CAT Quantitative Aptitude

Sample Paper – 8

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. Find the sum of all digits of $1^3 + 2^3 + 3^3 + \cdots + 9^3$.

(A) 9

(B) 11

(C) 12

(D) 7

Q2. Find the greatest number that divides 245, 1029, and 1274, leaving the same remainder in each case.

(A) 5

(B) 7

(C) 25

(D) 49

Q3. Evaluate: $\dfrac{1}{\sqrt{2}-1} + \dfrac{1}{\sqrt{2}+1}$

(A) 2

(B) $2\sqrt{2}$

(C) $\sqrt{2}$

(D) 4

Q4. A machine costs Rs. 50,000 and depreciates at 10% per annum on its book value. Find its book value after 2 years.

(A) Rs. 41,000

(B) Rs. 40,000

(C) Rs. 40,500

(D) Rs. 42,000

Q5. A shopkeeper marks goods 30% above cost price and gives a discount of 10%. Find the profit percentage.

(A) 17%

(B) 15%

(C) 20%

(D) 13%

Q6. A class of 30 students has an average score of 70, and another class of 20 students has an average score of 85. Find the combined average score of all 50 students.

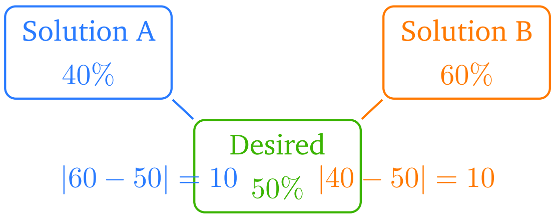
(A) 74

(B) 75

(C) 77

(D) 76

Q7. Solution A contains 40% acid and Solution B contains 60% acid. In what ratio should A and B be mixed to obtain a solution with 50% acid?



Ratio A : B $= 10 : 10 = 1 : 1$

(A) $2 : 1$

(B) $1 : 1$

(C) $1 : 2$

(D) $3 : 2$

Q8. Pipes A and B can fill a cistern in 4 and 6 hours respectively. Pipe C can drain the full cistern in 12 hours. If all three are opened simultaneously when the cistern is empty, how many hours will it take to fill the cistern?

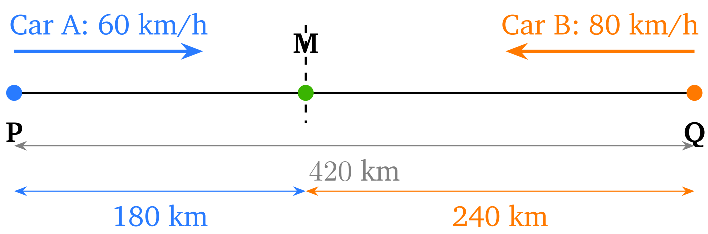
(A) 2 hours

(B) 4 hours

(C) 3 hours

(D) 6 hours

Q9. Two cities P and Q are 420 km apart. Car A starts from P towards Q at 60 km/h, and Car B starts from Q towards P at 80 km/h, both at the same time. How far from P (in km) do they meet?



(A) 180 km

(B) 200 km

(C) 210 km

(D) 240 km

Q10. A sum of Rs. 2,600 is divided among A, B, and C in the ratio $\frac{1}{2} : \frac{1}{3} : \frac{1}{4}$. Find B's share.

(A) Rs. 600

(B) Rs. 700

(C) Rs. 900

(D) Rs. 800

Q11. The sum of the first three terms of a geometric progression is 21 and their product is 216. Find the middle term.

(A) 4

(B) 6

(C) 8

(D) 9

Q12. Find the minimum value of $f(x) = x^2 - 8x + 20$.

(A) -4

(B) 0

(C) 4

(D) 8

Q13. Solve the system: $2x + 3y = 12$ and $x + y = 5$. Find xy.

(A) 6

(B) 5

(C) 8

(D) 4

Q14. Find the value of x if $\log_2 x + \log_2 4 = 5$.

