CAT Quantitative Aptitude

Sample Paper – 12

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 prime numbers between 1 and 30.

(A) 101

(B) 107

(C) 112

(D) 129

Q2. How many natural numbers from 1 to 500 are divisible by both 4 and 6?

(A) 37

(B) 41

(C) 83

(D) 125

Q3. At what time (in years) will Rs. 5,000 amount to Rs. 8,000 at 8% per annum simple interest?

(A) 7.5 years

(B) 8 years

(C) 6 years

(D) 10 years

Q4. A person sells $\frac{2}{3}$ of the goods at 15% profit and the remaining at a 9% loss. Find the overall profit or loss percentage.

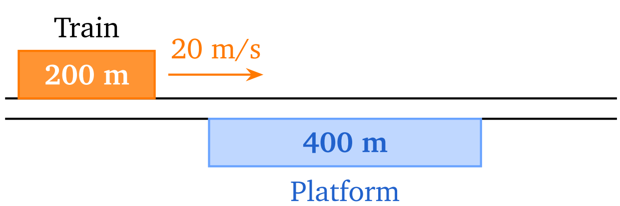
(A) 5%

(B) 6%

(C) 7%

(D) 8%

Q5. A train 200 m long passes a pole in 10 seconds. How many seconds will it take to pass a platform 400 m long?



(A) 20 s

(B) 30 s

(C) 40 s

(D) 50 s

Q6. A mixture of 60 litres contains milk and water in the ratio 2:1. How many litres of water must be added to make the ratio 1:2?

(A) 30 L

(B) 45 L

(C) 60 L

(D) 75 L

Q7. Rajan and Sajan invest Rs. 80,000 and Rs. 1,20,000 in a business. The total annual profit is Rs. 40,000. What is Rajan's share of the profit?

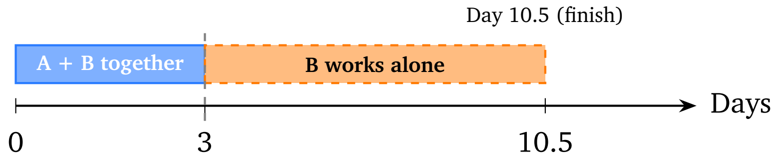
(A) Rs. 12,000

(B) Rs. 16,000

(C) Rs. 20,000

(D) Rs. 24,000

Q8. A can do a job in 10 days and B can do the same job in 15 days. They start together. After 3 days, A leaves. How many more days will B need to finish the remaining work?



(A) 5 days

(B) 6 days

(C) 7 days

(D) 7.5 days

Q9. A shopkeeper gives a discount of 10% on the marked price and still makes a profit of 8%. Find the ratio of the marked price to the cost price.

(A) 6:5

(B) 5:4

(C) 5:6

(D) 4:3

Q10. The average of 5 numbers is 24. If one number is excluded, the average of the remaining 4 numbers becomes 22. Find the excluded number.

(A) 28

(B) 30

(C) 34

(D) 32

Q11. Let $f(x) = x^2 - 3x + 2$ and $g(x) = x + 1$. Find $f(g(1))$.

(A) -1

(B) 1

(C) 0

(D) 2

Q12. For the equation $4x^2 - 12x + k = 0$ to have equal roots, find the value of k.

(A) 9

(B) 6

(C) 12

(D) 4

Q13. The sum of first n terms of a sequence is given by $S_n = 3n^2 + 5n$. Find the 10th term of the sequence.

(A) 56

(B) 58

(C) 60

(D) 62

Q14. Evaluate: $\log_{10} 1 + \log_{10} 10 + \log_{10} 1000$.

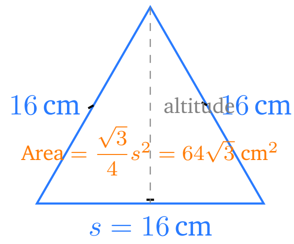
(A) 3

(B) 4

(C) 5

(D) 6

Q15. The perimeter of an equilateral triangle is 48 cm. Find its area.



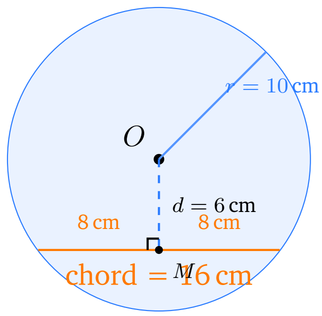
(A) $48\sqrt{3}$ cm^2

(B) $56\sqrt{3}$ cm^2

(C) $64\sqrt{3}$ cm^2

(D) $72\sqrt{3}$ cm^2

Q16. A chord of length 16 cm is drawn in a circle of radius 10 cm. Find the distance from the centre to the chord.



