CAT Quantitative Aptitude

Sample Paper – 13

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. What is the largest 4-digit number divisible by both 12 and 18?

(A) 9936

(B) 9960

(C) 9948

(D) 9972

Q2. Find the HCF of 252 and 168.

(A) 84

(B) 42

(C) 56

(D) 126

Q3. A principal of Rs. 4,000 amounts to Rs. 4,720 in 3 years under simple interest. Find the rate of interest per annum.

(A) 5%

(B) 6%

(C) 7%

(D) 8%

Q4. To pass an examination, a student must score 40% of the maximum marks. A student scores 185 marks and fails by 15 marks. What is the maximum marks of the examination?

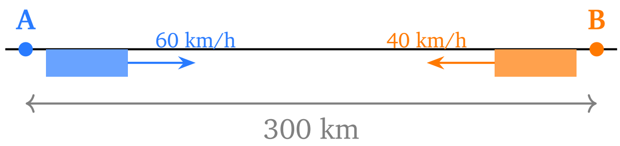
(A) 400

(B) 450

(C) 500

(D) 600

Q5. Two cars start simultaneously from cities A and B, which are 300 km apart, and travel towards each other. Car from A travels at 60 km/h and car from B travels at 40 km/h. After how many hours will they meet?



(A) 3 hours

(B) 2.5 hours

(C) 4 hours

(D) 3.5 hours

Q6. Rice costing Rs. 12 per kg and Rs. 18 per kg are mixed to obtain a mixture worth Rs. 14 per kg. Find the ratio in which the two varieties are mixed (cheaper to dearer).

(A) 1:2

(B) 3:2

(C) 1:1

(D) 2:1

Q7. A invests Rs. 5,000 for 6 months and B invests Rs. 6,000 for 5 months in a business. If the total annual profit is Rs. 2,200, find B's share of the profit.

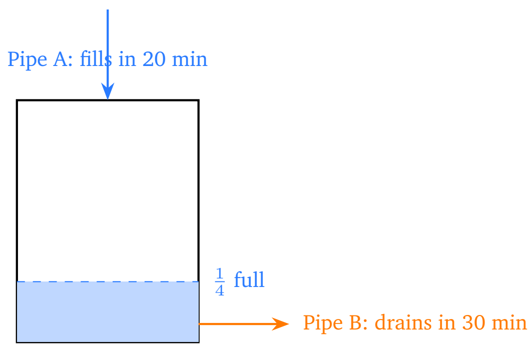
(A) Rs. 900

(B) Rs. 1,000

(C) Rs. 1,100

(D) Rs. 1,200

Q8. Pipe A can fill a tank in 20 minutes. Pipe B can drain a full tank in 30 minutes. The tank is currently one-quarter full. If both pipes are opened simultaneously, how many minutes will it take to fill the tank completely?



(A) 30 min

(B) 45 min

(C) 60 min

(D) 36 min

Q9. A shopkeeper uses a faulty weight of 900 g instead of 1 kg for every transaction. What is his percentage profit?

(A) $\frac{100}{9}\%$

(B) 10%

(C) 11%

(D) 9%

Q10. Find the average of all even numbers from 2 to 50.

(A) 24

(B) 25

(C) 27

(D) 26

Q11. Find the 20th term of the arithmetic progression $7, 11, 15, 19, \ldots$

(A) 79

(B) 83

(C) 87

(D) 75

Q12. If α and β are the roots of $x^2 - 5x + 6 = 0$, find $\alpha^2 + \beta^2$.

(A) 11

(B) 12

(C) 13

(D) 14

Q13. Evaluate: $\log_5 25 + \log_5 5 + \log_5 625$.

(A) 5

(B) 6

(C) 8

(D) 7

Q14. Find the sum to infinity of a geometric progression whose first term is 12 and common ratio is $\frac{2}{3}$.