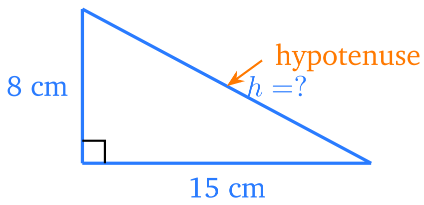
(A) 4

(B) 6

(C) 16

(D) 8

Q15. In a right-angled triangle, the two legs are 8 cm and 15 cm. Find the length of the hypotenuse.



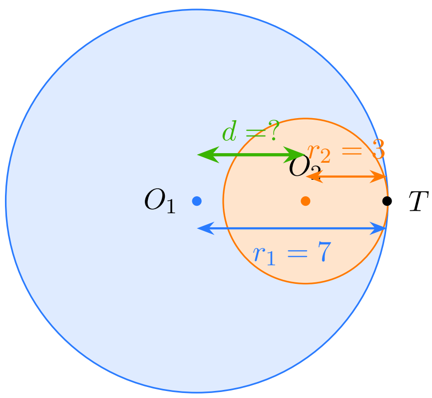
(A) 16 cm

(B) 17 cm

(C) 18 cm

(D) 20 cm

Q16. Two circles of radii 7 cm and 3 cm touch each other internally. Find the distance between their centres.



(A) 10 cm

(B) 7 cm

(C) 4 cm

(D) 3 cm

Q17. A point P moves such that its distances from $A(2, 0)$ and $B(-2, 0)$ are always equal. What is the locus of P?

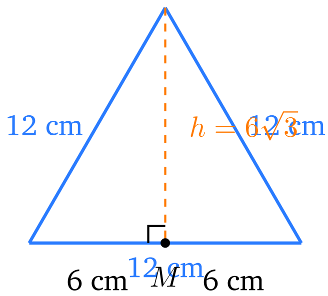
(A) The y-axis ($x = 0$)

(B) The x-axis ($y = 0$)

(C) The line $x = 2$

(D) The line $y = 2$

Q18. Find the area of an equilateral triangle with side 12 cm. (Leave the answer in surd form.)



(A) $16\sqrt{3}$ cm^2

(B) $24\sqrt{3}$ cm^2

(C) $48\sqrt{3}$ cm^2

(D) $36\sqrt{3}$ cm^2

Q19. A rectangular box (cuboid) has dimensions 10 cm $\times$ 8 cm $\times$ 6 cm. Find its total surface area.

(A) 340 cm^2

(B) 376 cm^2

(C) 400 cm^2

(D) 288 cm^2

Q20. In how many ways can 6 distinct people be seated around a circular dining table?

(A) 6

(B) 60

(C) 120

(D) 720

Q21. A bag contains 5 red, 4 blue, and 3 green balls. One ball is drawn at random. What is the probability of drawing a red or green ball?

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

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

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

(D) $\frac{5}{12}$

Q22. For two sets A and B, $n(A) = 20$, $n(B) = 25$, and $n(A \cap B) = 10$. Find $n(A \cup B)$.

(A) 30

(B) 40

(C) 45

(D) 35

Detailed Solutions

Q1.

Solution

Concept — Sum of cubes formula: The sum of the cubes of the first n natural numbers is given by the identity:

$$1^3 + 2^3 + 3^3 + \cdots + n^3 = \left[\frac{n(n+1)}{2}\right]^2.$$

This is a standard result that should be memorised for CAT.

Step 1 — Compute the sum of cubes for $n = 9$:

$$1^3 + 2^3 + \cdots + 9^3 = \left[\frac{9 \times 10}{2}\right]^2 = [45]^2 = 2025.$$

Step 2 — Find the digit sum of 2025:

$$2 + 0 + 2 + 5 = 9.$$

Why other options are wrong:

- Option B (11): Incorrectly computes the sum as 2045 or similar; digit sum error.
- Option C (12): Misapplies the formula, perhaps using $n = 10$: $[55]^2 = 3025$; digit sum $= 10$, still not 12.
- Option D (7): Uses an incorrect formula or miscalculates 45^2 as 2005; $2 + 0 + 0 + 5 = 7$.

