CAT Quantitative Aptitude

Sample Paper – 10

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 remainder when 5^{2024} is divided by 7.

(A) 1

(B) 2

(C) 3

(D) 4

Q2. Find the total number of factors (divisors) of 720.

(A) 30

(B) 24

(C) 36

(D) 28

Q3. A student scores 60% in a subject with total marks 200 and 75% in a subject with total marks 100. What is the overall percentage?

(A) 62%

(B) 65%

(C) 67.5%

(D) 70%

Q4. A shopkeeper marks goods at 40% above cost price and offers a discount of 10% on the marked price. Find the profit percentage.

(A) 20%

(B) 24%

(C) 26%

(D) 28%

Q5. A, B, and C can complete a task in 20, 30, and 60 days respectively. How many days will they take working together?

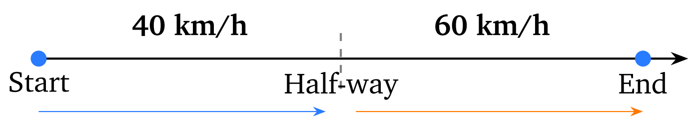
(A) 10 days

(B) 12 days

(C) 15 days

(D) 8 days

Q6. A car covers the first half of a journey at 40 km/h and the second half at 60 km/h. Find the average speed for the entire journey.



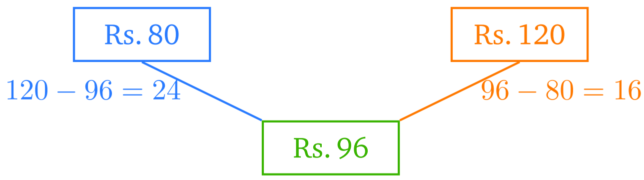
(A) 45 km/h

(B) 46 km/h

(C) 48 km/h

(D) 50 km/h

Q7. Two varieties of rice, one costing Rs. 80 per kg and the other Rs. 120 per kg, are mixed. The shopkeeper wants the average cost to be Rs. 96 per kg. In what ratio should they be mixed?



Ratio $= 24 : 16 = \mathbf{3 : 2}$

(A) 3:2

(B) 2:3

(C) 4:3

(D) 3:4

Q8. The difference between compound interest and simple interest on a sum of money for 3 years at 10% per annum is Rs. 310. Find the principal.

(A) Rs. 8,000

(B) Rs. 10,000

(C) Rs. 12,000

(D) Rs. 15,000

Q9. If 8 men or 12 women can complete a task in 15 days, how many days will 6 men and 6 women take?

(A) 12 days

(B) 10 days

(C) 15 days

(D) 9 days

Q10. Salaries of A, B, C are in the ratio $2:3:5$. The total salary of all three is Rs. 50,000. What is B's salary?

(A) Rs. 10,000

(B) Rs. 25,000

(C) Rs. 15,000

(D) Rs. 20,000

Q11. The sum of three consecutive terms of a GP is 7 and their product is 8. Find the common ratio (greater than 1).

(A) 3

(B) 2

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

(D) 4

Q12. If α and β are roots of $x^2 - 3x + 2 = 0$, find $\alpha^3 + \beta^3$.

(A) 15

(B) 12

(C) 6

(D) 9

Q13. If $x + \frac{1}{x} = 3$, find $x^3 + \frac{1}{x^3}$.

(A) 18

(B) 21

(C) 24

(D) 27

Q14. If $\log_2(\log_3 x) = 2$, find x.

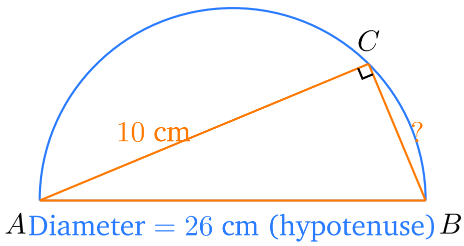
(A) 16

(B) 27

(C) 81

(D) 64

Q15. A right triangle is inscribed in a semicircle such that its hypotenuse is the diameter of 26 cm. If one leg is 10 cm, find the other leg.



