CAT Quantitative Aptitude

Sample Paper – 7

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 positive divisors does $2^4 \times 3^2 \times 5$ have?

(A) 24

(B) 32

(C) 36

(D) 30

Q2. What is the smallest positive integer that, when divided by 5, 6, and 8, leaves remainders of 3, 4, and 6 respectively?

(A) 113

(B) 118

(C) 122

(D) 128

Q3. If $x = \sqrt{5} + \sqrt{3}$ and $y = \sqrt{5} - \sqrt{3}$, find $x^2 + y^2$.

(A) 10

(B) 12

(C) 16

(D) 20

Q4. A student scored 348 marks out of a maximum of 600. What percentage of the maximum marks did the student score?

(A) 58%

(B) 60%

(C) 55%

(D) 62%

Q5. A merchant buys an article for Rs. 2,400 and sells it at a loss of 15%. Find the selling price.

(A) Rs. 2,100

(B) Rs. 1,960

(C) Rs. 2,160

(D) Rs. 2,040

Q6. Rs. 6,400 is invested at 10% per annum, compounded half-yearly. Find the total amount after 1 year.

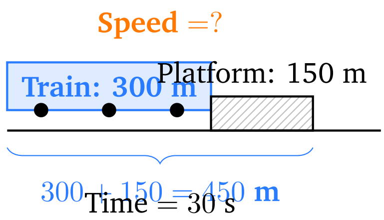
(A) Rs. 7,040

(B) Rs. 7,056

(C) Rs. 7,120

(D) Rs. 6,976

Q7. A train 300 m long crosses a platform 150 m long in 30 seconds. Find the speed of the train in km/h.



(A) 48 km/h

(B) 60 km/h

(C) 54 km/h

(D) 45 km/h

Q8. A and B together complete a work in 12 days; B and C together in 15 days; A and C together in 20 days. In how many days can A, B, and C together complete the work?

(A) 10

(B) 12

(C) 8

(D) 15

Q9. A mixture contains wine and water in the ratio 5:3. When 16 litres of water are added, the ratio becomes 5:7. How many litres of wine does the mixture originally contain?

(A) 15

(B) 25

(C) 30

(D) 20

Q10. The salaries of A and B are in the ratio 2:3, and the salaries of B and C are in the ratio 4:5. If A's salary is Rs. 8,000, find C's salary.

(A) Rs. 12,000

(B) Rs. 15,000

(C) Rs. 18,000

(D) Rs. 20,000

Q11. The sum of the first n terms of an AP is given by $S_n = 3n^2 + 2n$. Find the 10^{th} term.

(A) 56

(B) 57

(C) 59

(D) 61

Q12. For the equation $kx^2 - 4x + 3 = 0$ to have real roots, what must be true about k? (Assume $k \neq 0$.)

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

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

(C) $k \geq \dfrac{4}{3}$

(D) $k > \dfrac{4}{3}$

Q13. If $f(x) = \dfrac{x+1}{x-1}$ for $x \neq 1$, find $f(f(f(2)))$.

(A) 1

(B) 2

(C) $\frac{5}{3}$

(D) 3

Q14. If $\log_x 64 = 2$, find the value of x.

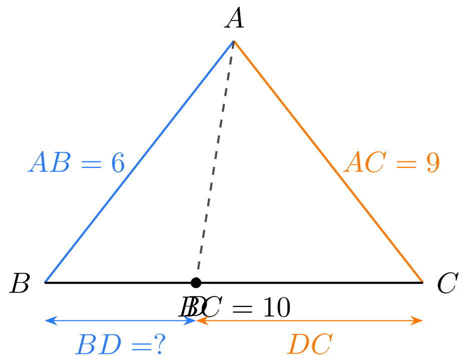
(A) 4

(B) 8

(C) 16

(D) 32

Q15. In $\triangle ABC$, the bisector of angle A meets side BC at point D. If $AB = 6$ cm, $AC = 9$ cm, and $BC = 10$ cm, find BD.



