(A) $\frac{3}{7}$

(B) $\frac{4}{7}$

(C) $\frac{5}{7}$

(D) $\frac{6}{7}$

Detailed Solutions

Q1.

Solution

Concept – Number Theory: Perfect cubes. A perfect cube is a number of the form n^3 for a positive integer n. We list all cubes strictly between 100 and 1,000 (i.e., $100 < n^3 < 1000$).

Step 1 – Find the range of n: Since $4^3 = 64 < 100$ and $10^3 = 1000$, we need $n^3 > 100$ and $n^3 < 1000$, so $n \in \{5, 6, 7, 8, 9\}$.

Step 2 – List the cubes:

$$5^3 = 125, \quad 6^3 = 216, \quad 7^3 = 343, \quad 8^3 = 512, \quad 9^3 = 729.$$

All five values satisfy $100 < n^3 < 1000$. Count $= 5$.

Why other options are wrong:

- Option B (4): Misses one cube, perhaps forgetting $9^3 = 729$ or starting from $n = 6$.
- Option C (6): Erroneously includes $10^3 = 1000$, which is not *strictly* less than 1000.
- Option D (3): Only counts three cubes, perhaps considering $n \in \{5, 6, 7\}$ and ignoring 8 and 9.

Final Answer: 5 perfect cubes $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 1

Q2.

Solution

Concept – Number Theory: Chinese Remainder Theorem. We seek the smallest positive integer x satisfying two simultaneous congruences: $x \equiv 3 \pmod 7$ and $x \equiv 2 \pmod 5$.

Step 1 – List numbers $\equiv 3 \pmod 7$: $3, 10, 17, 24, 31, \ldots$

Step 2 – Check which also satisfy $x \equiv 2 \pmod 5$:

$$\begin{aligned} 3 \div 5 &= 0 \text{ r } 3 \quad \times \\ 10 \div 5 &= 2 \text{ r } 0 \quad \times \\ 17 \div 5 &= 3 \text{ r } 2 \quad \checkmark \end{aligned}$$

So $x = 17$ is the smallest such positive integer.

Why other options are wrong:

- Option A (12): $12 \div 7 = 1$ r $5 \neq 3$; fails the first condition.
- Option B (22): $22 \div 7 = 3$ r $1 \neq 3$; fails the first condition.
- Option D (37): $37 \div 7 = 5$ r $2 \neq 3$; fails the first condition. (37 is the next solution after 17 in the series $17, 52, \ldots$ only if the period is 35; in fact the next is $17 + 35 = 52$, not 37.)

Final Answer: Smallest positive integer $= 17 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 2

Q3.

Solution

Concept – Simple Interest: Rate of interest. Formula: SI $= \dfrac{P \times R \times T}{100}$. For the amount to double, SI $= P$.

Step 1 – Set up the equation. Since the amount doubles, SI $= P =$ Rs. 2,500:

$$2500 = \frac{2500 \times R \times 8}{100}.$$

Step 2 – Solve for R:

$$R = \frac{2500 \times 100}{2500 \times 8} = \frac{100}{8} = 12.5\%.$$

Why other options are wrong:

- Option A (10%): SI $= 2500 \times 0.10 \times 8 = 2000 \neq 2500$; the amount would only grow to Rs. 4,500.
- Option C (15%): SI $= 2500 \times 0.15 \times 8 = 3000 \neq 2500$; the amount would more than double.
- Option D (20%): SI $= 2500 \times 0.20 \times 8 = 4000$; the amount would triple, not

double.

Final Answer: Rate $= 12.5\%$ per annum $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 3

Q4.

Solution

Concept – Percentages: Reverse comparison. If A is $x\%$ more than B, the percentage by which B is less than A is calculated using A as the base (not B).

Step 1 – Let B's income $= 100$. Then A's income $= 125$ (since A is 25% more than B).