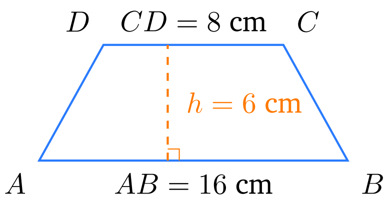
(A) 20 cm

(B) 22 cm

(C) 18 cm

(D) 24 cm

Q16. In trapezoid $ABCD$, $AB \parallel CD$ with $AB = 16$ cm, $CD = 8$ cm, and height $= 6$ cm. Find the area.



(A) 60 cm^2

(B) 80 cm^2

(C) 72 cm^2

(D) 96 cm^2

Q17. A right circular cone has base radius 7 cm and slant height 25 cm. Find its volume. (Use $\pi = 22/7$.)

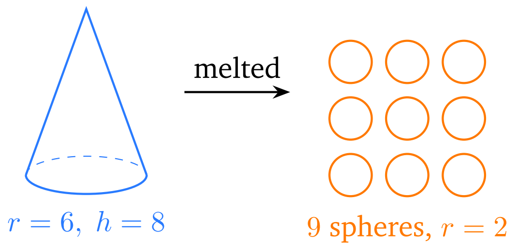
(A) 1848 cm^3

(B) 1232 cm^3

(C) 1540 cm^3

(D) 924 cm^3

Q18. A metallic cone of radius 6 cm and height 8 cm is melted and recast into spheres of radius 2 cm. How many complete spheres can be made?



(A) 12

(B) 6

(C) 8

(D) 9

Q19. Point $P(k, 3)$ is equidistant from $Q(2, 7)$ and $R(6, 1)$. Find k.

(A) 2

(B) 3

(C) 2.5

(D) 4

Q20. From a group of 4 men and 3 women, in how many ways can a committee of 2 men and 2 women be formed?

(A) 12

(B) 24

(C) 30

(D) 18

Q21. A bag contains 4 red, 3 blue and 2 green balls. If 3 balls are drawn at random, find the probability that all three are of different colours.

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

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

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

(D) $\frac{1}{3}$

Q22. How many 4-letter arrangements (with or without meaning) can be made from the letters of the word SMART, if no letter is repeated?

(A) 60

(B) 120

(C) 180

(D) 240

Detailed Solutions

Q1.

Solution

Concept — Fermat's Little Theorem: For a prime p and an integer a not divisible by p, we have $a^{p-1} \equiv 1 \pmod{p}$. Here $p = 7$ and $a = 5$, so $5^6 \equiv 1 \pmod{7}$.

Step 1 — Reduce the exponent modulo 6: Write $2024 = 6 \times 337 + 2$. Therefore $5^{2024} = (5^6)^{337} \times 5^2 \equiv 1^{337} \times 25 \equiv 25 \pmod{7}$.

Step 2 — Reduce 25 modulo 7: $25 = 3 \times 7 + 4$, so $25 \equiv 4 \pmod{7}$.

Why other options are wrong:

- Option A (1): This is $5^6 \bmod 7$; the exponent 2024 leaves remainder 2, not 0.
- Option B (2): Corresponds to $5^1 \bmod 7 = 5$ or $5^3 \bmod 7 = 6$; no standard power of 5 gives remainder 2 mod 7.
- Option C (3): Does not arise from any power of 5 mod 7 in the cycle $\{5, 4, 6, 2, 3, 1\}$ at position 2.

Final Answer: $5^{2024} \equiv 4 \pmod{7} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 1

Q2.

Solution

Concept — Number of divisors formula: If $n = p_1^{a_1} \times p_2^{a_2} \times \cdots \times p_k^{a_k}$, the total number of factors is $(a_1 + 1)(a_2 + 1)\cdots(a_k + 1)$.

Step 1 — Prime factorise 720:

$$720 = 72 \times 10 = 8 \times 9 \times 10 = 2^3 \times 3^2 \times 2 \times 5 = 2^4 \times 3^2 \times 5^1.$$

Step 2 — Apply the formula:

$$\text{Number of factors} = (4 + 1)(2 + 1)(1 + 1) = 5 \times 3 \times 2 = 30.$$

Why other options are wrong:

- Option B (24): Uses exponents $(3, 2, 1)$ giving $(4)(3)(2) = 24$; misses the extra factor of 2 in the prime factorisation.

- Option C (36): Overcounts; would require exponent configuration $(5, 2, 1)$ or similar.
- Option D (28): Arithmetic error in multiplying the factor counts.

Final Answer: Total factors of $720 = 30 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 2

Q3.