Final Answer: Digit sum of $2025 = 9 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 1

Q2.

Solution

Concept — GCD of differences for equal remainder: If a number d divides a, b, c leaving the same remainder, then d divides the pairwise differences $b-a$, $c-b$, and $c-a$. Hence $d = \gcd(b-a,\ c-b)$.

Step 1 — Compute the pairwise differences:

$$1029 - 245 = 784, \qquad 1274 - 1029 = 245.$$

Step 2 — Find GCD(784, 245) using the Euclidean algorithm:

$$784 = 3 \times 245 + 49, \quad 245 = 5 \times 49 + 0.$$

So $\gcd(784, 245) = 49$.

Step 3 — Verify: $245 = 4 \times 49 + 49$; remainder when $245 \div 49$: $245 = 5 \times 49 = 245$, remainder $= 0$. $1029 = 21 \times 49 = 1029$, remainder $= 0$. $1274 = 26 \times 49 = 1274$, remainder $= 0$. All leave remainder 0. ✓

Why other options are wrong:

- Option A (5): Divides into 245 and 1029 but $784/5 = 156.8$, not an integer.
- Option B (7): $7 \mid 245$ and $7 \mid 1029$ but 7 is a factor of 49, not the greatest such number.
- Option C (25): $784/25 = 31.36$; not an exact divisor of 784.

Final Answer: Greatest such number $= 49 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 2

Q3.

Solution

Concept — Rationalising surds: Multiply the numerator and denominator of each fraction by the conjugate of its denominator to eliminate the square root from the denominator.

Step 1 — Rationalise each term:

$$\frac{1}{\sqrt{2}-1} \times \frac{\sqrt{2}+1}{\sqrt{2}+1} = \frac{\sqrt{2}+1}{(\sqrt{2})^2 - 1^2} = \frac{\sqrt{2}+1}{2-1} = \sqrt{2}+1.$$

$$\frac{1}{\sqrt{2}+1} \times \frac{\sqrt{2}-1}{\sqrt{2}-1} = \frac{\sqrt{2}-1}{2-1} = \sqrt{2}-1.$$

Step 2 — Add the two results:

$$(\sqrt{2}+1) + (\sqrt{2}-1) = 2\sqrt{2}.$$

Why other options are wrong:

- Option A (2): Forgets the $\sqrt{2}$ factor; adds only the integer parts $1 + (-1) + 1 + 1 = 2$.
- Option C ($\sqrt{2}$): Takes only one of the two rationalised fractions.
- Option D (4): Doubles the answer, perhaps from $2 \times 2 = 4$, confusing $2\sqrt{2}$ with a rational.

Final Answer: $\frac{1}{\sqrt{2}-1} + \frac{1}{\sqrt{2}+1} = 2\sqrt{2} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 3

Q4.

Solution

Concept — Reducing-balance depreciation: Under the reducing-balance method, depreciation is applied each year to the *current* book value (not the original cost). After n years the book value is:

$$\text{Book Value} = \text{Cost} \times \left(1 - \frac{r}{100}\right)^n.$$

Step 1 — After Year 1:

$$50{,}000 \times \left(1 - \frac{10}{100}\right) = 50{,}000 \times 0.9 = 45{,}000.$$

Step 2 — After Year 2:

$$45{,}000 \times 0.9 = 40{,}500.$$

Why other options are wrong:

- Option A (Rs. 41,000): Uses straight-line depreciation: $50000 - 2 \times 4500 = 41000$, but that applies 10% of the original cost each year.
- Option B (Rs. 40,000): Deducts Rs. 5000 per year (flat), not a percentage of

book value.

- Option D (Rs. 42,000): Applies only one year of 10% twice but on the wrong base: $50000 - 8000 = 42000$.

Final Answer: Book value after 2 years = Rs. 40,500 $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 4

Q5.

Solution

Concept — Successive percentage changes (mark-up then discount): Let the cost price be 100 (for ease). Mark-up gives the marked price; the discount is applied to the marked price to get the selling price.