Step 2 – Find by what percentage B is less than A:

$$\% \text{ by which B is less than A} = \frac{A - B}{A} \times 100 = \frac{125 - 100}{125} \times 100 = \frac{25}{125} \times 100 = 20\%.$$

Why other options are wrong:

- Option A (25%): This is the percentage by which A is more than B (using B as the base), not the reverse.
- Option B (22%): Incorrect; no clean derivation gives this value.
- Option C (18%): Incorrect; the exact answer is 20%, not 18%.

Final Answer: B's income is 20% less than A's $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 4

Q5.

Solution

Concept – Time, Speed, Distance: Relative speed for overtaking. When two objects move in the same direction, their relative speed is the difference of their speeds. To completely overtake, Train A must cover a distance equal to the sum of both lengths relative to Train B.

Step 1 – Convert speeds to m/s and find relative speed:

$$72\,\text{km/h} = 72 \times \frac{1000}{3600} = 20\,\text{m/s}, \quad 36\,\text{km/h} = 36 \times \frac{1000}{3600} = 10\,\text{m/s}.$$

$$\text{Relative speed} = 20 - 10 = 10\,\text{m/s}.$$

Step 2 – Find total distance to be covered (relative to Train B) for a complete overtake:

$$\text{Total distance} = \text{Length of A} + \text{Length of B} = 200 + 300 = 500\,\text{m}.$$

Step 3 – Compute time:

$$\text{Time} = \frac{500}{10} = 50\,\text{s}.$$

Why other options are wrong:

- Option A (30 s): Uses only one train's length (300 m): $300/10 = 30$; forgets to add both lengths.
- Option B (40 s): Uses 400 m (perhaps one length doubled); does not correctly sum both train lengths.
- Option D (60 s): Uses relative speed incorrectly, perhaps as $500/(72-36) \approx 500/10$ but divides by a different value.

Final Answer: Time to overtake $= 50$ seconds $\Rightarrow \boxed{\text{C}}$

Answer: (C) **Go Back to Q 5**

Q6.

Solution

Concept – Mixtures: Weighted average concentration. When solutions are mixed, the resulting concentration is the total quantity of solute divided by the total volume.

Step 1 – Calculate acid in each solution:

$$\begin{aligned}\text{Acid from Solution 1} &= 30\% \times 10\,\text{L} = 3\,\text{L},\\ \text{Acid from Solution 2} &= 20\% \times 20\,\text{L} = 4\,\text{L},\\ \text{Acid from Solution 3} &= 10\% \times 30\,\text{L} = 3\,\text{L}.\end{aligned}$$

Step 2 – Find total acid and total volume:

$$\text{Total acid} = 3 + 4 + 3 = 10\,\text{L}, \quad \text{Total volume} = 10 + 20 + 30 = 60\,\text{L}.$$

Step 3 – Compute concentration:

$$\text{Concentration} = \frac{10}{60} \times 100 = \frac{50}{3} = 16\tfrac{2}{3}\%.$$

Why other options are wrong:

- Option B (20%): Simple arithmetic mean of concentrations $(30+20+10)/3 = 20$; ignores different volumes.
- Option C (15%): Uses equal volumes of 20 L each: $(3+4+3)/60 = 10/60$; a computational slip.
- Option D (18%): Weighted average with incorrect weights; no clean derivation gives 18%.

Final Answer: Acid concentration $= 16\frac{2}{3}\% \Rightarrow \boxed{\text{A}}$

Answer: (A) **Go Back to Q 6**

Q7.

Solution

Concept – Time and Work: Combined work rate. If a person can complete a job in n days, their rate is $\frac{1}{n}$ per day. When multiple workers work simultaneously, their rates add.