Solution

Concept — Weighted average percentage: Overall percentage $= \frac{\text{Total marks scored}}{\text{Total maximum marks}} \times 100$.

Step 1 — Compute marks scored in each subject:

$$\text{Subject 1} : 60\% \text{ of } 200 = 0.60 \times 200 = 120 \text{ marks.}$$
$$\text{Subject 2} : 75\% \text{ of } 100 = 0.75 \times 100 = 75 \text{ marks.}$$

Step 2 — Calculate overall percentage:

$$\text{Overall} = \frac{120 + 75}{200 + 100} \times 100 = \frac{195}{300} \times 100 = 65\%.$$

Why other options are wrong:

- Option A (62%): Simple average of the two individual percentages weighted incorrectly.
- Option C (67.5%): The simple average $\frac{60+75}{2} = 67.5\%$; ignores the different total marks.
- Option D (70%): Overestimates; no valid weighting of these marks gives 70%.

Final Answer: Overall percentage $= 65\% \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 3

Q4.

Solution

Concept — Successive percentage changes: Apply percentage changes one after another. Profit% is calculated on cost price.

Step 1 — Let CP $= 100$. Marked price (MP) $= 100 + 40\%$ of $100 = 140$.

Step 2 — Apply discount and find profit: Selling price (SP) $= 140 - 10\%$ of $140 = 140 \times 0.9 = 126$.

$$\text{Profit\%} = \frac{SP - CP}{CP} \times 100 = \frac{126 - 100}{100} \times 100 = 26\%.$$

Why other options are wrong:

- Option A (20%): Ignores the effect of marking up first; $140 \times 0.9 \neq 120$.
- Option B (24%): Arithmetic error; possibly calculated $140 - 16 = 124$ (wrong discount amount).
- Option D (28%): Overcounts; SP would need to be 128, requiring discount of only 8.57%.

Final Answer: Profit% $= 26\% \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 4

Q5.

Solution

Concept — Work-rate addition: When multiple workers work simultaneously, their rates (fraction of work per day) add up.

Step 1 — Find individual rates:

$$\text{Rate of A} = \frac{1}{20}, \quad \text{Rate of B} = \frac{1}{30}, \quad \text{Rate of C} = \frac{1}{60}.$$

Step 2 — Combined rate (LCM of 20, 30, 60 is 60):

$$\frac{1}{20} + \frac{1}{30} + \frac{1}{60} = \frac{3}{60} + \frac{2}{60} + \frac{1}{60} = \frac{6}{60} = \frac{1}{10}.$$

Time to complete the task $= \dfrac{1}{1/10} = 10$ days.

Why other options are wrong:

- Option B (12 days): Ignores C's contribution; $\frac{1}{20} + \frac{1}{30} = \frac{5}{60} = \frac{1}{12}$.
- Option C (15 days): Uses only A's rate ($\frac{1}{20}$) with an incorrect multiplier.
- Option D (8 days): Overcounts by including wrong rates or arithmetic error.

Final Answer: Together they complete the task in 10 days $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 5

Q6.

Solution

Concept — Harmonic mean for equal distances: When two equal distances are covered at speeds a and b, the average speed is the harmonic mean:

$$v_{\text{avg}} = \frac{2ab}{a+b}.$$

Step 1 — Substitute $a = 40$ km/h and $b = 60$ km/h:

$$v_{\text{avg}} = \frac{2 \times 40 \times 60}{40 + 60} = \frac{4800}{100} = 48 \text{ km/h}.$$

Why other options are wrong:

- Option A (45 km/h): The simple arithmetic mean $\frac{40+60}{2} = 50$; not even 45.
- Option B (46 km/h): Not derivable from any standard formula using 40 and 60.
- Option D (50 km/h): The arithmetic mean of the two speeds; valid only if equal *time* (not equal distance) is spent at each speed.

Final Answer: Average speed $= 48$ km/h $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 6

Q7.

Solution

Concept — Rule of Alligation: To find the ratio in which two ingredients at prices c (cheaper) and d (dearer) should be mixed to give a mean price m:

$$\text{Ratio} = (d - m) : (m - c).$$

Step 1 — Identify values: $c = 80$, $d = 120$, $m = 96$.