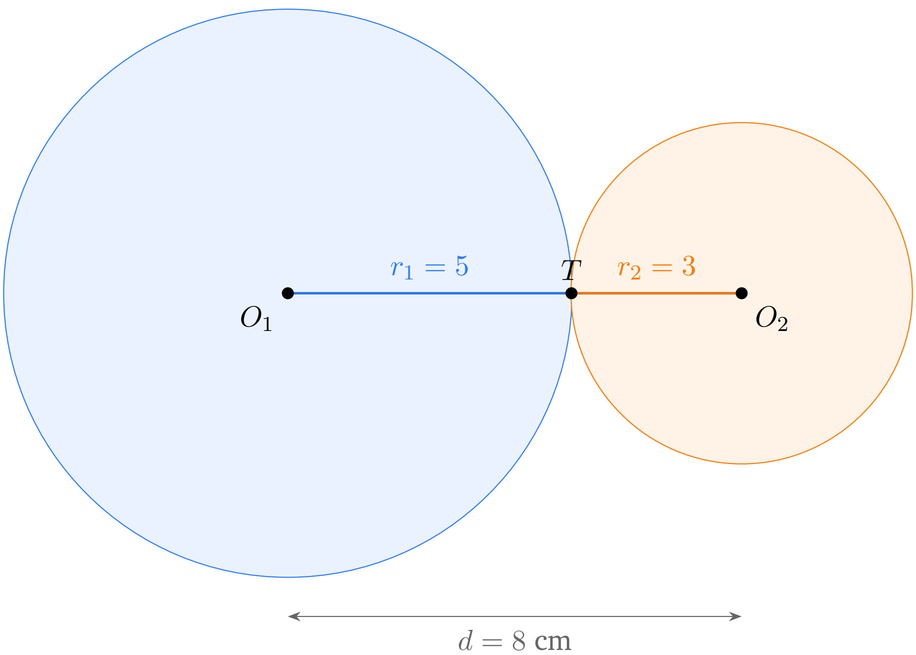
(A) 4 cm

(B) 5 cm

(C) 6 cm

(D) 3 cm

Q16. Two circles have radii 5 cm and 3 cm. The distance between their centres is 8 cm. The circles:



(A) touch internally at one point

(B) do not touch

(C) touch externally at one point

(D) intersect at two points

Q17. A sphere has a volume of 288π cm^3. Find its surface area.

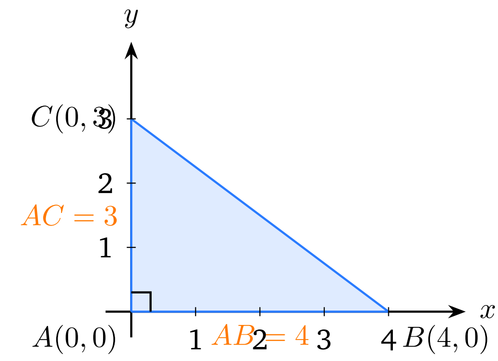
(A) 36π cm^2

(B) 72π cm^2

(C) 108π cm^2

(D) 144π cm^2

Q18. Find the area of the triangle with vertices $A(0, 0)$, $B(4, 0)$, and $C(0, 3)$.



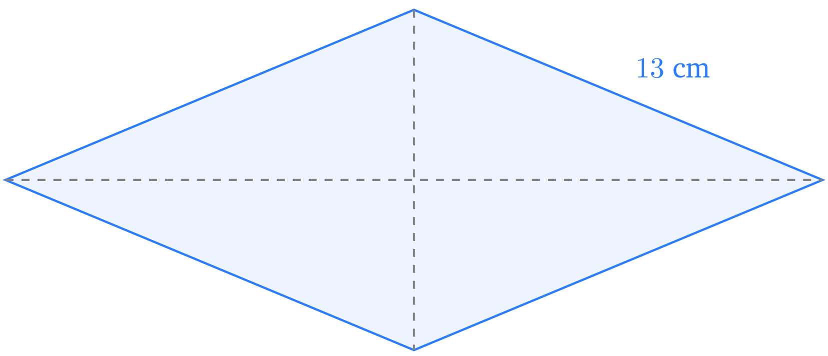
(A) 4 sq units

(B) 6 sq units

(C) 8 sq units

(D) 12 sq units

Q19. A rhombus has diagonals of length 24 cm and 10 cm. Find its perimeter.