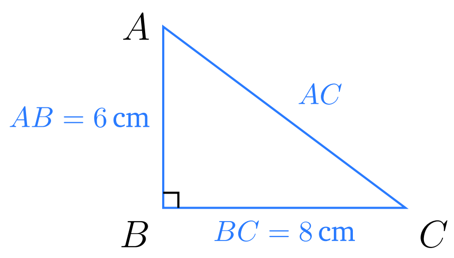
(A) 36

(B) 30

(C) 24

(D) 48

Q15. In right triangle ABC, the right angle is at B. If $AB = 6\,\text{cm}$ and $BC = 8\,\text{cm}$, find the area of the triangle.



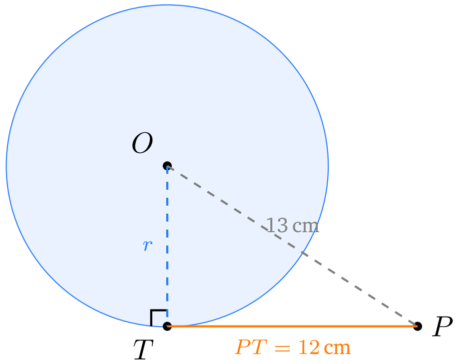
(A) $20\,\text{cm}^2$

(B) $21\,\text{cm}^2$

(C) $24\,\text{cm}^2$

(D) $28\,\text{cm}^2$

Q16. From an external point P, a tangent PT is drawn to a circle with centre O. If $PT = 12\,\text{cm}$ and $PO = 13\,\text{cm}$, find the radius of the circle.



(A) 4 cm

(B) 5 cm

(C) 6 cm

(D) 7 cm

Q17. The surface area of a sphere is $36\pi\ \text{cm}^2$. Find its volume.

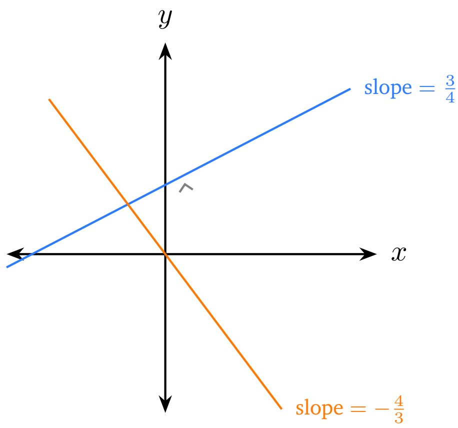
(A) $36\pi\ \text{cm}^3$

(B) $27\pi\ \text{cm}^3$

(C) $48\pi\ \text{cm}^3$

(D) $18\pi\ \text{cm}^3$

Q18. Find the slope of the line perpendicular to $3x - 4y + 8 = 0$.



(A) $\dfrac{3}{4}$

(B) $\dfrac{4}{3}$

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

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

Q19. A cylindrical vessel, open at the top, has a base radius of 7 cm and a height of 10 cm. Find its total surface area (use $\pi = 22/7$).

(A) 440 cm^2

(B) 528 cm^2

(C) 594 cm^2

(D) 616 cm^2

Q20. In how many ways can all the letters of the word **ARRANGE** be arranged?

(A) 2520

(B) 1260

(C) 5040

(D) 840

Q21. A bag contains 4 red balls and 3 green balls. Two balls are drawn at random without replacement. Find the probability that both balls are green.

(A) $\frac{2}{7}$

(B) $\frac{3}{14}$

(C) $\frac{1}{5}$

(D) $\frac{1}{7}$

Q22. In a class of 60 students, 25 like Mathematics, 30 like Science, and 10 like both subjects. How many students like neither subject?

(A) 15

(B) 12

(C) 10

(D) 20

Detailed Solutions

Q1.

Solution

Concept – Number Theory: To find the largest n-digit multiple of a number, compute the LCM of the given divisors, then find the largest multiple of that LCM not exceeding 9999.