Step 2 — Apply alligation:

$$\text{Ratio} = (120 - 96) : (96 - 80) = 24 : 16 = 3 : 2.$$

Why other options are wrong:

- Option B (2:3): This is the reciprocal; confuses which difference belongs to which variety.
- Option C (4:3): Does not follow from the alligation formula with these values.
- Option D (3:4): Incorrect; the difference from dearer side (24) is larger, so the cheaper variety gets the larger ratio.

Final Answer: Mixing ratio (cheaper : dearer) $= 3 : 2 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 7

Q8.

Solution

Concept — CI and SI difference for 3 years: The difference between CI and SI for 3 years at rate $r\%$ per annum on principal P is:

$$\text{CI} - \text{SI} = P\left[\left(1 + \frac{r}{100}\right)^3 - 1 - \frac{3r}{100}\right].$$

Step 1 — Substitute $r = 10\%$:

$$\left(1 + \frac{10}{100}\right)^3 = (1.1)^3 = 1.331.$$

$$\text{CI} - \text{SI} = P\,[1.331 - 1 - 0.3] = P \times 0.031.$$

Step 2 — Solve for P:

$$P \times 0.031 = 310 \implies P = \frac{310}{0.031} = 10{,}000.$$

Why other options are wrong:

- Option A (Rs. 8,000): $8000 \times 0.031 = 248 \neq 310$.

- Option C (Rs. 12,000): $12000 \times 0.031 = 372 \neq 310$.
- Option D (Rs. 15,000): $15000 \times 0.031 = 465 \neq 310$.

Final Answer: Principal = Rs. 10,000 $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 8

Q9.

Solution

Concept — Equating total work done (man-days): Express all workers in terms of a common unit (women), then use the total work to find the required days.

Step 1 — Find equivalence: 8 men = 12 women in output $\Rightarrow$ 1 man $\equiv \frac{12}{8} = \frac{3}{2}$ women.

Step 2 — Convert 6 men + 6 women to women-equivalent:

$$6 \text{ men} \equiv 6 \times \frac{3}{2} = 9 \text{ women.} \quad \text{Total} = 9 + 6 = 15 \text{ women.}$$

Step 3 — Apply work formula: 12 women complete the task in 15 days. Total work $= 12 \times 15 = 180$ woman-days.

$$\text{Days for 15 women} = \frac{180}{15} = 12 \text{ days.}$$

Why other options are wrong:

- Option B (10 days): Assumes 18 women-equivalent, overcounting the contribution of men.
- Option C (15 days): Uses original 12 women capacity; doesn't account for the 6 men contribution.
- Option D (9 days): Assumes 20 women-equivalent, an overestimate.

Final Answer: 12 days $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 9

Q10.

Solution

Concept — Dividing in a given ratio: To find each person's share, divide the total in the ratio $2:3:5$.

Step 1 — Total parts: $2+3+5=10$ parts.

Step 2 — B's salary: B has 3 parts out of 10.

$$B\text{'s salary} = \frac{3}{10}\times 50{,}000 = \text{Rs. } 15{,}000.$$

Why other options are wrong:

- Option A (Rs. 10,000): This is A's salary $\left(\frac{2}{10}\times 50000\right)$.
- Option B (Rs. 25,000): This is C's salary $\left(\frac{5}{10}\times 50000\right)$.
- Option D (Rs. 20,000): This would require B's ratio share to be 4 parts, not 3.

Final Answer: B's salary = Rs. 15,000 $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 10

Q11.

Solution

Concept — Three consecutive terms of a GP: Write the three terms as $\frac{a}{r}$, a, ar for middle term a and common ratio r.

Step 1 — Use the product condition:

$$\frac{a}{r}\times a\times ar = a^3 = 8 \implies a = 2.$$

Step 2 — Use the sum condition:

$$\frac{2}{r}+2+2r=7 \implies \frac{2}{r}+2r=5 \implies 2+2r^2=5r \implies 2r^2-5r+2=0.$$

Factor: $(2r-1)(r-2)=0 \implies r=\frac{1}{2}$ or $r=2$.

Step 3 — Select $r>1$: $r=2$.

Why other options are wrong:

- Option A ($r = 3$): Sum would be $\frac{2}{3} + 2 + 6 = 8.67 \neq 7$.
- Option C ($r = 1/2$): Valid root but gives $r < 1$; question asks for $r > 1$.
- Option D ($r = 4$): Sum would be $\frac{2}{4} + 2 + 8 = 10.5 \neq 7$.