(A) 4 cm

(B) 5 cm

(C) 8 cm

(D) 6 cm

Q17. The volume of a right pyramid with a square base is 75 cm^3 and its height is 9 cm. Find the side of the square base.

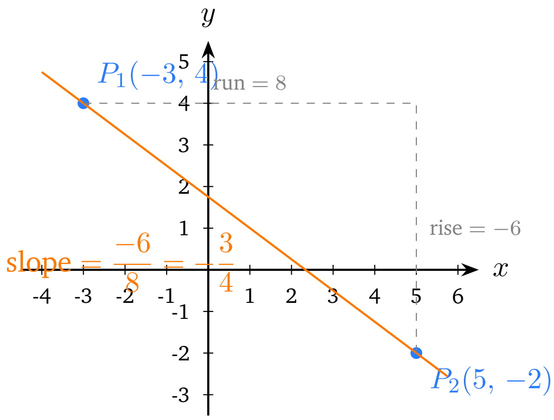
(A) 5 cm

(B) 6 cm

(C) 7 cm

(D) 8 cm

Q18. Find the slope of the line passing through the points $(-3, 4)$ and $(5, -2)$.



(A) $3/4$

(B) $-3/4$

(C) $4/3$

(D) $-4/3$

Q19. A cylinder and a cone have the same base radius and the same height. Find the ratio of the volume of the cylinder to the volume of the cone.

(A) 1:3

(B) 2:3

(C) 1:2

(D) 3:1

Q20. From a group of 8 people, 4 are to be selected such that 2 specific persons are always included. In how many ways can this selection be done?

(A) 28

(B) 20

(C) 15

(D) 10

Q21. The probability that a student passes in Mathematics is $2/3$ and in Science is $3/4$ (the events are independent). Find the probability of passing in exactly one subject.

(A) $5/12$

(B) $1/2$

(C) $7/12$

(D) $1/4$

Q22. Two cards are drawn at random from a standard deck of 52 cards. Find the probability that both cards drawn are aces.

(A) $1/13$

(B) $1/221$

(C) $1/52$

(D) $4/221$

Detailed Solutions

Q1.

Solution

Concept – A prime number is a natural number greater than 1 that has no positive divisors other than 1 and itself. We list all primes between 1 and 30 (exclusive of 1, inclusive up to 29) and sum them.

Step 1 – List all prime numbers between 1 and 30:

$$2,\ 3,\ 5,\ 7,\ 11,\ 13,\ 17,\ 19,\ 23,\ 29.$$

Note: 1 is not prime; 4, 6, 8, 9, 10, 12, 14, 15, 16, 18, 20, 21, 22, 24, 25, 26, 27, 28 are composite.

Step 2 – Add all the primes:

$$2+3+5+7+11+13+17+19+23+29 = (2+3)+(5+7)+(11+13)+(17+19)+(23+29) = 5+12+24+36$$

Why other options are wrong:

- Option A (101): Misses the prime 29 and includes only 9 primes instead of 10.
- Option B (107): Omits 23 from the list; $129 - 23 + 1 = 107$ is a common slip.
- Option C (112): Omits 17 from the list; typical error when skipping mid-range primes.

Final Answer: Sum of all primes between 1 and 30 $= 129 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 1

Q2.

Solution

Concept – A number divisible by both 4 and 6 must be divisible by their LCM. The LCM is the smallest positive integer divisible by both numbers.

Step 1 – Find LCM$(4, 6)$:

$$4 = 2^2, \quad 6 = 2 \times 3 \implies \text{LCM}(4, 6) = 2^2 \times 3 = 12.$$

Step 2 – Count multiples of 12 from 1 to 500:

$$\left\lfloor \frac{500}{12} \right\rfloor = \lfloor 41.67 \rfloor = 41.$$

Why other options are wrong:

- Option A (37): Uses $\lfloor 500/13 \rfloor = 38$ or makes an off-by-one error.
- Option C (83): Counts multiples of 6 only: $\lfloor 500/6 \rfloor = 83$; forgets the condition on 4.
- Option D (125): Counts multiples of 4 only: $\lfloor 500/4 \rfloor = 125$; ignores divisibility by 6.