Step 1 – Find LCM$(12, 18)$:

$$12 = 2^2 \times 3, \quad 18 = 2 \times 3^2 \implies \text{LCM}(12, 18) = 2^2 \times 3^2 = 36.$$

Step 2 – Find the largest 4-digit multiple of 36:

$$\left\lfloor \frac{9999}{36} \right\rfloor = \lfloor 277.75 \rfloor = 277.$$

$$277 \times 36 = 9972.$$

Why other options are wrong:

- Option A (9936): $9936/36 = 276$; this is the second-largest 4-digit multiple of 36, not the largest.
- Option B (9960): $9960/36 = 276.67$; not divisible by 36.
- Option C (9948): $9948/36 = 276.33$; not divisible by 36.

Final Answer: Largest 4-digit number divisible by both 12 and 18 $= 9972 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 1

Q2.

Solution

Concept – Number Theory: Euclid's Division Algorithm states that HCF$(a, b) =$ HCF(b, r) where r is the remainder when a is divided by b. Repeat until the remainder is 0.

Step 1 – Apply Euclid's algorithm to 252 and 168:

$$252 = 168 \times 1 + 84.$$

Step 2 – Continue with 168 and 84:

$$168 = 84 \times 2 + 0.$$

Since the remainder is 0, $\text{HCF}(252, 168) = 84$.

Why other options are wrong:

- Option B (42): $42 \times 2 = 84$; 42 is a factor of 84 but not the HCF of 252 and 168 since both are divisible by 84.
- Option C (56): $252/56 = 4.5$; 56 does not divide 252 exactly, so it cannot be the HCF.
- Option D (126): $168/126 = 1.33$; 126 does not divide 168 exactly, so it cannot be the HCF.

Final Answer: $\text{HCF}(252, 168) = 84 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 2

Q3.

Solution

Concept – Simple Interest: $\text{SI} = \dfrac{P \times R \times T}{100}$, where P = principal, R = rate% per annum, T = time in years. Amount $A = P + \text{SI}$.

Step 1 – Find the Simple Interest earned:

$$\text{SI} = A - P = 4720 - 4000 = \text{Rs.}\,720.$$

Step 2 – Solve for R:

$$720 = \frac{4000 \times R \times 3}{100} = 120R \implies R = \frac{720}{120} = 6\%.$$

Why other options are wrong:

- Option A (5%): Would give $\text{SI} = 4000 \times 5 \times 3/100 = 600$; amount $= 4600 \neq 4720$.
- Option C (7%): Would give $\text{SI} = 4000 \times 7 \times 3/100 = 840$; amount $= 4840 \neq 4720$.
- Option D (8%): Would give $\text{SI} = 4000 \times 8 \times 3/100 = 960$; amount $= 4960 \neq 4720$.

Final Answer: Rate of interest $= 6\%$ per annum $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 3

Q4.

Solution

Concept – Percentages: If a student fails by x marks and scores y marks, the passing mark is $y + x$. The passing percentage then gives the maximum marks.

Step 1 – Find the passing marks:

$$\text{Passing marks} = 185 + 15 = 200.$$

Step 2 – Use the passing percentage to find maximum marks:

$$40\% \text{ of Max} = 200 \implies \text{Max} = \frac{200 \times 100}{40} = 500.$$

Why other options are wrong:

- Option A (400): 40% of $400 = 160 \neq 200$; would mean passing mark is only 160.
- Option B (450): 40% of $450 = 180 \neq 200$; student would fail by $180 - 185 = -5$ (actually pass), contradiction.
- Option D (600): 40% of $600 = 240 \neq 200$; student would fail by $240 - 185 = 55$ marks, not 15.

Final Answer: Maximum marks $= 500 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 4

Q5.

Solution

Concept – Time, Speed, Distance: When two objects move towards each other, their relative speed is the sum of their individual speeds. Time to meet $= \frac{\text{Total Distance}}{\text{Relative Speed}}$.