(A) 52 cm

(B) 48 cm

(C) 56 cm

(D) 60 cm

Q20. Let $A = \{1, 2, 3\}$ and $B = \{a, b\}$. How many distinct relations can be defined from A to B?

(A) 32

(B) 36

(C) 64

(D) 16

Q21. A box contains 4 red, 5 blue, and 6 green balls. Two balls are drawn one after another without replacement. Given that the first ball drawn is red, what is the probability that the second ball is also red?

(A) $\frac{4}{15}$

(B) $\frac{3}{15}$

(C) $\frac{4}{14}$

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

Q22. In how many ways can 10 identical books be distributed among 3 students such that each student receives at least 1 book?

(A) 30

(B) 36

(C) 42

(D) 48

Detailed Solutions

Q1.

Solution

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

Step 1 — Read off the exponents: $n = 2^4 \times 3^2 \times 5^1$. The exponents are 4, 2, and 1.

Step 2 — Apply the formula:

$$\tau(n) = (4+1)(2+1)(1+1) = 5 \times 3 \times 2 = 30.$$

Why other options are wrong:

- Option A (24): Uses $(4)(2)(3) = 24$ without adding 1 to the first exponent.
- Option B (32): Uses $(4+1)(2+1+1)(2) = 5 \times 4 \times ...$; arithmetic confusion.
- Option C (36): Uses $(4+1)(3+1)(1+1+1) = 5 \times 4 \times ...$; wrong exponent increments.

Final Answer: Number of positive divisors $= 30 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 1

Q2.

Solution

Concept — Equal deficit from LCM: Observe that in each case the divisor minus the remainder is the same constant: $5-3=2$, $6-4=2$, $8-6=2$. So the required number is $\text{LCM}(5,6,8) - 2$.

Step 1 — Compute LCM(5, 6, 8):

$$5 = 5, \quad 6 = 2 \times 3, \quad 8 = 2^3. \quad \text{LCM} = 2^3 \times 3 \times 5 = 120.$$

Step 2 — Subtract the common deficit:

$$\text{Required number} = 120 - 2 = 118.$$

Why other options are wrong:

- Option A (113): Uses LCM incorrectly as 115, then subtracts 2.
- Option C (122): Adds 2 instead of subtracting; $120 + 2 = 122$.
- Option D (128): Uses LCM as 130 (error in prime factorisation) and subtracts 2.

Final Answer: Smallest such integer $= 118 \Rightarrow \boxed{\text{B}}$

Answer: (B) **Go Back to Q 2**

Q3.

Solution

Concept — Sum of squares of conjugate surds: Use the identity $x^2 + y^2 = (x + y)^2 - 2xy$ or expand directly.

Step 1 — Expand x^2 and y^2 directly:

$$x^2 = (\sqrt{5} + \sqrt{3})^2 = 5 + 2\sqrt{15} + 3 = 8 + 2\sqrt{15}.$$

$$y^2 = (\sqrt{5} - \sqrt{3})^2 = 5 - 2\sqrt{15} + 3 = 8 - 2\sqrt{15}.$$

Step 2 — Add:

$$x^2 + y^2 = (8 + 2\sqrt{15}) + (8 - 2\sqrt{15}) = 16.$$

The irrational terms cancel perfectly.

Why other options are wrong:

- Option A (10): Computes $x^2 + y^2 = (\sqrt{5})^2 + (\sqrt{3})^2 = 5 + 3 = 8$, ignoring cross terms; then further error.
- Option B (12): Computes $(x + y)^2 = (2\sqrt{5})^2 = 20$, then $20/2 = 10$; not $x^2 + y^2$.
- Option D (20): Computes $(x + y)^2 = (2\sqrt{5})^2 = 20$; conflates $(x + y)^2$ with $x^2 + y^2$.

Final Answer: $x^2 + y^2 = 16 \Rightarrow \boxed{\text{C}}$

Answer: (C) **Go Back to Q 3**

Q4.