Step 1 — Find the marked price:

$$\text{MP} = 100 + 30\% \text{ of } 100 = 130.$$

Step 2 — Apply the discount to get selling price:

$$\text{SP} = 130 \times \left(1 - \frac{10}{100}\right) = 130 \times 0.9 = 117.$$

Step 3 — Compute profit percentage:

$$\text{Profit\%} = \frac{117 - 100}{100} \times 100 = 17\%.$$

Why other options are wrong:

- Option B (15%): Uses $30 - 10 - 3 = 17$ but rounds down incorrectly to 15.
- Option C (20%): Simply takes the mark-up percentage without accounting for the discount.
- Option D (13%): Uses $30\% - 10\% - \frac{30 \times 10}{100} = 30 - 10 - 3 = 17$, then makes an arithmetic error giving 13.

Final Answer: Profit $= 17\% \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 5

Q6.

Solution

Concept — Weighted average: When combining two groups of sizes n_1 and n_2 with averages $\bar{x}_1$ and $\bar{x}_2$, the combined average is:

$$\bar{x} = \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2}.$$

Step 1 — Substitute the values:

$$\bar{x} = \frac{30 \times 70 + 20 \times 85}{30 + 20} = \frac{2100 + 1700}{50} = \frac{3800}{50} = 76.$$

Why other options are wrong:

- Option A (74): Incorrectly computes the sum as $30 \times 70 + 20 \times 80 = 2100 + 1600 = 3700$; $3700/50 = 74$.
- Option B (75): Uses the simple (unweighted) average of 70 and 85: $(70 + 85)/2 = 77.5$; rounding down to 75 is a common error.
- Option C (77): Uses unweighted average $(70 + 85)/2 = 77.5$, rounded to 77.

Final Answer: Combined average $= 76 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 6

Q7.

Solution

Concept — Rule of Alligation: The alligation method finds the ratio in which two ingredients at different concentrations must be mixed to give a desired mean concentration. The ratio is:

$$\frac{\text{Amount of cheaper}}{\text{Amount of dearer}} = \frac{\text{Dearer} - \text{Mean}}{\text{Mean} - \text{Cheaper}}.$$

Step 1 — Identify values: Solution A (cheaper) $= 40\%$, Solution B (dearer) $= 60\%$, Desired $= 50\%$.

Step 2 — Apply alligation:

$$\frac{\text{A}}{\text{B}} = \frac{60 - 50}{50 - 40} = \frac{10}{10} = 1 : 1.$$

Why other options are wrong:

- Option A (2:1): Inverts one of the differences; uses $(50-40):(60-50)=10:10$ but then doubles A's part incorrectly.
- Option C (1:2): Swaps the positions of A and B in the alligation diagram.
- Option D (3:2): Arises from an arithmetic error in computing the differences.

Final Answer: Ratio $\mathrm{A}:\mathrm{B}=1:1 \Rightarrow \boxed{\mathrm{B}}$

Answer: (B) Go Back to Q 7

Q8.

Solution

Concept — Pipes and Cisterns (net work rate): Assign filling pipes positive work rates and draining pipes negative rates. The fraction of the cistern filled per hour by each pipe is the reciprocal of its fill/drain time.

Step 1 — Assign individual rates (fraction of cistern per hour):

$$\mathrm{A}=\frac{1}{4}, \quad \mathrm{B}=\frac{1}{6}, \quad \mathrm{C}\text{ (drain)}=-\frac{1}{12}.$$

Step 2 — Compute net rate using LCM of 4, 6, 12 (LCM $=12$):

$$\text{Net rate}=\frac{3}{12}+\frac{2}{12}-\frac{1}{12}=\frac{4}{12}=\frac{1}{3}.$$

Step 3 — Time to fill the cistern:

$$\text{Time}=\frac{1}{\frac{1}{3}}=3\text{ hours.}$$

Why other options are wrong:

- Option A (2 hours): Ignores pipe C; net rate $=\frac{1}{4}+\frac{1}{6}=\frac{5}{12}$; time $=2.4$ h, rounded down to 2.
- Option B (4 hours): Uses only pipe A's rate; ignores B and C.
- Option D (6 hours): Uses only pipe B's rate.