Step 1 – Find the relative speed:

$$\text{Relative Speed} = 60 + 40 = 100 \text{ km/h}.$$

Step 2 – Find the time to meet:

$$\text{Time} = \frac{\text{Distance}}{\text{Relative Speed}} = \frac{300}{100} = 3 \text{ hours}.$$

Why other options are wrong:

- Option B (2.5 hours): Uses relative speed $= 300/2.5 = 120$ km/h, which does not equal $60 + 40 = 100$.
- Option C (4 hours): Uses relative speed $= 300/4 = 75$ km/h; incorrect sum of speeds.
- Option D (3.5 hours): Uses relative speed ≈ 85.7 km/h; not the sum of the two speeds.

Final Answer: The cars meet after 3 hours $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 5

Q6.

Solution

Concept – Mixtures and Alligation: The alligation rule states that the ratio in which two ingredients at prices C_1 and C_2 must be mixed to get a mean price M is:

$$\text{Cheaper} : \text{Dearer} = (C_2 - M) : (M - C_1).$$

Step 1 – Identify prices: $C_1 = 12$, $C_2 = 18$, $M = 14$.

Step 2 – Apply alligation:

$$\text{Cheaper} : \text{Dearer} = (18 - 14) : (14 - 12) = 4 : 2 = 2 : 1.$$

Why other options are wrong:

- Option A (1:2): This is the ratio dearer:cheaper (inverted); the cheaper variety is twice the dearer, not half.
- Option B (3:2): Incorrectly takes $(18 - 12) : (18 - 14) = 6 : 4 = 3 : 2$; wrong alligation formula.
- Option C (1:1): Would give mean price $= (12 + 18)/2 = 15 \neq 14$.

Final Answer: Ratio (cheaper to dearer) $= 2 : 1 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 6

Q7.

Solution

Concept – Partnership with unequal time: Each partner's effective capital is Investment $\times$ Time (in months). Profits are shared in the ratio of effective capitals.

Step 1 – Compute effective capital-months:

$$A\text{'s capital-months} = 5000 \times 6 = 30{,}000.$$

$$B\text{'s capital-months} = 6000 \times 5 = 30{,}000.$$

Step 2 – Find the profit-sharing ratio and B's share:

$$A : B = 30{,}000 : 30{,}000 = 1 : 1.$$

$$B\text{'s share} = \frac{1}{2} \times 2200 = \text{Rs. } 1{,}100.$$

Why other options are wrong:

- Option A (Rs. 900): Uses ratio $5 : 6$ based only on investment amounts, ignoring time: $B = \frac{6}{11} \times 2200 = 1200$; or computes with wrong ratio.
- Option B (Rs. 1,000): Assumes ratio $10 : 12$ (ignoring months correctly); or splits 2200 unequally without proper calculation.
- Option D (Rs. 1,200): Assigns more than half despite equal effective capitals, reversing A and B's shares.

Final Answer: B's share of profit = Rs. $1{,}100 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 7

Q8.

Solution

Concept – Pipes and Cisterns: Net rate = filling rate − draining rate. Time to fill remaining volume = Remaining fraction ÷ Net rate per minute.

Step 1 – Find the net filling rate when both pipes are open:

$$\text{Rate of A (fill)} = \frac{1}{20}\ \text{tank/min}, \quad \text{Rate of B (drain)} = \frac{1}{30}\ \text{tank/min}.$$

$$\text{Net rate} = \frac{1}{20} - \frac{1}{30} = \frac{3}{60} - \frac{2}{60} = \frac{1}{60}\ \text{tank/min}.$$

Step 2 – Find time to fill the remaining $\frac{3}{4}$ of the tank:

$$\text{Time} = \frac{3/4}{1/60} = \frac{3}{4} \times 60 = 45 \text{ minutes.}$$

Why other options are wrong:

- Option A (30 min): Ignores the initial $1/4$ fill; $30 \times \frac{1}{60} = \frac{1}{2}$ tank, which only fills from $1/4$ to $3/4$, not to full.
- Option C (60 min): Time to fill an empty tank; ignores that the tank is already $1/4$ full.
- Option D (36 min): $36 \times \frac{1}{60} = 0.6$ tank; would fill $1/4 + 0.6 = 0.85$ tank, not a full tank.