Final Answer: 41 natural numbers $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 2

Q3.

Solution

Concept – Simple Interest (SI) formula: SI $= \dfrac{P \times R \times T}{100}$, where P is the principal, R is the rate per annum, and T is the time in years. The amount $A = P + \text{SI}$.

Step 1 – Find the Simple Interest earned:

$$\text{SI} = A - P = 8000 - 5000 = \text{Rs.}\,3000.$$

Step 2 – Solve for T:

$$3000 = \frac{5000 \times 8 \times T}{100} = 400T \implies T = \frac{3000}{400} = 7.5 \text{ years}.$$

Why other options are wrong:

- Option B (8 years): Would give SI $= 5000 \times 0.08 \times 8 = 3200$, not 3000.
- Option C (6 years): Would give SI $= 5000 \times 0.08 \times 6 = 2400$, not 3000.
- Option D (10 years): Would give SI $= 5000 \times 0.08 \times 10 = 4000$, not 3000.

Final Answer: Time $= 7.5$ years $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 3

Q4.

Solution

Concept – When different fractions of goods are sold at different profit/loss percentages, the overall percentage is the weighted average of the individual percentages, with the fractions of goods as weights.

Step 1 – Assign weights and compute weighted average:

$$\text{Overall } \% = \left(\frac{2}{3} \times 15\right) + \left(\frac{1}{3} \times (-9)\right)$$
$$= 10 + (-3) = 7\%.$$

Step 2 – Since the result is positive, it is a **profit** of 7%.

Why other options are wrong:

- Option A (5%): Uses weights $1/2$ and $1/2$ instead of $2/3$ and $1/3$.
- Option B (6%): Arithmetic error; possibly computes $(15 - 9)/2 -$ some correction.
- Option D (8%): Ignores the loss on the remaining $1/3$; uses only the profit portion.

Final Answer: Overall profit $= 7\% \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 4

Q5.

Solution

Concept – Speed, Distance, Time: Speed $= \frac{\text{Distance}}{\text{Time}}$. To cross an object, the train must travel a distance equal to its own length plus the length of the object.

Step 1 – Find the speed of the train using the pole-crossing data:

$$\text{Speed} = \frac{\text{Length of train}}{\text{Time to cross pole}} = \frac{200}{10} = 20 \text{ m/s}.$$

(A pole is a point object, so the distance covered equals the train's length.)

Step 2 – Find time to cross the platform:

$$\text{Total distance} = \text{Length of train} + \text{Length of platform} = 200 + 400 = 600 \text{ m}.$$

$$\text{Time} = \frac{600}{20} = 30 \text{ seconds.}$$

Why other options are wrong:

- Option A (20 s): Uses only the train's length (200 m) ignoring the platform.
- Option C (40 s): Divides only the platform length (400 m) by speed: $400/20 = 20$, then adds incorrectly.
- Option D (50 s): Uses $1000/20 = 50$; inflates total distance to 1000 m.

Final Answer: Time $= 30$ seconds $\Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 5

Q6.

Solution

Concept – In mixture problems, the quantity of one component (here, milk) stays constant when water is added. We use this invariant to find how much water to add.

Step 1 – Find initial quantities:

$$\text{Total} = 60 \text{ L}, \quad \text{Ratio milk:water} = 2 : 1.$$

$$\text{Milk} = \frac{2}{3} \times 60 = 40 \text{ L}, \quad \text{Water} = \frac{1}{3} \times 60 = 20 \text{ L}.$$

Step 2 – Set up equation for new ratio 1:2 (milk:water):

$$\frac{\text{Milk}}{\text{New Water}} = \frac{1}{2} \implies \text{New Water} = 2 \times 40 = 80 \text{ L}.$$

$$\text{Water to add} = 80 - 20 = 60 \text{ L}.$$

Why other options are wrong:

- Option A (30 L): Incorrect; adding 30 L gives total water $= 50$ L and ratio $= 40 : 50 = 4 : 5 \neq 1 : 2$.
- Option B (45 L): Adding 45 L gives water $= 65$ L; ratio $= 40 : 65 = 8 : 13 \neq 1 : 2$.
- Option D (75 L): Adding 75 L gives water $= 95$ L; ratio $= 40 : 95 \neq 1 : 2$.

Final Answer: Add 60 litres of water $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 6

Q7.