Final Answer: Time to fill $=3$ hours $\Rightarrow \boxed{\mathrm{C}}$

Answer: (C) Go Back to Q 8

Q9.

Solution

Concept — Two objects moving towards each other (relative speed): When two objects move towards each other, their relative speed is the sum of their individual speeds. The time to meet is total distance divided by relative speed.

Step 1 — Find time to meet:

$$\text{Relative speed} = 60 + 80 = 140 \text{ km/h}. \qquad t = \frac{420}{140} = 3 \text{ hours}.$$

Step 2 — Distance covered by Car A from P:

$$d_A = 60 \times 3 = 180 \text{ km}.$$

Step 3 — Verify: Distance covered by Car B from Q $= 80 \times 3 = 240$ km. Total $= 180 + 240 = 420$ km ✓.

Why other options are wrong:

- Option B (200 km): Uses relative speed $= 60 + 50 = 110$; $t = 420/110 \approx 3.82$ h; $60 \times 3.82 \approx 229$; or assumes equal speeds midpoint incorrectly.
- Option C (210 km): Takes the simple midpoint $420/2 = 210$, valid only when both speeds are equal.
- Option D (240 km): Gives the distance covered by Car B, not Car A.

Final Answer: Distance from P $= 180$ km $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 9

Q10.

Solution

Concept — Division in fractional ratio: First convert the fractional ratio to whole numbers by multiplying each part by the LCM of the denominators, then find each person's share using the proportion formula.

Step 1 — Convert $\frac{1}{2} : \frac{1}{3} : \frac{1}{4}$ to integers: LCM of 2, 3, 4 $= 12$.

$$\frac{1}{2} \times 12 : \frac{1}{3} \times 12 : \frac{1}{4} \times 12 = 6 : 4 : 3.$$

Step 2 — Find B's share: Total parts $= 6 + 4 + 3 = 13$. B has 4 parts.

$$\text{B's share} = \frac{4}{13} \times 2600 = \frac{10400}{13} = 800.$$

Why other options are wrong:

- Option A (Rs. 600): This is C's share: $\frac{3}{13} \times 2600 = 600$.
- Option B (Rs. 700): Arithmetic error; uses $\frac{4}{13} \times 2275 = 700$.
- Option C (Rs. 900): This is A's share: $\frac{6}{13} \times 2600 \approx 1200$; or miscalculates total parts as $6 + 4 + 3 = 12$.

Final Answer: B's share $=$ Rs. 800 $\Rightarrow \boxed{\text{D}}$

Answer: (D) **Go Back to Q 10**

Q11.

Solution

Concept — Three terms of a GP: When three terms of a GP are taken symmetrically as $\frac{a}{r}$, a, ar, their product simplifies nicely: $\frac{a}{r} \times a \times ar = a^3$. This makes the product condition easy to solve.

Step 1 — Use the product condition: Let the three terms be $\frac{a}{r}$, a, ar.

$$\frac{a}{r} \cdot a \cdot ar = a^3 = 216 \implies a = \sqrt[3]{216} = 6.$$

Step 2 — The middle term is a: The middle term of the GP is simply $a = 6$.

Step 3 — Verify using the sum: $a^3 = 216$ and the sum $\frac{a}{r} + a + ar = 21$ must be satisfied. With $a = 6$: $\frac{6}{r} + 6 + 6r = 21 \Rightarrow \frac{6}{r} + 6r = 15 \Rightarrow 6r^2 - 15r + 6 = 0 \Rightarrow 2r^2 - 5r + 2 = 0 \Rightarrow r = 2$ or $r = \frac{1}{2}$. Both valid (one is the reciprocal of the other). ✓

Why other options are wrong:

- Option A (4): Would give product $= 4^3 = 64 \neq 216$.
- Option C (8): Would give product $= 8^3 = 512 \neq 216$.
- Option D (9): Would give product $= 9^3 = 729 \neq 216$.