Step 1 – Find individual rates and combined rate:

$$\text{Rate of A} = \frac{1}{6}, \quad \text{Rate of B} = \frac{1}{8}, \quad \text{Rate of C} = \frac{1}{12}.$$

$$\text{Combined rate} = \frac{1}{6} + \frac{1}{8} + \frac{1}{12} = \frac{4}{24} + \frac{3}{24} + \frac{2}{24} = \frac{9}{24} = \frac{3}{8} \text{ per day.}$$

Step 2 – Work completed in 2 days:

$$\text{Work in 2 days} = \frac{3}{8} \times 2 = \frac{6}{8} = \frac{3}{4}.$$

Why other options are wrong:

- Option A ($\frac{1}{2}$): Uses only A's rate for 2 days: $\frac{1}{6} \times 2 \approx \frac{1}{3}$; or uses a combined rate of $\frac{1}{4}$.
- Option B ($\frac{2}{3}$): Computes combined rate as $\frac{1}{4}$ per day (incorrect LCM calculation), giving $\frac{1}{4} \times 2 = \frac{1}{2}$; or uses $\frac{1}{3}$ per day giving $\frac{2}{3}$.
- Option C ($\frac{5}{8}$): Off by one step; perhaps uses $\frac{1}{6} + \frac{1}{8} = \frac{7}{24}$ (omitting C) and

multiplies by 2 to get $\frac{7}{12}$, then rounds.

Final Answer: Fraction completed in 2 days $= \dfrac{3}{4} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 7

Q8.

Solution

Concept – Averages: Batting average. The batting average after n innings is the total runs scored divided by n. When a new score is added, we update both the total and the count.

Step 1 – Find total runs after 10 innings:

$$\text{Total runs after 10 innings} = \text{Average} \times \text{Innings} = 50 \times 10 = 500.$$

Step 2 – Add the 11th innings score and compute new average:

$$\text{Total runs after 11 innings} = 500 + 6 = 506.$$

$$\text{New average} = \frac{506}{11} = 46.$$

Why other options are wrong:

- Option A (48): Would require total $= 48 \times 11 = 528$; that means the 11th score $= 528 - 500 = 28 \neq 6$.
- Option C (44): Would require total $= 44 \times 11 = 484$; 11th score $= -16$, impossible.
- Option D (42): Would require total $= 42 \times 11 = 462$; 11th score $= -38$, impossible.

Final Answer: New batting average $= 46 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 8

Q9.

Solution

Concept – Profit and Loss: Marked price with discount. Selling Price (SP) = Marked Price (MP) $\times(1-\text{discount\%})$. The profit percentage is calculated on the Cost Price (CP).

Step 1 – Let CP $=100$. Then MP $=100\times1.40=140$ (marked 40% above CP).

Step 2 – Apply 25% discount to get SP:

$$\text{SP}=140\times(1-0.25)=140\times0.75=105.$$

Step 3 – Calculate profit percentage:

$$\text{Profit\%}=\frac{\text{SP}-\text{CP}}{\text{CP}}\times100=\frac{105-100}{100}\times100=5\%.$$

Why other options are wrong:

- Option A (10% profit): Requires SP $=110$; not achieved with the given mark-up and discount.
- Option B (15% loss): Requires SP $=85$; $140\times0.75=105\neq85$.
- Option D (5% loss): Requires SP $=95$; the calculation gives $105>100$, confirming a profit not loss.

Final Answer: Profit $=5\%\Rightarrow\boxed{\text{C}}$

Answer: (C) Go Back to Q 9

Q10.

Solution

Concept – Ratio: Division in a given ratio. When an amount is divided in ratio $a:b:c$, each person's share is their part divided by the total parts, multiplied by the whole amount.

Step 1 – Find total parts of the ratio:

$$3+5+4=12\text{ parts.}$$

Step 2 – Find A's share:

$$\text{A's share} = \frac{3}{12} \times 360 = \frac{1}{4} \times 360 = \text{Rs. } 90.$$

Why other options are wrong:

- Option B (Rs. 150): This is B's share: $\frac{5}{12} \times 360 = 150$; mistakenly assigns B's share to A.
- Option C (Rs. 120): This is C's share: $\frac{4}{12} \times 360 = 120$; mistakenly assigns C's share to A.
- Option D (Rs. 100): Divides 360 equally among 3 people without applying the ratio weights.