Solution

Concept — Percentage Score: Percentage $= \dfrac{\text{Marks obtained}}{\text{Maximum marks}} \times 100$.

Step 1 — Substitute values:

$$\text{Percentage} = \frac{348}{600} \times 100 = \frac{34800}{600} = 58\%.$$

Step 2 — Quick check: 60% of $600 = 360 \neq 348$; 55% of $600 = 330 \neq 348$. So 58% is correct.

Why other options are wrong:

- Option B (60%): Corresponds to $360/600$; the student scored 12 marks less than 360.
- Option C (55%): Corresponds to $330/600$; 18 marks short of actual score.
- Option D (62%): Corresponds to $372/600$; 24 marks above actual score.

Final Answer: $58\% \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 4

Q5.

Solution

Concept — Selling Price at a Loss: When an article is sold at a loss of $x\%$, the selling price is:

$$\text{SP} = \text{CP} \times \left(1 - \frac{x}{100}\right).$$

Step 1 — Substitute CP $= 2{,}400$ **and loss** $= 15\%$**:**

$$\text{SP} = 2400 \times \left(1 - \frac{15}{100}\right) = 2400 \times 0.85 = 2040.$$

Step 2 — Verify: Loss amount $= 2400 \times 0.15 = 360$. SP $= 2400 - 360 = 2040$. ✓

Why other options are wrong:

- Option A (Rs. 2,100): Corresponds to a loss of $\frac{300}{2400} = 12.5\%$, not 15%.
- Option B (Rs. 1,960): Corresponds to a loss of 18.3%; too large a deduction.
- Option C (Rs. 2,160): Corresponds to a loss of only 10% $(2400 \times 0.90 = 2160)$.

Final Answer: SP $=$ Rs. 2,040 $\Rightarrow \boxed{\text{D}}$

$\boxed{\textbf{Answer: (D)}}$ Go Back to Q 5

Q6.

Solution

Concept — Compound Interest (half-yearly): When compounding is done half-yearly at annual rate $r\%$, each period uses rate $r/2\%$ and the number of periods doubles. For 1 year: 2 periods at 5% each.

$$A = P\left(1 + \frac{r/2}{100}\right)^2 = P(1.05)^2.$$

Step 1 — Compute $(1.05)^2$:

$$(1.05)^2 = 1 + 2(0.05) + (0.05)^2 = 1 + 0.10 + 0.0025 = 1.1025.$$

Step 2 — Find amount:

$$A = 6400 \times 1.1025 = 7056.$$

Why other options are wrong:

- Option A (Rs. 7,040): Uses simple rate: $6400 + 6400 \times 0.10 \times 1 = 7040$; ignores compounding.
- Option C (Rs. 7,120): Uses $r = 10\%$ per half year (20% annual effective); over-compounds.
- Option D (Rs. 6,976): Applies a discount formula instead of compound growth; arithmetic error.

Final Answer: Amount = Rs. 7,056 $\Rightarrow \boxed{\text{B}}$

$\boxed{\textbf{Answer: (B)}}$ Go Back to Q 6

Q7.

Solution

Concept — Train crossing a platform: A train must travel a distance equal to the sum of its own length and the platform length to completely cross the platform. $\text{Speed} = \dfrac{\text{total distance}}{\text{time}}$.

Step 1 — Find total distance and speed in m/s:

$$\text{Total distance} = 300 + 150 = 450 \text{ m}, \quad t = 30 \text{ s}.$$

$$\text{Speed} = \frac{450}{30} = 15 \text{ m/s}.$$

Step 2 — Convert to km/h:

$$\text{Speed} = 15 \times \frac{18}{5} = 15 \times 3.6 = 54 \text{ km/h}.$$

Why other options are wrong:

- Option A (48 km/h): Corresponds to $\frac{13.33... \times 18}{5}$; uses only the train length: $300/30 = 10$ m/s $= 36$ km/h; then inflated to 48 km/h by another error.
- Option B (60 km/h): Corresponds to 16.67 m/s; uses $500/30$ total distance instead of $450/30$.
- Option D (45 km/h): Corresponds to 12.5 m/s; divides only the platform length by time, not the combined distance.