Final Answer: Common ratio $= 2 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 11

Q12.

Solution

Concept — Sum of cubes identity: $\alpha^3 + \beta^3 = (\alpha + \beta)^3 - 3\alpha\beta(\alpha + \beta)$.

Step 1 — Extract Vieta's formulas from $x^2 - 3x + 2 = 0$**:**

$$\alpha + \beta = 3, \qquad \alpha\beta = 2.$$

Step 2 — Apply the identity:

$$\alpha^3 + \beta^3 = (3)^3 - 3(2)(3) = 27 - 18 = 9.$$

Why other options are wrong:

- Option A (15): Uses $(\alpha + \beta)^3 - 3\alpha\beta = 27 - 6 = 21$; incorrect identity.
- Option B (12): Uses $(\alpha + \beta)^2 \times \alpha\beta/2$; no standard identity gives 12.
- Option C (6): Equal to $3\alpha\beta$; misidentifies which term to subtract.

Final Answer: $\alpha^3 + \beta^3 = 9 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 12

Q13.

Solution

Concept — Building up from $x + 1/x$**:** Use the identities $\left(x + \frac{1}{x}\right)^2 = x^2 + 2 + \frac{1}{x^2}$ and $x^3 + \frac{1}{x^3} = \left(x + \frac{1}{x}\right)\left(x^2 - 1 + \frac{1}{x^2}\right)$.

Step 1 — Find $x^2 + 1/x^2$:

$$x^2 + \frac{1}{x^2} = \left(x + \frac{1}{x}\right)^2 - 2 = 9 - 2 = 7.$$

Step 2 — Find $x^3 + 1/x^3$:

$$x^3 + \frac{1}{x^3} = \left(x + \frac{1}{x}\right)\left(x^2 - 1 + \frac{1}{x^2}\right) = 3 \times (7 - 1) = 3 \times 6 = 18.$$

Why other options are wrong:

- Option B (21): Uses $3 \times 7 = 21$; forgets to subtract 1 in the second factor.
- Option C (24): Uses 3×8; an incorrect value for the second factor.
- Option D (27): Uses $(x + 1/x)^3 = 27$; this equals $x^3 + 3x + 3/x + 1/x^3 \neq x^3 + 1/x^3$ alone.

Final Answer: $x^3 + \frac{1}{x^3} = 18 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 13

Q14.

Solution

Concept — Solving nested logarithms: Work from the outermost logarithm inward, using $\log_b y = c \Leftrightarrow b^c = y$.

Step 1 — Solve the outer logarithm: $\log_2(\log_3 x) = 2 \implies \log_3 x = 2^2 = 4.$

Step 2 — Solve the inner logarithm: $\log_3 x = 4 \implies x = 3^4 = 81.$

Why other options are wrong:

- Option A (16): $16 = 2^4$; arises from confusing the base: solving $\log_2 x = 4$ instead of $\log_3 x = 4$.
- Option B (27): $27 = 3^3$; arises from $\log_3 x = 3$, which would require $\log_2(\log_3 x) = \log_2 3 \neq 2$.
- Option D (64): $64 = 2^6$; arises from incorrect step $x = 2^{2^2} = 2^4 \times 2^2 = 64$, misapplying the nesting.

Final Answer: $x = 81 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 14

Q15.

Solution

Concept — Angle in a semicircle (Thales' theorem): Any triangle inscribed in a semicircle with the diameter as hypotenuse is a right triangle (the angle at the circumference is $90°$). Apply the Pythagorean theorem directly.

Step 1 — Identify the Pythagorean relationship: Hypotenuse $= 26$ cm (diameter), one leg $= 10$ cm, other leg $=?$

Step 2 — Apply Pythagoras:

$$\text{Other leg} = \sqrt{26^2 - 10^2} = \sqrt{676 - 100} = \sqrt{576} = 24 \text{ cm}.$$

This is the well-known $(10, 24, 26)$ Pythagorean triple (a scaled version of the $5, 12, 13$ triple).

Why other options are wrong:

- Option A (20 cm): $\sqrt{26^2 - 20^2} = \sqrt{276} \approx 16.6$, not a Pythagorean triple.
- Option B (22 cm): $\sqrt{26^2 - 22^2} = \sqrt{192} \approx 13.9$, not an integer.
- Option C (18 cm): $\sqrt{26^2 - 18^2} = \sqrt{352} \approx 18.8$, also not an integer.