Final Answer: Middle term $= 6 \Rightarrow \boxed{\text{B}}$

Answer: (B) **Go Back to Q 11**

Q12.

Solution

Concept — Minimum of a quadratic (completing the square): For a quadratic $f(x) = x^2 - bx + c$ with positive leading coefficient, the minimum occurs at $x = \frac{b}{2}$ and equals $f\left(\frac{b}{2}\right)$. Equivalently, rewrite as $(x-h)^2 + k$; the minimum value is k.

Step 1 — Complete the square:

$$f(x) = x^2 - 8x + 20 = (x^2 - 8x + 16) + 4 = (x-4)^2 + 4.$$

Step 2 — Read off the minimum: Since $(x-4)^2 \geq 0$ for all real x, the minimum value is 4, attained at $x = 4$.

Why other options are wrong:

- Option A (-4): Uses the vertex x-coordinate (which is $+4$) as the minimum value with a sign error.
- Option B (0): Assumes the minimum is always 0, valid only when the quadratic has a real root at the vertex.
- Option D (8): Evaluates $f(0) = 0 - 0 + 20 = 20$, or takes the constant term minus twice the shift: $20 - 8 - 4 = 8$.

Final Answer: Minimum value of $f(x) = 4 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 12

Q13.

Solution

Concept — Solving a 2×2 linear system by substitution: Express one variable in terms of the other from the simpler equation, then substitute into the other equation.

Step 1 — From equation (2): $x + y = 5 \Rightarrow x = 5 - y$.

Step 2 — Substitute into equation (1):

$$2(5-y) + 3y = 12 \implies 10 - 2y + 3y = 12 \implies y = 2.$$

Step 3 — Find x and xy:

$$x = 5 - 2 = 3. \qquad xy = 3 \times 2 = 6.$$

Why other options are wrong:

- Option B (5): This is the value of $x + y$, not xy.
- Option C (8): Arises from a sign error: $10 + 2y + 3y = 12 \Rightarrow y = 2/5$; or from using $x = 4, y = 2$.
- Option D (4): From $x = 2, y = 2$ (ignoring the first equation); $xy = 4$.

Final Answer: $xy = 6 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 13

Q14.

Solution

Concept — Logarithm laws: The sum of logarithms with the same base equals the logarithm of the product:

$$\log_b m + \log_b n = \log_b(mn).$$

Step 1 — Combine the logarithms:

$$\log_2 x + \log_2 4 = \log_2(4x) = 5.$$

Step 2 — Exponentiate both sides (base 2):

$$4x = 2^5 = 32 \implies x = \frac{32}{4} = 8.$$

Why other options are wrong:

- Option A (4): Sets $\log_2 x = 5$ ignoring the $\log_2 4$ term; $x = 2^5 = 32$, then divides by 8 instead of 4.
- Option B (6): Arithmetic error in dividing 32 by 4 or in computing 2^5.
- Option C (16): Computes $x = 2^4 = 16$ by subtracting 1 from the exponent for each $\log$ term (incorrect).

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

Answer: (D) Go Back to Q 14

Q15.

Solution

Concept — Pythagoras' theorem: In a right-angled triangle with legs a and b and hypotenuse h:

$$h = \sqrt{a^2 + b^2}.$$

The triple $(8, 15, 17)$ is a well-known Pythagorean triple.

Step 1 — Substitute $a = 8$ cm and $b = 15$ cm:

$$h = \sqrt{8^2 + 15^2} = \sqrt{64 + 225} = \sqrt{289} = 17 \text{ cm}.$$

Step 2 — Confirm $(8, 15, 17)$ is a Pythagorean triple: $8^2 + 15^2 = 64 + 225 = 289 = 17^2$. ✓

Why other options are wrong:

- Option A (16 cm): $8^2 + 15^2 = 289 \neq 256 = 16^2$.
- Option C (18 cm): $18^2 = 324 \neq 289$.
- Option D (20 cm): $20^2 = 400 \neq 289$; this corresponds to the triple $(12, 16, 20)$.