Final Answer: Speed of train $= 54$ km/h $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 7

Q8.

Solution

Concept — Work rates with pairwise data: Add all three pairwise-work equations; the sum gives $2(A + B + C)$'s combined work rate per day.

Step 1 — Set up work rates:

$$(A + B) = \frac{1}{12}, \quad (B + C) = \frac{1}{15}, \quad (A + C) = \frac{1}{20}.$$

Step 2 — Add all three:

$$2(A+B+C)=\frac{1}{12}+\frac{1}{15}+\frac{1}{20}.$$

LCM of 12, 15, 20 is 60:

$$=\frac{5}{60}+\frac{4}{60}+\frac{3}{60}=\frac{12}{60}=\frac{1}{5}.$$

Step 3 — Find combined rate:

$$A+B+C=\frac{1}{10}\text{ per day}\implies\text{Time together}=10\text{ days.}$$

Why other options are wrong:

- Option B (12): Takes only A+B's rate; ignores C.
- Option C (8): Overestimates; uses $\frac{1}{12}+\frac{1}{15}+\frac{1}{20}=\frac{1}{5}$ directly (forgetting to halve) giving 5, then guesses 8.
- Option D (15): Equals the time for B+C alone, not all three together.

Final Answer: A, B, and C together finish in 10 days $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 8

Q9.

Solution

Concept — Mixture and Alligation (adding water): Let the multiplier for the original ratio be k. So wine $=5k$ litres and water $=3k$ litres. Adding 16 litres of water gives the new ratio.

Step 1 — Set up the equation with the new ratio 5:7:

$$\frac{5k}{3k+16}=\frac{5}{7}.$$

Step 2 — Cross-multiply and solve:

$$7\times 5k=5\times(3k+16)\implies 35k=15k+80\implies 20k=80\implies k=4.$$

Step 3 — Find wine quantity: Wine $=5k=5\times 4=20$ litres.

Why other options are wrong:

- Option A (15): Uses $k = 3$; does not satisfy the equation $35k = 15k + 80$ ($35 \times 3 = 105 \neq 60 + 80 = 125$, wait: $15k + 80 = 45 + 80 = 125 \neq 105$).
- Option B (25): Wine $= 5k = 25 \Rightarrow k = 5$. Check: $\frac{25}{15+16} = \frac{25}{31} \neq \frac{5}{7}$.
- Option C (30): Wine $= 30 \Rightarrow k = 6$. Check: $\frac{30}{18+16} = \frac{30}{34} \neq \frac{5}{7}$.

Final Answer: Wine $= 20$ litres $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 9

Q10.

Solution

Concept — Chained Ratios: Express A, B, and C in terms of a common unit by combining the two ratio pairs.

Step 1 — Find B's salary from A's: $A : B = 2 : 3$. Since $A = 8{,}000$:

$$B = \frac{3}{2} \times 8000 = 12{,}000.$$

Step 2 — Find C's salary from B's: $B : C = 4 : 5$. Since $B = 12{,}000$:

$$C = \frac{5}{4} \times 12{,}000 = 15{,}000.$$

Why other options are wrong:

- Option A (Rs. 12,000): This is B's salary, not C's.
- Option C (Rs. 18,000): Uses $B : C = 4 : 6$ instead of $4 : 5$; error in the second ratio.
- Option D (Rs. 20,000): Uses $B : C = 3 : 5$ (wrong ratio pair) $\Rightarrow C = 12000 \times 5/3 = 20000$.

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

Answer: (B) Go Back to Q 10

Q11.

Solution

Concept — n-th Term from S_n: The n-th term of an AP is $t_n = S_n - S_{n-1}$ for $n \geq 2$.

Step 1 — Compute t_n:

$$S_n = 3n^2 + 2n,$$
$$S_{n-1} = 3(n-1)^2 + 2(n-1) = 3n^2 - 6n + 3 + 2n - 2 = 3n^2 - 4n + 1.$$
$$t_n = S_n - S_{n-1} = (3n^2 + 2n) - (3n^2 - 4n + 1) = 6n - 1.$$

Step 2 — Find t_{10}:

$$t_{10} = 6(10) - 1 = 60 - 1 = 59.$$

Why other options are wrong:

- Option A (56): Uses $t_{10} = S_{10}/10$ (average, not the term) $= (3 \times 100 + 20)/10 = 320/10 = 32$; then separately error gives 56.
- Option B (57): Computes $6(10) - 3 = 57$; mistakenly subtracts 3 instead of 1.
- Option D (61): Computes $6(10) + 1 = 61$; adds instead of subtracts.