Solution

Concept – In a partnership, profits are shared in the ratio of investments (when the duration of investment is the same for all partners).

Step 1 – Find the profit-sharing ratio:

$$\text{Rajan} : \text{Sajan} = 80{,}000 : 1{,}20{,}000 = 2 : 3.$$

Step 2 – Calculate Rajan's share of the profit:

$$\text{Rajan's share} = \frac{2}{2+3} \times 40{,}000 = \frac{2}{5} \times 40{,}000 = \text{Rs. } 16{,}000.$$

Why other options are wrong:

- Option A (Rs. 12,000): Uses ratio $3 : 7$ or some other incorrect division.
- Option C (Rs. 20,000): Uses equal split (50:50) instead of the actual investment ratio.
- Option D (Rs. 24,000): Assigns Sajan's share to Rajan; uses ratio $3/5$ instead of $2/5$.

Final Answer: Rajan's share $=$ Rs. $16{,}000 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 7

Q8.

Solution

Concept – Work-rate problems: if a person can complete a job in n days, their rate is $1/n$ of the job per day. When multiple people work together, their rates add.

Step 1 – Find work done in the first 3 days (A and B together):

$$\text{Rate of A} = \frac{1}{10}, \quad \text{Rate of B} = \frac{1}{15}.$$

$$\text{Combined rate} = \frac{1}{10} + \frac{1}{15} = \frac{3}{30} + \frac{2}{30} = \frac{5}{30} = \frac{1}{6}.$$

$$\text{Work done in 3 days} = \frac{1}{6} \times 3 = \frac{1}{2}.$$

Step 2 – Find remaining work and time for B to complete it:

$$\text{Remaining work} = 1 - \frac{1}{2} = \frac{1}{2}.$$

$$\text{Time for B} = \frac{1/2}{1/15} = \frac{1}{2} \times 15 = 7.5 \text{ days}.$$

Why other options are wrong:

- Option A (5 days): Assumes half the work remains but uses A's rate instead of B's.
- Option B (6 days): Uses combined rate of A+B for remaining work: $(1/2)/(1/6) = 3$ days — not 6.
- Option C (7 days): Rounds 7.5 down to 7; the exact answer is 7.5.

Final Answer: B needs 7.5 more days $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q 8

Q9.

Solution

Concept – Discount and profit/loss on marked price: Selling Price (SP) $=$ Marked Price (MP) $\times(1 -$ discount%$)$. Profit means SP $=$ Cost Price (CP) $\times(1 +$ profit%$)$.

Step 1 – Express SP in terms of MP and CP:

$$\text{SP} = \text{MP} \times (1 - 0.10) = 0.9 \times \text{MP}.$$

$$\text{SP} = \text{CP} \times (1 + 0.08) = 1.08 \times \text{CP}.$$

Step 2 – Equate and find the ratio MP:CP:

$$0.9 \times \text{MP} = 1.08 \times \text{CP} \implies \frac{\text{MP}}{\text{CP}} = \frac{1.08}{0.9} = \frac{108}{90} = \frac{6}{5}.$$

$$\text{MP} : \text{CP} = 6 : 5.$$

Why other options are wrong:

- Option B (5:4): Corresponds to $\text{MP}/\text{CP} = 1.25$; would require a different discount/profit combination.
- Option C (5:6): Inverts the ratio; this would imply MP $<$ CP, meaning a loss even before discount.

- Option D (4:3): Ratio ≈ 1.33; corresponds to higher profit or lower discount scenario.

Final Answer: MP : CP $= 6 : 5 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 9

Q10.

Solution

Concept – Average = (Sum of all values) $\div$ (Count of values). To find a removed value, subtract the new total from the original total.

Step 1 – Find the sum of all 5 numbers:

$$\text{Sum of 5 numbers} = \text{Average} \times \text{Count} = 24 \times 5 = 120.$$

Step 2 – Find the sum of the remaining 4 numbers after exclusion:

$$\text{Sum of 4 numbers} = 22 \times 4 = 88.$$

Step 3 – Find the excluded number:

$$\text{Excluded number} = 120 - 88 = 32.$$

Why other options are wrong:

- Option A (28): Would require new average $= (120 - 28)/4 = 23$, not 22.
- Option B (30): Would require new average $= 90/4 = 22.5$, not 22.
- Option C (34): Would require new average $= 86/4 = 21.5$, not 22.