Final Answer: A's share $= \text{Rs. } 90 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 10

Q11.

Solution

Concept – Geometric Progression: Sum to infinity. For an infinite GP with first term a and common ratio $|r| < 1$, the sum to infinity is:

$$S_\infty = \frac{a}{1-r}.$$

Step 1 – Identify the values: $a = 4$, $r = \frac{1}{2}$. Since $|r| = \frac{1}{2} < 1$, the series converges.

Step 2 – Compute the sum:

$$S_\infty = \frac{4}{1 - \frac{1}{2}} = \frac{4}{\frac{1}{2}} = 4 \times 2 = 8.$$

Why other options are wrong:

- Option A (6): Computes $\frac{4}{1 - 1/3}$ with $r = 1/3$ instead of $1/2$.
- Option B (4): Simply uses the first term $a = 4$; ignores the infinite sum formula.
- Option C (10): Perhaps adds a few terms: $4 + 2 + 1 + 0.5 + \ldots$ and stops prematurely, or uses an incorrect formula.

Final Answer: $S_\infty = 8 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 11

Q12.

Solution

Concept – Quadratic Equations: Condition on roots. By Vieta's formulas, for $x^2 + bx + c = 0$ with roots α and β: $\alpha + \beta = -b$ and $\alpha \cdot \beta = c$.

Step 1 – Let the two roots be α and 3α (one is triple the other). Apply Vieta's formulas for $x^2 - 4x + k = 0$:

$$\alpha + 3\alpha = 4 \implies 4\alpha = 4 \implies \alpha = 1.$$

Step 2 – Find k from the product of roots:

$$\alpha \cdot 3\alpha = k \implies 3\alpha^2 = k \implies 3 \times 1^2 = 3.$$

Verification: $x^2 - 4x + 3 = 0 \implies (x-1)(x-3) = 0$; roots are 1 and 3. Indeed, $3 = 3 \times 1$. ✓

Why other options are wrong:

- Option A (2): $\alpha \cdot 3\alpha = 2 \implies \alpha^2 = 2/3$; then $4\alpha \neq 4$, inconsistency.
- Option C (4): $3\alpha^2 = 4$ and $4\alpha = 4 \implies \alpha = 1 \implies 3 \neq 4$; contradiction.
- Option D (6): $3\alpha^2 = 6 \implies \alpha = \sqrt{2}$; then $\alpha + 3\alpha = 4\sqrt{2} \neq 4$; inconsistency.

Final Answer: $k = 3 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 12

Q13.

Solution

Concept – Logarithms: Change of base and power rule. Key identity: $\log_b(b^n) = n$. Since $9 = 3^2$, $27 = 3^3$, $81 = 3^4$, each term simplifies directly.

Step 1 – Evaluate each logarithm separately:

$$\log_3 9 = \log_3 3^2 = 2, \quad \log_3 27 = \log_3 3^3 = 3, \quad \log_3 81 = \log_3 3^4 = 4.$$

Step 2 – Sum the values:

$$2 + 3 + 4 = 9.$$

Why other options are wrong:

- Option B (7): Omits $\log_3 81 = 4$ and adds only $2 + 3 = 5$, or incorrectly evaluates one term.
- Option C (12): Adds an extra power, perhaps treating $\log_3 81 = 5$ (incorrect: $3^5 = 243 \neq 81$).
- Option D (6): Perhaps computes $1 + 2 + 3 = 6$, using $\log_3$ of $3, 9, 27$ instead of $9, 27, 81$.

Final Answer: $\log_3 9 + \log_3 27 + \log_3 81 = 9 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 13

Q14.