Final Answer: Time to fill the tank completely $= 45$ minutes $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 8

Q9.

Solution

Concept – Faulty Weights and Profit: When a shopkeeper uses a weight less than the standard, he gives less quantity than charged for. The profit is calculated on the actual quantity given.

$$\text{Profit } \% = \frac{\text{Error}}{\text{True weight} - \text{Error}} \times 100 = \frac{\text{True weight} - \text{False weight}}{\text{False weight}} \times 100.$$

Step 1 – Identify true weight and false weight:

$$\text{True weight} = 1000 \text{ g}, \quad \text{False weight} = 900 \text{ g}.$$

Step 2 – Calculate profit percentage:

$$\text{Profit } \% = \frac{1000 - 900}{900} \times 100 = \frac{100}{900} \times 100 = \frac{100}{9}\% \approx 11.11\%.$$

Why other options are wrong:

- Option B (10%): Uses $\frac{100}{1000} \times 100 = 10\%$; divides error by true weight instead of false weight.
- Option C (11%): Rounds $100/9 \approx 11.11\%$ down to 11%; the exact answer is

$\frac{100}{9}\%$.

- Option D (9%): Uses $\frac{900}{1000} - 1 = -10\%$ type logic; does not correctly compute the profit formula.

Final Answer: Profit percentage $= \dfrac{100}{9}\% \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 9

Q10.

Solution

Concept – Averages: The even numbers from 2 to 50 form an arithmetic progression with first term $a = 2$, last term $l = 50$, and common difference $d = 2$. Average of an AP $= \dfrac{a+l}{2}$.

Step 1 – Count the even numbers from 2 to 50:

$$n = \frac{50-2}{2} + 1 = \frac{48}{2} + 1 = 25.$$

Step 2 – Calculate the average:

$$\text{Average} = \frac{a+l}{2} = \frac{2+50}{2} = \frac{52}{2} = 26.$$

(Alternatively: Sum $= \frac{n}{2}(a+l) = \frac{25}{2} \times 52 = 650$; Average $= 650/25 = 26$.)

Why other options are wrong:

- Option A (24): Average of even numbers from 2 to 46 (not 50).
- Option B (25): Median of integers 1 to 49; not the average of even numbers from 2 to 50.
- Option C (27): Average of even numbers from 4 to 50; shifts the range incorrectly.

Final Answer: Average of all even numbers from 2 to 50 $= 26 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 10

Q11.

Solution

Concept – Arithmetic Progression (AP): The n-th term is given by $a_n = a+(n-1)d$, where a is the first term and d is the common difference.

Step 1 – Identify a and d from the sequence 7, 11, 15, 19, $\ldots$:

$$a = 7, \quad d = 11 - 7 = 4.$$

Step 2 – Find the 20th term:

$$a_{20} = 7 + (20 - 1) \times 4 = 7 + 19 \times 4 = 7 + 76 = 83.$$

Why other options are wrong:

- Option A (79): Computes $a_{19} = 7 + 18 \times 4 = 79$; uses $n = 19$ instead of $n = 20$.
- Option C (87): Computes $a_{21} = 7 + 20 \times 4 = 87$; uses $n = 21$ (off-by-one in the formula).
- Option D (75): Computes $a_{18} = 7 + 17 \times 4 = 75$; two positions short of the 20th term.

Final Answer: 20th term $= 83 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 11

Q12.

Solution

Concept – Quadratic Roots: By Vieta's formulas, if α and β are roots of $x^2-5x+6 = 0$, then $\alpha + \beta = 5$ and $\alpha\beta = 6$. Use the identity $\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$.