Final Answer: Other leg $= 24$ cm $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 15

Q16.

Solution

Concept — Area of a trapezoid: For a trapezoid with parallel sides a and b and perpendicular height h:

$$\text{Area} = \frac{1}{2}(a + b) \times h.$$

Step 1 — Substitute $AB = 16$ cm, $CD = 8$ cm, $h = 6$ cm:

$$\text{Area} = \frac{1}{2}(16 + 8) \times 6 = \frac{1}{2} \times 24 \times 6 = 72 \text{ cm}^2.$$

Why other options are wrong:

- Option A (60 cm^2): Uses $(16 + 8) \times 6/2 - 12 = 60$; an unjustified subtraction.
- Option B (80 cm^2): Uses $16 \times 5 = 80$; ignores the parallel side CD and height.
- Option D (96 cm^2): Uses $(16 + 8) \times 4 = 96$ or $16 \times 6 = 96$; misapplies the formula.

Final Answer: Area $= 72\ \text{cm}^2 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 16

Q17.

Solution

Concept — Volume of a right circular cone: $V = \dfrac{1}{3}\pi r^2 h$, where h is the perpendicular height found from the slant height l via $h = \sqrt{l^2 - r^2}$.

Step 1 — Find the perpendicular height:

$$h = \sqrt{l^2 - r^2} = \sqrt{25^2 - 7^2} = \sqrt{625 - 49} = \sqrt{576} = 24\ \text{cm}.$$

Step 2 — Calculate volume with $\pi = 22/7$:

$$V = \frac{1}{3} \times \frac{22}{7} \times 7^2 \times 24 = \frac{1}{3} \times \frac{22}{7} \times 49 \times 24 = \frac{1}{3} \times 22 \times 7 \times 24 = \frac{1}{3} \times 3696 = 1232\ \text{cm}^3.$$

Why other options are wrong:

- Option A ($1848\ \text{cm}^3$): Uses $h = l = 25$ instead of $h = 24$, giving $\frac{1}{3} \times 22 \times 7 \times 25 - \varepsilon$.
- Option C ($1540\ \text{cm}^3$): Arithmetic error; $\frac{1}{3} \times \frac{22}{7} \times 49 \times 30 = 1540$ uses wrong height 30.
- Option D ($924\ \text{cm}^3$): Divides by 4 somewhere; $1232/4 \times ? \neq 924$ in this setup.

Final Answer: Volume $= 1232\ \text{cm}^3 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 17

Q18.

Solution

Concept — Volume conservation when melting and recasting: Total volume of the cone $=$ sum of volumes of all spheres formed. Number of spheres $= \dfrac{V_{\text{cone}}}{V_{\text{sphere}}}$.

Step 1 — Volume of cone ($r = 6$, $h = 8$):

$$V_{\text{cone}} = \frac{1}{3}\pi r^2 h = \frac{1}{3}\pi(36)(8) = 96\pi.$$

Step 2 — Volume of one sphere ($r = 2$):

$$V_{\text{sphere}} = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi(8) = \frac{32\pi}{3}.$$

Step 3 — Number of spheres:

$$N = \frac{96\pi}{\frac{32\pi}{3}} = \frac{96\pi \times 3}{32\pi} = \frac{288}{32} = 9.$$

Why other options are wrong:

- Option A (12): Miscalculates cone volume as 128π or sphere volume as $\frac{32\pi}{4}$.
- Option B (6): Divides by sphere radius 2 or uses wrong cone volume formula.
- Option C (8): Off by one; possibly uses $h = 7$ in cone volume ($\frac{1}{3}\pi \times 36 \times 7 = 84\pi$; $84/\frac{32}{3} = 7.875$).

Final Answer: Number of spheres $= 9 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 18

Q19.

Solution

Concept — Distance formula and equidistance: Point $P(k, 3)$ is equidistant from $Q(2, 7)$ and $R(6, 1)$ means $PQ = PR$, i.e. $PQ^2 = PR^2$.