Final Answer: Excluded number $= 32 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 10

Q11.

Solution

Concept – Function composition $f(g(x))$ means: first apply g to get $g(x)$, then apply f to that result.

Step 1 – Evaluate $g(1)$:

$$g(x) = x + 1 \implies g(1) = 1 + 1 = 2.$$

Step 2 – Evaluate $f(g(1)) = f(2)$:

$$f(x) = x^2 - 3x + 2 \implies f(2) = (2)^2 - 3(2) + 2 = 4 - 6 + 2 = 0.$$

Why other options are wrong:

- Option A (-1): Evaluates $f(1)$ directly without applying g first: $f(1) = 1 - 3 + 2 = 0 \neq -1$; or computes $g(f(1))$ instead of $f(g(1))$.
- Option B (1): May compute $f(g(1))$ using $g(1) = 2$ but evaluate $f(2)$ as $4 - 6 + 3 = 1$ (sign error).
- Option D (2): Evaluates $g(g(1)) = g(2) = 3$, or uses $f(0)$ instead.

Final Answer: $f(g(1)) = 0 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 11

Q12.

Solution

Concept – A quadratic $ax^2 + bx + c = 0$ has equal (repeated) roots if and only if its discriminant is zero: $\Delta = b^2 - 4ac = 0$.

Step 1 – Identify coefficients for $4x^2 - 12x + k = 0$:

$$a = 4, \quad b = -12, \quad c = k.$$

Step 2 – Set discriminant to zero and solve for k:

$$\Delta = (-12)^2 - 4(4)(k) = 0 \implies 144 - 16k = 0 \implies k = \frac{144}{16} = 9.$$

Why other options are wrong:

- Option B (6): $16 \times 6 = 96 \neq 144$; incorrect value of k.
- Option C (12): $16 \times 12 = 192 \neq 144$; discriminant would be negative, giving no real roots.
- Option D (4): $16 \times 4 = 64 \neq 144$; discriminant $= 80 > 0$, giving two distinct real roots.

Final Answer: $k = 9 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 12

Q13.

Solution

Concept – The n-th term of a sequence is found from its sum formula by: $a_n = S_n - S_{n-1}$ for $n \geq 2$.

Step 1 – Compute S_{10}:

$$S_{10} = 3(10)^2 + 5(10) = 300 + 50 = 350.$$

Step 2 – Compute S_9:

$$S_9 = 3(9)^2 + 5(9) = 3 \times 81 + 45 = 243 + 45 = 288.$$

Step 3 – Find the 10th term:

$$a_{10} = S_{10} - S_9 = 350 - 288 = 62.$$

Why other options are wrong:

- Option A (56): Computed $S_9 - S_8 = 288 - (3 \times 64 + 40) = 288 - 232 = 56$; this is a_9, not a_{10}.
- Option B (58): Arithmetic error, likely computing $S_{10} - S_9$ with a mistake in S_9.
- Option C (60): Off by 2; possible sign error in $5(9) = 45$ computed as 43.

Final Answer: 10th term $= 62 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 13

Q14.

Solution

Concept – Key logarithm properties: $\log_{10} 1 = 0$ (since $10^0 = 1$), $\log_{10} 10 = 1$ (since $10^1 = 10$), and $\log_{10}(10^k) = k$.

Step 1 – Evaluate each term:

$$\begin{aligned} \log_{10} 1 &= 0 \quad (\text{since } 10^0 = 1), \\ \log_{10} 10 &= 1 \quad (\text{since } 10^1 = 10), \\ \log_{10} 1000 &= \log_{10} 10^3 = 3. \end{aligned}$$

Step 2 – Sum all three values:

$$0 + 1 + 3 = 4.$$

Why other options are wrong:

- Option A (3): Omits $\log_{10} 1 = 0$ conceptually but then computes only $1 + 3 - 1 = 3$ with an error.
- Option C (5): Incorrectly evaluates $\log_{10} 1000$ as 4 instead of 3.
- Option D (6): Evaluates $\log_{10} 1 = 1$ (incorrect) and $\log_{10} 1000 = 4$ (incorrect), giving $1 + 1 + 4 = 6$.

Final Answer: $0 + 1 + 3 = 4 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 14

Q15.

Solution

Concept – Area of an equilateral triangle with side s:

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

The perimeter of an equilateral triangle $= 3s$, so we first find s.