Step 1 – Extract sum and product of roots:

$$\alpha + \beta = 5, \quad \alpha\beta = 6.$$

Step 2 – Apply the identity:

$$\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta = 5^2 - 2 \times 6 = 25 - 12 = 13.$$

Why other options are wrong:

- Option A (11): Computes $(\alpha+\beta)^2 - 2\alpha\beta$ as $25 - 14 = 11$; incorrectly uses $2\alpha\beta = 14$ instead of 12.
- Option B (12): Gives only the value of $2\alpha\beta = 12$; forgets to apply the full identity.
- Option D (14): Computes $(\alpha+\beta)^2 - (\alpha\beta) = 25 - 6 - 5 = 14$; subtracts $\alpha\beta$ instead of $2\alpha\beta$.

Final Answer: $\alpha^2 + \beta^2 = 13 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 12

Q13.

Solution

Concept – Logarithms: $\log_b(b^k) = k$. Express each argument as a power of 5 and sum the exponents.

Step 1 – Express each argument as a power of 5:

$$25 = 5^2, \quad 5 = 5^1, \quad 625 = 5^4.$$

Step 2 – Evaluate each logarithm and sum:

$$\log_5 25 + \log_5 5 + \log_5 625 = \log_5 5^2 + \log_5 5^1 + \log_5 5^4 = 2 + 1 + 4 = 7.$$

Why other options are wrong:

- Option A (5): Omits $\log_5 625 = 4$; computes only $2 + 1 - (\text{error}) = 5$, or mistakes $625 = 5^3$.
- Option B (6): Incorrectly evaluates $\log_5 625 = 3$ (perhaps confusing $5^3 = 125$ with 625); gives $2 + 1 + 3 = 6$.
- Option C (8): Incorrectly evaluates $\log_5 625 = 5$ or $\log_5 25 = 3$; gives a sum of 8.

Final Answer: $\log_5 25 + \log_5 5 + \log_5 625 = 7 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 13

Q14.

Solution

Concept – Geometric Progression (GP): Sum to infinity of a GP with first term a and common ratio r (where $|r| < 1$) is:

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

Step 1 – Verify $|r| < 1$:

$$r = \frac{2}{3}, \quad |r| = \frac{2}{3} < 1. \quad \checkmark$$

Step 2 – Apply the formula:

$$S_\infty = \frac{12}{1-\frac{2}{3}} = \frac{12}{\frac{1}{3}} = 12 \times 3 = 36.$$

Why other options are wrong:

- Option B (30): Computes $\frac{12}{1-3/5} = \frac{12}{2/5} = 30$; uses wrong value of r.
- Option C (24): Computes $\frac{12}{1-1/2} = 24$; uses $r = 1/2$ instead of $2/3$.
- Option D (48): Computes $\frac{12}{1-3/4} = 48$; uses $r = 3/4$ instead of $2/3$.

Final Answer: Sum to infinity $= 36 \Rightarrow \boxed{\text{A}}$

Answer: (A) **Go Back to Q 14**

Q15.

Solution

Concept – Geometry: Area of a right triangle $= \frac{1}{2} \times$ base $\times$ height. In a right triangle, the two legs serve as the base and the height.

Step 1 – Identify the two legs (sides forming the right angle at B):

$$AB = 6 \text{ cm (height)}, \quad BC = 8 \text{ cm (base)}.$$

Step 2 – Calculate the area:

$$\text{Area} = \frac{1}{2} \times BC \times AB = \frac{1}{2} \times 8 \times 6 = 24 \text{ cm}^2.$$

Why other options are wrong:

- Option A (20 cm^2): Incorrect product; perhaps uses $\frac{1}{2} \times 8 \times 5 = 20$.
- Option B (21 cm^2): Incorrect; perhaps uses $\frac{1}{2} \times 6 \times 7 = 21$.
- Option D (28 cm^2): Computes $\frac{1}{2} \times 8 \times 7 = 28$; uses wrong dimension.

Final Answer: Area of triangle $ABC = 24\ \text{cm}^2 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 15

Q16.

Solution

Concept – Circles: A tangent from an external point is perpendicular to the radius at the point of tangency. This creates a right triangle: $OT \perp PT$, with OP as the hypotenuse.