Solution

Concept – Arithmetic Progressions: Sum formula evaluation. Given S_n explicitly, substitute $n = 10$ directly to find S_{10}.

Step 1 – Substitute $n = 10$ into $S_n = \dfrac{n(3n+1)}{2}$:

$$S_{10} = \frac{10(3 \times 10 + 1)}{2} = \frac{10 \times 31}{2} = \frac{310}{2} = 155.$$

Verification: Find the first term and common difference. $a_n = S_n - S_{n-1}$:

$$a_1 = S_1 = \frac{1 \times 4}{2} = 2, \quad a_2 = S_2 - S_1 = \frac{2 \times 7}{2} - 2 = 7 - 2 = 5.$$

So $d = a_2 - a_1 = 3$. Then $S_{10} = \frac{10}{2}(2 \times 2 + 9 \times 3) = 5 \times 31 = 155$. ✓

Why other options are wrong:

- Option A (135): Uses $S_{10} = \frac{10(3\times10-1)}{2} = \frac{10\times29}{2} = 145$; or a different formula variant giving 135.
- Option B (145): Uses $S_{10} = \frac{10\times29}{2} = 145$, a sign error: $3n-1$ instead of $3n+1$.
- Option D (165): Uses $S_{10} = \frac{10(3\times10+3)}{2} = \frac{10\times33}{2} = 165$, adding 3 instead of 1 in the bracket.

Final Answer: $S_{10} = 155 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 14

Q15.

Solution

Concept – Geometry: Interior angles of regular polygons. The sum of interior angles of an n-sided polygon is $(n-2) \times 180$. For a regular polygon, all interior angles are equal.

Step 1 – Find the sum of interior angles of a hexagon ($n = 6$):

$$\text{Sum} = (6-2) \times 180 = 4 \times 180 = 720.$$

Step 2 – Each interior angle (regular hexagon):

$$\text{Each angle} = \frac{720}{6} = 120.$$

Why other options are wrong:

- Option A (90°): Interior angle of a square (4-sided polygon); $\frac{(4-2)\times180}{4} = 90$.
- Option B (100°): Not the interior angle of any standard regular polygon with a small number of sides.
- Option C (108°): Interior angle of a regular pentagon ($n = 5$): $\frac{(5-2)\times180}{5} = 108$.

Final Answer: Each interior angle of a regular hexagon $= 120 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 15

Q16.

Solution

Concept – Geometry: Rhombus and its diagonals. The diagonals of a rhombus bisect each other at right angles. Each side of the rhombus is the hypotenuse of a right triangle formed by the two half-diagonals.

Step 1 – Find the half-diagonals:

$$\text{Half of 24 cm diagonal} = 12\,\text{cm}, \quad \text{Half of 10 cm diagonal} = 5\,\text{cm}.$$

Step 2 – Apply the Pythagorean theorem to find the side length:

$$s = \sqrt{12^2 + 5^2} = \sqrt{144 + 25} = \sqrt{169} = 13\,\text{cm}.$$

Step 3 – Find the perimeter:

$$\text{Perimeter} = 4s = 4 \times 13 = 52\,\text{cm}.$$

Why other options are wrong:

- Option B (48 cm): Side $= 12\,\text{cm}$; this ignores the perpendicular half-diagonal (5 cm) completely.
- Option C (56 cm): Side $= 14\,\text{cm}$; $\sqrt{144 + 25} = 13 \neq 14$.
- Option D (60 cm): Side $= 15\,\text{cm}$; perhaps confuses $\sqrt{12^2 + 9^2} = 15$ using a different diagonal split.

Final Answer: Perimeter $= 52\,\text{cm} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 16

Q17.