Step 1 – Find the side length from the perimeter:

$$3s = 48 \implies s = 16 \text{ cm}.$$

Step 2 – Calculate the area:

$$A = \frac{\sqrt{3}}{4} \times 16^2 = \frac{\sqrt{3}}{4} \times 256 = 64\sqrt{3}\ \text{cm}^2.$$

Why other options are wrong:

- Option A ($48\sqrt{3}$ cm^2): Uses $s = 16$ but computes $\frac{\sqrt{3}}{4} \times 12^2 = 36\sqrt{3}$, or confuses s with perimeter/4 $= 12$.
- Option B ($56\sqrt{3}$ cm^2): Arithmetic error; no clean derivation gives this value with $s = 16$.
- Option D ($72\sqrt{3}$ cm^2): Uses $s = \frac{48}{2} = 24$ (divides perimeter by 2 instead of 3): $\frac{\sqrt{3}}{4} \times 144 \approx 62.4\sqrt{3}$; or computes $\frac{\sqrt{3}}{4} \times (4+12)^2/2$.

Final Answer: Area $= 64\sqrt{3}$ cm$^2 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 15

Q16.

Solution

Concept – A perpendicular drawn from the centre of a circle to a chord bisects the chord. This creates a right triangle with the radius as hypotenuse, the perpendicular distance as one leg, and the half-chord as the other leg.

Step 1 – Identify the right triangle:

$$r = 10\ \text{cm}, \quad \text{chord} = 16\ \text{cm} \implies \text{half-chord} = 8\ \text{cm}.$$

Step 2 – Apply the Pythagorean theorem:

$$d^2 + 8^2 = 10^2 \implies d^2 = 100 - 64 = 36 \implies d = 6\ \text{cm}.$$

Why other options are wrong:

- Option A (4 cm): $4^2 + 8^2 = 16 + 64 = 80 \neq 100$; incorrect.
- Option B (5 cm): $5^2 + 8^2 = 25 + 64 = 89 \neq 100$; incorrect.
- Option C (8 cm): Confuses the half-chord with the perpendicular distance; if $d = 8$ then $8^2 + 8^2 = 128 \neq 100$.

Final Answer: Distance from centre to chord $= 6$ cm $\Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 16

Q17.

Solution

Concept – Volume of a right pyramid with square base: $V = \frac{1}{3} \times s^2 \times h$, where s is the side of the square base and h is the perpendicular height.

Step 1 – Substitute the known values ($V = 75$ cm^3, $h = 9$ cm):

$$75 = \frac{1}{3} \times s^2 \times 9 = 3s^2.$$

Step 2 – Solve for s:

$$s^2 = \frac{75}{3} = 25 \implies s = \sqrt{25} = 5 \text{ cm}.$$

Why other options are wrong:

- Option B (6 cm): $3 \times 36 = 108 \neq 75$.
- Option C (7 cm): $3 \times 49 = 147 \neq 75$.
- Option D (8 cm): $3 \times 64 = 192 \neq 75$.

Final Answer: Side of square base $= 5$ cm $\Rightarrow \boxed{\text{A}}$

Answer: (A) **Go Back to Q 17**

Q18.

Solution

Concept – The slope of a line through two points (x_1, y_1) and (x_2, y_2) is:

$$m = \frac{y_2 - y_1}{x_2 - x_1}.$$

Step 1 – Identify the coordinates:

$$(x_1, y_1) = (-3, 4), \quad (x_2, y_2) = (5, -2).$$

Step 2 – Compute the slope:

$$m = \frac{-2 - 4}{5 - (-3)} = \frac{-6}{8} = -\frac{3}{4}.$$

Why other options are wrong:

- Option A $(3/4)$: Drops the negative sign; takes absolute value of the slope.
- Option C $(4/3)$: Inverts rise and run: $\frac{8}{6} = \frac{4}{3}$ (positive version of inverted slope).
- Option D $(-4/3)$: Inverts rise and run and keeps the negative sign.

Final Answer: Slope $= -\dfrac{3}{4} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 18

Q19.

Solution

Concept – Volume formulas: Cylinder with base radius r and height h: $V_{\text{cyl}} = \pi r^2 h$. Cone with the same base radius and height: $V_{\text{cone}} = \dfrac{1}{3}\pi r^2 h$.