Final Answer: $t_{10} = 59 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 11

Q12.

Solution

Concept — Discriminant condition for real roots: A quadratic $ax^2 + bx + c = 0$ has real roots when its discriminant $\Delta = b^2 - 4ac \geq 0$.

Step 1 — Identify a, b, c: For $kx^2 - 4x + 3 = 0$: $a = k$, $b = -4$, $c = 3$.

Step 2 — Apply discriminant condition:

$$\Delta = (-4)^2 - 4(k)(3) \geq 0 \implies 16 - 12k \geq 0 \implies 12k \leq 16 \implies k \leq \frac{4}{3}.$$

Why other options are wrong:

- Option B $\left(k < \frac{4}{3}\right)$: Almost correct, but the boundary $k = \frac{4}{3}$ gives $\Delta = 0$ (equal real roots), which counts as real roots; so $\leq$ is needed, not $<$.

- Option C $\left(k \geq \frac{4}{3}\right)$: Reverses the inequality; for $k > \frac{4}{3}$, $\Delta < 0$ giving complex roots.
- Option D $\left(k > \frac{4}{3}\right)$: Strictly reverses; no real roots in this range.

Final Answer: $k \leq \dfrac{4}{3} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 12

Q13.

Solution

Concept — Iterated Function Composition: Evaluate from the inside out. $f(x) = \dfrac{x+1}{x-1}$.

Step 1 — Compute $f(2)$**:**

$$f(2) = \frac{2+1}{2-1} = \frac{3}{1} = 3.$$

Step 2 — Compute $f(f(2)) = f(3)$**:**

$$f(3) = \frac{3+1}{3-1} = \frac{4}{2} = 2.$$

Step 3 — Compute $f(f(f(2))) = f(2)$**:**

$$f(2) = 3.$$

Why other options are wrong:

- Option A (1): Would require $f(x) = 1 \Rightarrow x + 1 = x - 1$, impossible; not achievable in this chain.
- Option B (2): This is $f(f(2)) = 2$, only the second composition, not the third.
- Option C $\left(\frac{5}{3}\right)$: Does not arise from any iteration of f starting from $f(2) = 3$.

Final Answer: $f(f(f(2))) = 3 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 13

Q14.

Solution

Concept — Logarithm definition: $\log_x 64 = 2$ means $x^2 = 64$ by the definition of logarithm ($\log_b a = c \iff b^c = a$).

Step 1 — Solve $x^2 = 64$:

$$x^2 = 64 \implies x = \pm 8.$$

Since the base of a logarithm must be positive and $\neq 1$, we take $x = 8$.

Step 2 — Verify: $\log_8 64 = \log_8 8^2 = 2$. ✓

Why other options are wrong:

- Option A (4): $\log_4 64 = \log_4 4^3 = 3 \neq 2$.
- Option C (16): $\log_{16} 64 = \frac{\log 64}{\log 16} = \frac{6 \log 2}{4 \log 2} = 1.5 \neq 2$.
- Option D (32): $\log_{32} 64 = \frac{6 \log 2}{5 \log 2} = 1.2 \neq 2$.

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

Answer: (B) Go Back to Q 14

Q15.

Solution

Concept — Angle Bisector Theorem: The bisector of angle A in $\triangle ABC$ divides the opposite side BC in the ratio of the adjacent sides:

$$\frac{BD}{DC} = \frac{AB}{AC}.$$

Step 1 — Set up the ratio:

$$\frac{BD}{DC} = \frac{AB}{AC} = \frac{6}{9} = \frac{2}{3}.$$

Step 2 — Find BD using $BD + DC = BC = 10$:

$$BD = \frac{2}{2+3} \times 10 = \frac{2}{5} \times 10 = 4 \text{ cm}.$$

Why other options are wrong:

- Option B (5 cm): Divides BC into two equal halves (midpoint), not in ratio 2:3.