Final Answer: Hypotenuse $= 17$ cm $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 15

Q16.

Solution

Concept — Internal tangency of two circles: When two circles touch internally, the distance between their centres equals the *difference* of their radii:

$$d = r_1 - r_2 \quad (r_1 > r_2).$$

(For external tangency, $d = r_1 + r_2$.)

Step 1 — Substitute $r_1 = 7$ cm and $r_2 = 3$ cm:

$$d = 7 - 3 = 4 \text{ cm}.$$

Why other options are wrong:

- Option A (10 cm): Uses the external tangency formula $d = r_1 + r_2 = 7 + 3 = 10$.
- Option B (7 cm): Takes $d = r_1$ (the larger radius); incorrect.
- Option D (3 cm): Takes $d = r_2$ (the smaller radius); incorrect.

Final Answer: Distance between centres $= 4$ cm $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 16

Q17.

Solution

Concept — Locus of a point equidistant from two fixed points: The set of all points equidistant from two fixed points A and B is the perpendicular bisector of the segment AB. It passes through the midpoint of AB and is perpendicular to AB.

Step 1 — Find the midpoint of $A(2, 0)$ and $B(-2, 0)$:

$$\text{Midpoint} = \left(\frac{2 + (-2)}{2}, \frac{0 + 0}{2}\right) = (0, 0).$$

Step 2 — Find the perpendicular bisector: Segment AB lies along the x-axis (since both points have $y = 0$). The perpendicular bisector of a horizontal segment through the origin is the vertical line $x = 0$, which is the y-axis.

Step 3 — Verify with algebra: Let $P = (x, y)$. $PA = PB$ gives:

$$\sqrt{(x-2)^2 + y^2} = \sqrt{(x+2)^2 + y^2} \implies (x-2)^2 = (x+2)^2 \implies -4x \cdot 2 = 4x \cdot 2 \implies x = 0.$$

Why other options are wrong:

- Option B (x-axis, $y = 0$): A and B both lie on the x-axis, so the x-axis is not the perpendicular bisector.
- Option C ($x = 2$): This is the vertical line through A, not through the midpoint.
- Option D ($y = 2$): A horizontal line that does not pass through the midpoint $(0, 0)$.

Final Answer: Locus $=$ the y-axis $(x = 0) \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 17

Q18.

Solution

Concept — Area of an equilateral triangle: For an equilateral triangle with side s:

$$\text{Area} = \frac{\sqrt{3}}{4}s^2.$$

This follows from drawing the altitude, which bisects the base and creates two 30-60-90 triangles. The altitude has length $h = \frac{\sqrt{3}}{2}s$.

Step 1 — Substitute $s = 12$ cm:

$$\text{Area} = \frac{\sqrt{3}}{4} \times 12^2 = \frac{\sqrt{3}}{4} \times 144 = 36\sqrt{3}\ \text{cm}^2.$$

Step 2 — Cross-check using altitude: $h = \frac{\sqrt{3}}{2} \times 12 = 6\sqrt{3}$ cm. Area $= \frac{1}{2} \times 12 \times 6\sqrt{3} = 36\sqrt{3}$ cm^2. ✓

Why other options are wrong:

- Option A ($16\sqrt{3}$): Uses $s = 8$ in the formula: $\frac{\sqrt{3}}{4} \times 64 = 16\sqrt{3}$.
- Option B ($24\sqrt{3}$): Uses half-base $\times$ height with base $= 8$: $\frac{1}{2} \times 8 \times 6\sqrt{3} = 24\sqrt{3}$.
- Option C ($48\sqrt{3}$): Forgets the $\frac{1}{4}$ in the formula; uses $\sqrt{3} \times s^2/3 = \sqrt{3} \times 48 = 48\sqrt{3}$.

Final Answer: Area $= 36\sqrt{3}$ cm$^2 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 18

Q19.