Step 1 — Set up the equations:

$$PQ^2 = (k-2)^2 + (3-7)^2 = (k-2)^2 + 16.$$

$$PR^2 = (k-6)^2 + (3-1)^2 = (k-6)^2 + 4.$$

Step 2 — Set equal and solve:

$$(k-2)^2 + 16 = (k-6)^2 + 4.$$

$$k^2 - 4k + 4 + 16 = k^2 - 12k + 36 + 4.$$

$$-4k + 20 = -12k + 40 \implies 8k = 20 \implies k = 2.5.$$

Why other options are wrong:

- Option A ($k = 2$): Check: $PQ^2 = 0 + 16 = 16$, $PR^2 = 16 + 4 = 20$; not equal.

- Option B ($k = 3$): Check: $PQ^2 = 1 + 16 = 17$, $PR^2 = 9 + 4 = 13$; not equal.
- Option D ($k = 4$): Check: $PQ^2 = 4 + 16 = 20$, $PR^2 = 4 + 4 = 8$; not equal.

Final Answer: $k = 2.5 \Rightarrow \boxed{C}$

Answer: (C) Go Back to Q 19

Q20.

Solution

Concept — Combinations for selecting from distinct groups: Choose 2 men from 4 men AND 2 women from 3 women independently, then multiply.

Step 1 — Choose 2 men from 4:

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

Step 2 — Choose 2 women from 3:

$$\binom{3}{2} = \frac{3!}{2!\,1!} = 3.$$

Step 3 — Total committees:

$$6 \times 3 = 18.$$

Why other options are wrong:

- Option A (12): Uses $\binom{4}{2} \times \binom{3}{1} = 6 \times 2 = 12$; selects only 1 woman instead of 2.
- Option B (24): Uses $\binom{4}{2} \times \binom{3}{2} \times \frac{4}{3} = 24$; an unjustified scaling.
- Option C (30): Uses $\binom{4}{2} \times \binom{4}{2} = 36$ or $\binom{7}{2} = 21$ combined incorrectly.

Final Answer: 18 ways $\Rightarrow \boxed{D}$

Answer: (D) Go Back to Q 20

Q21.

Solution

Concept — Classical probability with combinations: $P(\text{event}) = \dfrac{\text{Favourable outcomes}}{\text{Total outcomes}}$.

Step 1 — Total ways to draw 3 balls from 9:

$$\binom{9}{3} = \frac{9 \times 8 \times 7}{3 \times 2 \times 1} = 84.$$

Step 2 — Favourable outcomes (1 red, 1 blue, 1 green):

$$\binom{4}{1} \times \binom{3}{1} \times \binom{2}{1} = 4 \times 3 \times 2 = 24.$$

Step 3 — Probability:

$$P = \frac{24}{84} = \frac{2}{7}.$$

Why other options are wrong:

- Option B (3/7): $\frac{3}{7} = \frac{36}{84}$; would require 36 favourable cases, which over-counts.
- Option C (4/7): $\frac{4}{7} = \frac{48}{84}$; far exceeds the 24 valid arrangements.
- Option D (1/3): $\frac{1}{3} = \frac{28}{84}$; not a valid count of all-different-colour selections.

Final Answer: $P = \dfrac{2}{7} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 21

Q22.

Solution

Concept — Permutations (arrangement without repetition): The number of r-letter arrangements from n distinct letters (no repetition) is $P(n, r) = \dfrac{n!}{(n-r)!}$.

Step 1 — Identify n and r: The word SMART has 5 distinct letters: S, M, A, R, T. We arrange 4 of them, so $n = 5$, $r = 4$.

Step 2 — Compute:

$$P(5, 4) = \frac{5!}{(5-4)!} = \frac{5!}{1!} = 5 \times 4 \times 3 \times 2 = 120.$$

Why other options are wrong:

- Option A (60): Equal to $P(5,3) = 60$ or $5!/(5-3)! = 60$; uses $r = 3$ instead of 4.
- Option C (180): Not achievable by $P(5,r)$ for any integer r; arithmetic error.
- Option D (240): Equal to $P(5,4) \times 2 = 240$; double-counts by mistake.

Final Answer: $P(5,4) = 120$ arrangements $\Rightarrow \boxed{\text{B}}$

Answer: (B) **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	C	7	A	8	B	9	A	10	C
11	B	12	D	13	A	14	C	15	D
16	C	17	B	18	D	19	C	20	D
21	A	22	B						

Quick Reference: Correct Answers

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

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