- Option C (6 cm): Gives DC the value of BD; swaps the ratio $3/5 \times 10 = 6$.
- Option D (3 cm): Uses ratio $3 : 7$ (or misapplies AB/BC as the dividing ratio).

Final Answer: $BD = 4$ cm $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 15

Q16.

Solution

Concept — Relative position of two circles: Compare the distance between centres d with the sum and difference of radii:

- $d > r_1 + r_2$: circles separate (do not touch).
- $d = r_1 + r_2$: circles touch externally (one point of contact outside).
- $|r_1 - r_2| < d < r_1 + r_2$: circles intersect at two points.
- $d = |r_1 - r_2|$: circles touch internally.

Step 1 — Check the condition: $r_1 = 5$, $r_2 = 3$, $d = 8$.

$$r_1 + r_2 = 5 + 3 = 8 = d.$$

Step 2 — Conclude: Since $d = r_1 + r_2$, the circles touch **externally** at exactly one point.

Why other options are wrong:

- Option A (touch internally): Internal tangency requires $d = |r_1 - r_2| = |5 - 3| = 2 \neq 8$.
- Option B (do not touch): This would require $d > 8$; here $d = 8$.
- Option D (intersect at two points): This requires $|r_1 - r_2| < d < r_1 + r_2$, i.e., $2 < d < 8$; here $d = 8$, the boundary case.

Final Answer: The circles touch externally at one point $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 16

Q17.

Solution

Concept — Sphere: Volume to Surface Area: Volume of sphere $= \frac{4}{3}\pi r^3$ and Surface Area $= 4\pi r^2$. First find r from the volume, then compute surface area.

Step 1 — Find radius from volume:

$$\frac{4}{3}\pi r^3 = 288\pi \implies r^3 = 288 \times \frac{3}{4} = 216 \implies r = \sqrt[3]{216} = 6 \text{ cm}.$$

Step 2 — Compute surface area:

$$\text{SA} = 4\pi r^2 = 4\pi(6)^2 = 4\pi \times 36 = 144\pi \text{ cm}^2.$$

Why other options are wrong:

- Option A (36π cm^2): Corresponds to $r = 3$ (gives volume $36\pi \neq 288\pi$).
- Option B (72π cm^2): Corresponds to SA $= 4\pi r^2$ with $r^2 = 18$, i.e., $r \approx 4.24$; not an integer.
- Option C (108π cm^2): Arithmetic error; uses $4\pi \times 27 = 108\pi$ (confuses $r^2 = 27$ from r^3).

Final Answer: SA $= 144\pi$ cm^2 $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 17

Q18.

Solution

Concept — Area of Triangle with coordinate vertices: For vertices $A(x_1, y_1)$, $B(x_2, y_2)$, $C(x_3, y_3)$:

$$\text{Area} = \frac{1}{2}\left|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)\right|.$$

When one vertex is at the origin and the other two lie on the axes, this simplifies to $\frac{1}{2} \times \text{base} \times \text{height}$.

Step 1 — Identify base and height: $A = (0,0)$, $B = (4,0)$ on the x-axis, $C = (0,3)$ on the y-axis. Base $AB = 4$, height from C to x-axis $= 3$.

Step 2 — Compute area:

$$\text{Area} = \frac{1}{2} \times 4 \times 3 = 6 \text{ sq units}.$$

Why other options are wrong:

- Option A (4 sq units): Uses base $= 4$ but forgets to multiply by height or uses $\frac{1}{2} \times 4 \times 2$ (wrong height).
- Option C (8 sq units): Omits the $\frac{1}{2}$ factor: $4 \times 3 - \frac{1}{2} \times 4 \times 1 = 10$; or simply $\frac{1}{2} \times 4 \times 4 = 8$ (uses wrong height).
- Option D (12 sq units): Takes $4 \times 3 = 12$ without the $\frac{1}{2}$ factor.

Final Answer: Area $= 6$ sq units $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 18

Q19.