Solution

Concept – Mensuration: Area of a circular annulus (ring). The area of a ring with outer radius R and inner radius r is:

$$A = \pi(R^2 - r^2) = \pi(R + r)(R - r).$$

Step 1 – Substitute $R = 7\,\text{cm}$, $r = 3.5\,\text{cm}$, $\pi = 22/7$:

$$A = \frac{22}{7}(7^2 - 3.5^2) = \frac{22}{7}(49 - 12.25) = \frac{22}{7} \times 36.75.$$

Step 2 – Compute:

$$\frac{22}{7} \times 36.75 = 22 \times \frac{36.75}{7} = 22 \times 5.25 = 115.5\,\text{cm}^2.$$

Why other options are wrong:

- Option A ($154\,\text{cm}^2$): Area of full circle with $r = 7\,\text{cm}$: $\pi \times 7^2 = \frac{22}{7} \times 49 = 154$; ignores the inner hole.

- Option C ($77\,\text{cm}^2$): Half of 154; perhaps divides the outer area by 2 instead of subtracting inner area.
- Option D ($231\,\text{cm}^2$): Uses $\pi(R^2 + r^2)$ instead of $\pi(R^2 - r^2)$: $\frac{22}{7}(49 + 12.25) = \frac{22}{7} \times 61.25 = 192.5 \neq 231$.

Final Answer: Area of ring $= 115.5\,\text{cm}^2 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 17

Q18.

Solution

Concept – Coordinate Geometry: Equation of a straight line. The slope-intercept form is $y = mx+c$, where m is the slope and c is the y-intercept. The slope through two points (x_1, y_1) and (x_2, y_2) is $m = \dfrac{y_2 - y_1}{x_2 - x_1}$.

Step 1 – Find the slope using $(2, 5)$ and $(4, 9)$:

$$m = \frac{9-5}{4-2} = \frac{4}{2} = 2.$$

Step 2 – Write the equation using point-slope form with point $(2, 5)$:

$$y - 5 = 2(x-2) \implies y - 5 = 2x - 4 \implies y = 2x + 1.$$

Step 3 – Read the y-intercept: Setting $x = 0$, $y = 1$. So the y-intercept is **1**.

Why other options are wrong:

- Option A (-1): Arithmetic slip: $y - 5 = 2(x-2) \implies y = 2x + 1$, not $2x - 1$.
- Option B (2): Confuses the slope ($m = 2$) with the y-intercept.
- Option D (3): May use the equation $y - 5 = 2(x - 1)$ (incorrect point) giving $y = 2x + 3$.

Final Answer: y-intercept $= 1 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 18

Q19.

Solution

Concept – Mensuration: Curved surface area of a hemisphere. The curved surface area (CSA) of a hemisphere with radius r is:

$$\text{CSA} = 2\pi r^2.$$

The cost to whitewash is: Cost = Area × Rate per sq. m.

Step 1 – Compute the curved surface area with $r = 7\,\text{m}$, $\pi = 22/7$:

$$\text{CSA} = 2 \times \frac{22}{7} \times 7^2 = 2 \times \frac{22}{7} \times 49 = 2 \times 22 \times 7 = 308\,\text{m}^2.$$

Step 2 – Calculate the cost at Rs. 5 per sq. m:

$$\text{Cost} = 308 \times 5 = \text{Rs. } 1{,}540.$$

Why other options are wrong:

- Option A (Rs. 770): Uses CSA $= \pi r^2 = 154\,\text{m}^2$ (area of circle base, not hemisphere CSA); $154 \times 5 = 770$.
- Option B (Rs. 1,078): Uses total surface area $= 3\pi r^2 = 3 \times 154 = 462$ but applies a wrong rate, or uses different values.
- Option C (Rs. 1,100): Uses CSA $= 2\pi r^2$ but with $\pi \approx 3.14$ giving ≈ 307.7; cost ≈ 1538.5; rounding error.

Final Answer: Cost to whitewash = Rs. $1{,}540 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 19

Q20.

Solution

Concept – Permutations: Forming numbers with digit restrictions. For a 4-digit even number, the units digit must be even. We count by fixing the last digit first, then filling the remaining positions.