Solution

Concept — Total Surface Area (TSA) of a cuboid: A cuboid has 3 pairs of rectangular faces. If the dimensions are length l, breadth b, and height h:

$$\text{TSA} = 2(lb + bh + lh).$$

Step 1 — Identify dimensions: $l = 10$ cm, $b = 8$ cm, $h = 6$ cm.

Step 2 — Compute each pair of face areas:

$$lb = 10 \times 8 = 80, \quad bh = 8 \times 6 = 48, \quad lh = 10 \times 6 = 60.$$

Step 3 — Calculate TSA:

$$\text{TSA} = 2(80 + 48 + 60) = 2 \times 188 = 376 \text{ cm}^2.$$

Why other options are wrong:

- Option A (340 cm^2): Uses $2(80+48+42) = 2\times 170 = 340$; takes $lh = 7\times 6 = 42$ (error in length).
- Option C (400 cm^2): Overcounts one face pair or uses $l = 10, b = 10, h = 6$: $2(100 + 60 + 60) = 400$.
- Option D (288 cm^2): Computes only the lateral surface area $= 2(l + b)h = 2 \times 18 \times 6 = 216$, or uses wrong dimensions.

Final Answer: TSA $= 376$ cm$^2 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 19

Q20.

Solution

Concept — Circular permutations: When n distinct objects are arranged in a circle, one position is fixed to account for rotational equivalence. The number of distinct arrangements is:

$$(n - 1)!$$

Step 1 — Apply the formula for $n = 6$:

$$(6 - 1)! = 5! = 5 \times 4 \times 3 \times 2 \times 1 = 120.$$

Why other options are wrong:

- Option A (6): This equals $3!$; confuses circular arrangements of 6 with linear arrangements of 3.
- Option B (60): Halves the answer, perhaps accounting for reflections (clockwise vs. anti-clockwise) when the problem does not ask for that.
- Option D (720): This is $6! = 720$, the number of *linear* arrangements; forgets to fix one position for circular arrangements.

Final Answer: Number of arrangements $= 120 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 20

Q21.

Solution

Concept — Classical probability (mutually exclusive events): When events are mutually exclusive, $P(A \cup B) = P(A) + P(B)$. Here, drawing a red ball and drawing a green ball are mutually exclusive.

Step 1 — Count the balls: Red $= 5$, Blue $= 4$, Green $= 3$. Total $= 12$.

Step 2 — Compute the probability:

$$P(\text{red or green}) = \frac{5+3}{12} = \frac{8}{12} = \frac{2}{3}.$$

Why other options are wrong:

- Option B ($\frac{1}{2}$): Counts only 6 favourable outcomes (e.g., only red or only half the green); $6/12 = 1/2$.
- Option C ($\frac{3}{4}$): Computes $(5+4)/12 = 9/12 = 3/4$ (red and blue, not green).
- Option D ($\frac{5}{12}$): Counts only the red balls; ignores the green balls.

Final Answer: $P = \dfrac{2}{3} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 21

Q22.

Solution

Concept — Inclusion-Exclusion principle for sets: For any two sets A and B:

$$n(A \cup B) = n(A) + n(B) - n(A \cap B).$$

Subtracting $n(A \cap B)$ removes the elements counted twice (once in $n(A)$ and once in $n(B)$).

Step 1 — Substitute the given values:

$$n(A \cup B) = 20 + 25 - 10 = 35.$$

Why other options are wrong:

- Option A (30): Uses $n(A) + n(A \cap B) = 20 + 10 = 30$; incorrect formula.
- Option B (40): Adds only $n(A)$ and $n(B)$ but subtracts nothing, then adjusts: $20 + 25 - 5 = 40$; wrong subtraction.

- Option C (45): Adds all three values: $20 + 25 + 10 - 10 = 45$; double-counts the intersection.

Final Answer: $n(A \cup B) = 35 \Rightarrow \boxed{\text{D}}$

Answer: (D) **Go Back to Q 22**

Answer Key

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

Quick Reference: Correct Answers

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

Practice more CAT Sample Papers at ***collegedunia.com/exams/cat/sample-paper***