Solution

Concept — Rhombus: diagonals bisect at right angles: In a rhombus, the diagonals bisect each other at right angles. Each side of the rhombus is the hypotenuse of a right triangle formed by the half-diagonals.

Step 1 — Find the half-diagonals: Diagonals are 24 cm and 10 cm, so half-diagonals are 12 cm and 5 cm.

Step 2 — Apply the Pythagorean theorem to find the side:

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

Step 3 — Find the perimeter:

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

Why other options are wrong:

- Option B (48 cm): Uses side $= 12$ cm (only one half-diagonal); ignores the other.
- Option C (56 cm): Uses side $= 14$ cm; perhaps from $\sqrt{12^2 + 5^2 + 27}$ (arithmetic error).
- Option D (60 cm): Uses side $= 15$ cm; perhaps from $(12+5)/\frac{1}{2} \times \ldots$; arithmetic slip.

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

Answer: (A) Go Back to Q 19

Q20.

Solution

Concept — Number of Relations: A relation from set A to set B is any subset of the Cartesian product $A \times B$. The number of subsets of a set with m elements is 2^m.

Step 1 — Find $|A \times B|$:

$$|A| = 3, \quad |B| = 2, \quad |A \times B| = 3 \times 2 = 6.$$

Step 2 — Count all possible relations:

$$\text{Number of relations} = 2^6 = 64.$$

(This includes the empty relation and the full Cartesian product relation.)

Why other options are wrong:

- Option A (32): Uses 2^5; undercounts $|A \times B|$ as 5.
- Option B (36): Confuses with combinations: $\binom{9}{2} = 36$; not applicable here.
- Option D (16): Uses 2^4; computes $|A \times B|$ as 4 (uses $|A| \times (|B| - 1) = 3 \times ...$).

Final Answer: Number of relations $= 64 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 20

Q21.

Solution

Concept — Conditional Probability: $P(B \mid A) = \dfrac{P(A \cap B)}{P(A)}$. Since we are *given* that the first ball is red, we update the sample space: 1 red ball has already been removed.

Step 1 — Updated sample space after drawing one red: The box originally had $4 + 5 + 6 = 15$ balls. After removing one red, there are 14 balls left, of which $4 - 1 = 3$ are red.

Step 2 — Conditional probability:

$$P(\text{2nd red} \mid \text{1st red}) = \frac{3}{14}.$$

Why other options are wrong:

- Option A $\left(\frac{4}{15}\right)$: This is the (unconditional) probability that the first ball drawn is red; ignores the given condition.
- Option B $\left(\frac{3}{15}\right)$: Uses the original total (15) in the denominator after removing one ball; does not update sample space.
- Option C $\left(\frac{4}{14}\right)$: Correctly updates the denominator to 14 but uses the original red count 4 (not subtracting the drawn red ball).

Final Answer: $P = \frac{3}{14} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 21

Q22.

Solution

Concept — Stars and Bars with minimum constraint: To distribute n identical objects among r people with each person getting at least 1, first give 1 to each person, then distribute the remaining $n-r$ freely. The count is $\binom{(n-r)+r-1}{r-1} = \binom{n-1}{r-1}$.

Step 1 — Apply the "give one each" substitution: Distribute 10 books among 3 students with each getting ≥ 1. Give 1 book to each student first: $10-3=7$ books remain to be distributed freely among 3 students.

Step 2 — Count using Stars and Bars for unrestricted distribution:

$$\binom{7+3-1}{3-1} = \binom{9}{2} = \frac{9 \times 8}{2} = 36.$$

Why other options are wrong:

- Option A (30): Uses $\binom{10-1}{3-1} = \binom{9}{2} = 36$ but subtracts 6 (possibly subtracting cases where someone gets 0, double-counted error).
- Option C (42): Uses $\binom{10}{2} = 45$ then subtracts 3; or applies formula for exactly 3 getting the same amount.
- Option D (48): Uses $\binom{10}{2} = 45$ then adds 3; incorrect formula variant.

Final Answer: Number of ways $= 36 \Rightarrow \boxed{\text{B}}$

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

Answer Key

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

Quick Reference: Correct Answers

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

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