Step 1 – Choose the units digit (must be even from $\{1, 2, 3, 4, 5, 6\}$): Even digits are $\{2, 4, 6\}$, giving 3 choices.

Step 2 – Fill the remaining 3 positions from the leftover 5 digits (no repetition):

$$\text{Thousands} \times \text{Hundreds} \times \text{Tens} = 5 \times 4 \times 3 = 60 \text{ ways.}$$

Step 3 – Total 4-digit even numbers:

$$3 \times 60 = 180.$$

Why other options are wrong:

- Option A (120): Uses only 2 choices for the units digit: $2 \times 60 = 120$; under-counts the even digits.
- Option C (240): Perhaps counts 4 choices for even units digit (incorrect); or uses 3×80 with a wrong second factor.
- Option D (360): Uses $6 \times 5 \times 4 \times 3 = 360$ (all 4-digit numbers without repetition, not restricted to even).

Final Answer: 180 four-digit even numbers $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 20

Q21.

Solution

Concept – Probability: Drawing from a deck of cards. Classical probability: $P = \dfrac{\text{favourable outcomes}}{\text{total outcomes}}$. Face cards are Jack (J), Queen (Q), and King (K) in each of 4 suits.

Step 1 – Count total cards and face cards:

$$\text{Total cards} = 52, \quad \text{Face cards} = 3 \text{ per suit} \times 4 \text{ suits} = 12.$$

Step 2 – Calculate probability:

$$P(\text{face card}) = \frac{12}{52} = \frac{3}{13}.$$

Why other options are wrong:

- Option B ($\frac{1}{13}$): Counts only 4 face cards (one per suit, e.g., only Jacks); $\frac{4}{52} = \frac{1}{13}$.

- Option C ($\frac{4}{13}$): Counts 16 face cards, perhaps including Aces: $\frac{16}{52} = \frac{4}{13}$; but Aces are not face cards.
- Option D ($\frac{1}{4}$): Counts 13 face cards (one full suit); $\frac{13}{52} = \frac{1}{4}$; incorrect count.

Final Answer: $P(\text{face card}) = \dfrac{3}{13} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 21

Q22.

Solution

Concept – Probability: Complementary counting. $P(\text{at least one woman}) = 1 - P(\text{no woman})$. This avoids separately counting cases with exactly 1 and exactly 2 women.

Step 1 – Find total ways to select 2 from 7 (4 men + 3 women):

$$\binom{7}{2} = \frac{7 \times 6}{2} = 21.$$

Step 2 – Find ways to select 2 with no woman (i.e., both from 4 men):

$$\binom{4}{2} = \frac{4 \times 3}{2} = 6.$$

Step 3 – Apply complementary counting:

$$P(\text{at least 1 woman}) = 1 - \frac{6}{21} = 1 - \frac{2}{7} = \frac{5}{7}.$$

Why other options are wrong:

- Option A ($\frac{3}{7}$): This is $P(\text{no woman})$ + something; or equals $\binom{3}{1}\binom{4}{1}/21 = 12/21 \neq 3/7$.
- Option B ($\frac{4}{7}$): Possibly $1 - P = 3/7$ confused with $4/7$.
- Option D ($\frac{6}{7}$): Uses $P(\text{at least 1 woman}) = 1 - 1/7$; incorrect denominator or numerator in complement.

Final Answer: $P(\text{at least 1 woman}) = \dfrac{5}{7} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 22

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	2	C	3	B	4	D	5	C
6	A	7	D	8	B	9	C	10	A
11	D	12	B	13	A	14	C	15	D
16	A	17	B	18	C	19	D	20	B
21	A	22	C						

Quick Reference: Correct Answers

Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	7	D	13	A	19	D
2	C	8	B	14	C	20	B
3	B	9	C	15	D	21	A
4	D	10	A	16	A	22	C
5	C	11	D	17	B		
6	A	12	B	18	C		