Step 1 – Identify the right triangle OTP:

$$OP = 13 \text{ cm (hypotenuse)}, \quad PT = 12 \text{ cm (one leg)}, \quad OT = r \text{ (other leg)}.$$

Step 2 – Apply the Pythagorean theorem:

$$OT^2 + PT^2 = OP^2 \implies r^2 + 12^2 = 13^2 \implies r^2 = 169 - 144 = 25 \implies r = 5 \text{ cm}.$$

Why other options are wrong:

- Option A (4 cm): $4^2 + 12^2 = 16 + 144 = 160 \neq 169$.
- Option C (6 cm): $6^2 + 12^2 = 36 + 144 = 180 \neq 169$.
- Option D (7 cm): $7^2 + 12^2 = 49 + 144 = 193 \neq 169$.

Final Answer: Radius of the circle $= 5$ cm $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 16

Q17.

Solution

Concept – Mensuration: Surface area of a sphere $= 4\pi r^2$. Volume of a sphere $= \frac{4}{3}\pi r^3$. Find r from the surface area, then compute the volume.

Step 1 – Find the radius from the surface area:

$$4\pi r^2 = 36\pi \implies r^2 = \frac{36\pi}{4\pi} = 9 \implies r = 3 \text{ cm}.$$

Step 2 – Calculate the volume:

$$V = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi \times 27 = \frac{108\pi}{3} = 36\pi \text{ cm}^3.$$

Why other options are wrong:

- Option B (27π cm^3): Computes $r^3 = 27$ (correct) but forgets the $\frac{4}{3}$ factor: $\pi r^3 = 27\pi$.
- Option C (48π cm^3): Uses $r = 4$ (perhaps from $\frac{36}{9} = 4$); $V = \frac{4}{3}\pi(64) \neq 48\pi$.
- Option D (18π cm^3): Computes $\frac{1}{2} \times 36\pi$; divides surface area by 2 instead of using the volume formula.

Final Answer: Volume of sphere $= 36\pi$ cm$^3 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 17

Q18.

Solution

Concept – Coordinate Geometry: For a line $ax+by+c=0$, the slope is $m = -a/b$. Two lines are perpendicular if and only if the product of their slopes equals -1: $m_1 \times m_2 = -1$.

Step 1 – Find the slope of $3x - 4y + 8 = 0$:

$$-4y = -3x - 8 \implies y = \frac{3}{4}x + 2 \implies m_1 = \frac{3}{4}.$$

Step 2 – Find the slope of the perpendicular line:

$$m_1 \times m_2 = -1 \implies \frac{3}{4} \times m_2 = -1 \implies m_2 = -\frac{4}{3}.$$

Why other options are wrong:

- Option A ($\frac{3}{4}$): This is the slope of the given line itself, not the perpendicular.
- Option B ($\frac{4}{3}$): This is the reciprocal of the given slope without the negative sign; not perpendicular.
- Option C ($-\frac{3}{4}$): This is the negative of the given slope; represents a line parallel to one with slope $3/4$ reflected, not the perpendicular.

Final Answer: Slope of perpendicular line $= -\dfrac{4}{3} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 18

Q19.

Solution

Concept – Mensuration: For a cylinder open at the top, the total surface area consists of the curved (lateral) surface area and one circular base (no top lid):

$$\text{TSA (open top)} = 2\pi rh + \pi r^2.$$

Step 1 – Calculate the curved surface area (CSA):

$$\text{CSA} = 2\pi rh = 2 \times \frac{22}{7} \times 7 \times 10 = 2 \times 22 \times 10 = 440 \text{ cm}^2.$$

Step 2 – Calculate the base area and total surface area:

$$\text{Base area} = \pi r^2 = \frac{22}{7} \times 7^2 = \frac{22}{7} \times 49 = 22 \times 7 = 154 \text{ cm}^2.$$

$$\text{TSA} = 440 + 154 = 594 \text{ cm}^2.$$

Why other options are wrong:

- Option A (440 cm^2): This is only the CSA; omits the base area of 154 cm^2.
- Option B (528 cm^2): Incorrect; perhaps uses $\pi = 3$ (approx.) giving CSA $= 420$ and base $= 147$, then rounds; does not match standard calculation.
- Option D (616 cm^2): This is the TSA of a *closed* cylinder (both top and bottom): $440 + 2 \times 88 = 440 + 176 = 616$; the problem states open at the top.