Step 1 – Write the volumes:

$$V_{\text{cyl}} = \pi r^2 h, \qquad V_{\text{cone}} = \frac{1}{3}\pi r^2 h.$$

Step 2 – Find the ratio:

$$\frac{V_{\text{cyl}}}{V_{\text{cone}}} = \frac{\pi r^2 h}{\frac{1}{3}\pi r^2 h} = 3.$$

$$V_{\text{cyl}} : V_{\text{cone}} = 3 : 1.$$

Why other options are wrong:

- Option A (1:3): Inverts the ratio; this is cone to cylinder, not cylinder to cone.
- Option B (2:3): Incorrect; there is no factor-of-$2/3$ relationship between cylinder and cone volumes.
- Option C (1:2): Based on incorrect formula, perhaps confusing with hemisphere volume.

Final Answer: Cylinder : Cone $= 3 : 1 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q 19

Q20.

Solution

Concept – When specific persons must always be included in a selection, fix those persons and choose the remaining required members from the rest.

Step 1 – Fix the 2 specific persons in the group of 4. We now need to choose $4 - 2 = 2$ more people from the remaining $8 - 2 = 6$ people.

Step 2 – Count the number of ways:

$$\binom{6}{2} = \frac{6!}{2!\,4!} = \frac{6 \times 5}{2 \times 1} = 15.$$

Why other options are wrong:

- Option A (28): Equals $\binom{8}{2} = 28$; selects 2 from all 8 without fixing anyone.
- Option B (20): Equals $\binom{6}{3} = 20$; incorrectly chooses 3 instead of 2 from the remaining 6.
- Option D (10): Equals $\binom{5}{2}$; reduces the remaining pool to 5 instead of 6.

Final Answer: 15 ways $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q 20

Q21.

Solution

Concept – For independent events A and B, $P(A\text{ only}) = P(A) \times P(\bar{B})$ and $P(B\text{ only}) = P(\bar{A}) \times P(B)$, where $\bar{X}$ denotes the complement of event X.

Step 1 – Define probabilities. Let M = passes Maths, S = passes Science:

$$P(M) = \frac{2}{3}, \quad P(\bar{M}) = \frac{1}{3}, \quad P(S) = \frac{3}{4}, \quad P(\bar{S}) = \frac{1}{4}.$$

Step 2 – Compute probability of exactly one subject:

$$P(M\text{ only}) = P(M) \times P(\bar{S}) = \frac{2}{3} \times \frac{1}{4} = \frac{2}{12} = \frac{1}{6}.$$

$$P(S\text{ only}) = P(\bar{M}) \times P(S) = \frac{1}{3} \times \frac{3}{4} = \frac{3}{12} = \frac{1}{4}.$$

$$P(\text{exactly one}) = \frac{1}{6} + \frac{1}{4} = \frac{2}{12} + \frac{3}{12} = \frac{5}{12}.$$

Why other options are wrong:

- Option B $(1/2)$: This is $P(M \text{ or } S) = P(M) + P(S) - P(M \cap S)$ computed incorrectly.
- Option C $(7/12)$: This equals $P(\text{at least one}) = P(M) + P(S) - P(M)P(S) = 2/3 + 3/4 - 1/2 = 11/12$; not $7/12$.
- Option D $(1/4)$: This is only $P(S \text{ only})$; omits $P(M \text{ only})$.

Final Answer: $P(\text{exactly one}) = \dfrac{5}{12} \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q 21

Q22.

Solution

Concept – Classical probability (without replacement): $P = \dfrac{\text{favourable outcomes}}{\text{total outcomes}}$, using combinations for unordered draws.

Step 1 – Total number of ways to draw 2 cards from 52:

$$\binom{52}{2} = \frac{52 \times 51}{2} = 1326.$$

Step 2 – Favourable ways to draw 2 aces (there are 4 aces in the deck):

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

Step 3 – Compute the probability:

$$P = \frac{6}{1326} = \frac{1}{221}.$$

Why other options are wrong:

- Option A $(1/13)$: Uses $\frac{4}{52} = \frac{1}{13}$; probability of drawing one ace, not two.
- Option C $(1/52)$: An incorrect simplification; $\frac{6}{1326} \neq \frac{1}{52} = \frac{6}{312}$.
- Option D $(4/221)$: Uses numerator 4 instead of 6; possibly computes $\frac{4 \times 3}{1326/\text{something}}$ incorrectly.

Final Answer: $P = \dfrac{1}{221} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q 22

Answer Key

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

Quick Reference: Correct Answers

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

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