Final Answer: Total surface area $= 594 \text{ cm}^2 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 19

Q20.

Solution

Concept – Permutations with Repetition: The number of ways to arrange n objects where some are repeated is $\frac{n!}{p!\,q!\,\cdots}$, where $p, q, \ldots$ are the frequencies of repeated elements.

Step 1 – Count letters in ARRANGE and identify repetitions:

$$\text{A R R A N G E} \implies 7 \text{ letters total.}$$

$$\text{A appears } 2 \text{ times}, \quad \text{R appears } 2 \text{ times}, \quad \text{N, G, E appear once each.}$$

Step 2 – Apply the formula:

$$\text{Number of arrangements} = \frac{7!}{2! \times 2!} = \frac{5040}{2 \times 2} = \frac{5040}{4} = 1260.$$

Why other options are wrong:

- Option A (2520): Divides $7!$ by only one $2!$ (accounts for only A or only R being repeated, not both): $5040/2 = 2520$.
- Option C (5040): Computes $7!$ without dividing by any repetition factor; treats all letters as distinct.
- Option D (840): Divides $7!$ by $3! = 6$ instead of $2! \times 2! = 4$; incorrect repetition count.

Final Answer: Number of arrangements of ARRANGE $= 1260 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 20

Q21.

Solution

Concept – Probability without replacement: $P = \frac{\text{Favourable outcomes}}{\text{Total outcomes}}$. Use combinations $\binom{n}{r}$ for unordered draws without replacement.

Step 1 – Find total ways to draw 2 balls from 7 (4 red + 3 green):

$$\binom{7}{2} = \frac{7 \times 6}{2 \times 1} = 21.$$

Step 2 – Find favourable ways to draw 2 green balls from 3:

$$\binom{3}{2} = \frac{3 \times 2}{2 \times 1} = 3.$$

Step 3 – Calculate the probability:

$$P(\text{both green}) = \frac{3}{21} = \frac{1}{7}.$$

Why other options are wrong:

- Option A ($\frac{2}{7}$): Computes $\frac{2\times\binom{3}{2}}{21} = \frac{6}{21} = \frac{2}{7}$; erroneously doubles the numerator.
- Option B ($\frac{3}{14}$): Computes $\frac{3}{14}$ by using denominator $\binom{7}{2}/\binom{2}{1} = 14$ incorrectly.
- Option C ($\frac{1}{5}$): Incorrect; $\frac{1}{5} = \frac{21}{105}$ does not match the correct probability.

Final Answer: $P(\text{both green}) = \frac{1}{7} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 21

Q22.

Solution

Concept – Sets and Venn Diagrams: By the inclusion-exclusion principle:

$$n(M \cup S) = n(M) + n(S) - n(M \cap S).$$

Students who like neither subject = Total $-n(M \cup S)$.

Step 1 – Find $n(M \cup S)$:

$$n(M \cup S) = 25 + 30 - 10 = 45.$$

Step 2 – Find students who like neither subject:

$$\text{Neither} = 60 - 45 = 15.$$

Why other options are wrong:

- Option B (12): Subtracts 10 only from the smaller set; computes $25-10-3 = 12$ with an additional error.
- Option C (10): Equals $n(M \cap S) = 10$; confuses "both" with "neither".

- Option D (20): Computes $60 - (25 + 30 - 15) = 60 - 40 = 20$; uses wrong intersection value.

Final Answer: Students who like neither subject $= 15 \Rightarrow \boxed{\text{A}}$

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

Answer Key

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

Quick Reference: Correct Answers

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