SAAT Mathematics

Sample Paper – 6

Duration: 40 Minutes **Maximum Marks: 40**

Instructions

- This paper contains **40** Multiple Choice Questions (Single Correct Answer), modelled on the Mathematics section of the **SAAT** (Siksha 'O' Anusandhan Admission Test).
- Each correct answer carries **+1 mark**. There is **no negative marking** for incorrect or unattempted answers.
- Only **one** option is correct. Attempt every question, since wrong answers are not penalised.
- Use of mobile phones, calculators, or other electronic gadgets is strictly prohibited.

Q1. If a set A has 5 elements, then the total number of subsets of A is

(A) 32

(B) 25

(C) 10

(D) 31

Q2. The domain of the real function $f(x) = \dfrac{1}{\sqrt{x-3}}$ is

(A) $[3, \infty)$

(B) $(3, \infty)$

(C) $(-\infty, 3)$

(D) $\mathbb{R} \setminus \{3\}$

Q3. The argument of the complex number $z = 1 + i$ is

(A) $\dfrac{\pi}{6}$

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

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

(D) $\frac{\pi}{2}$

Q4. The value of i^{10}, where $i = \sqrt{-1}$, is

(A) 1

(B) i

(C) $-i$

(D) -1

Q5. The quadratic equation whose roots are 2 and 5 is

(A) $x^2 + 7x + 10 = 0$

(B) $x^2 - 7x + 10 = 0$

(C) $x^2 - 7x - 10 = 0$

(D) $x^2 + 3x + 10 = 0$

Q6. If I is the identity matrix and A is any square matrix of the same order, then AI equals

(A) A

(B) I

(C) O (zero matrix)

(D) A^2

Q7. For the determinant $\begin{vmatrix} 2 & 5 \\ 1 & 3 \end{vmatrix}$, the minor of the element 5 (entry in row 1, column 2) is

(A) 3

(B) 2

(C) 5

(D) 1

Q8. A square matrix A is invertible (non-singular) if and only if

(A) A is symmetric

(B) $A = A^T$

(C) $|A| \neq 0$

(D) $|A| = 0$

Q9. The number of distinct arrangements of all the letters of the word "LEVEL" is

(A) 30

(B) 120

(C) 60

(D) 20

Q10. The value of ${}^7C_3$ is

(A) 21

(B) 35

(C) 42

(D) 70

Q11. In the binomial expansion of $(x + y)^6$, the middle term is the

(A) 2nd term

(B) 3rd term

(C) 4th term

(D) 7th term

Q12. The common difference of the arithmetic progression $7, 11, 15, 19, \ldots$ is

(A) 7

(B) 11

(C) 3

(D) 4

Q13. The geometric mean of the numbers 4 and 9 is

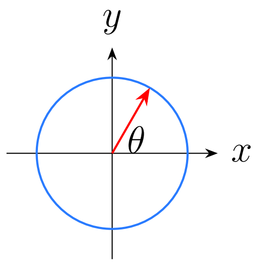
(A) 6

(B) 13

(C) 36

(D) $\frac{13}{2}$

Q14. If $\cos\theta = \frac{1}{2}$, then the value of $\cos 2\theta$, with θ marked on the unit circle below, is



(A) 1

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

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

(D) 0

Q15. The general solution of the trigonometric equation $\tan\theta = 1$ is ($n \in \mathbb{Z}$)

(A) $n\pi + \frac{\pi}{3}$

(B) $2n\pi + \frac{\pi}{4}$

(C) $n\pi + \frac{\pi}{4}$

(D) $n\pi$

Q16. The principal value of $\sin^{-1}(1)$ is

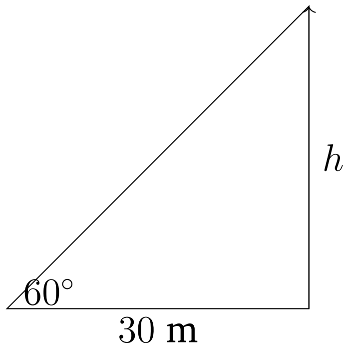
(A) π

(B) 0

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

(D) $\frac{\pi}{2}$

Q17. The angle of elevation of the top of a tower from a point 30 m from its base is 60°, as shown. The height of the tower is



(A) $30\sqrt{3}$ m

(B) 30 m

(C) $15\sqrt{3}$ m

(D) 60 m

Q18. The value of $\lim_{x\to 0} \frac{1-\cos x}{x^2}$ is

(A) 1

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

(C) 0

(D) 2

Q19. The function $f(x) = \frac{x^2-9}{x-3}$ (for $x \neq 3$) has, at $x = 3$, a

(A) jump discontinuity

(B) infinite discontinuity

(C) removable discontinuity

(D) point of differentiability

Q20. At a corner point of a continuous curve, the left-hand derivative and right-hand derivative are unequal; the function at that point is

(A) discontinuous

(B) differentiable

(C) constant

(D) not differentiable

Q21. The derivative of $\sin(x^2)$ with respect to x is

(A) $\cos(x^2)$

(B) $2x\cos(x^2)$

(C) $2x\sin(x^2)$

(D) $\cos(2x)$

Q22. The slope of the normal to the curve $y = x^2$ at the point where $x = 1$ is

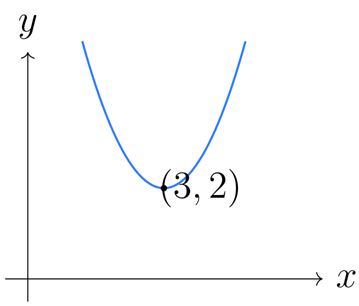
(A) 2

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

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

(D) -2

Q23. The minimum value of the function $f(x) = x^2 - 6x + 11$, whose graph is shown, is



(A) 2

(B) 3

(C) 11

(D) 0

Q24. The value of $\int \sin x \, dx$ is

(A) $\cos x + C$

(B) $\sin x + C$

(C) $-\sin x + C$

(D) $-\cos x + C$

Q25. The value of $\int 2x\,(x^2+1)^3\,dx$ is

(A) $\dfrac{(x^2+1)^3}{3} + C$

(B) $\dfrac{(x^2+1)^4}{4} + C$

(C) $4(x^2+1)^4 + C$

(D) $(x^2+1)^4 + C$

Q26. The value of $\int_0^1 x^2\,dx$ is

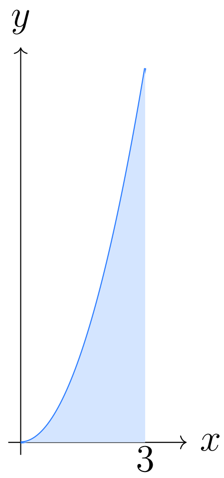
(A) $\dfrac{1}{3}$

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

(C) 1

(D) $\dfrac{2}{3}$

Q27. The area of the shaded region under the curve $y = x^2$ between $x = 0$ and $x = 3$, shown below, is



(A) 6

(B) 27

(C) 9

(D) 3

Q28. The degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^3 + y = 0$ is

(A) 1

(B) 3

(C) 4

(D) 2

Q29. The general solution of the differential equation $\frac{dy}{dx} = x$ is

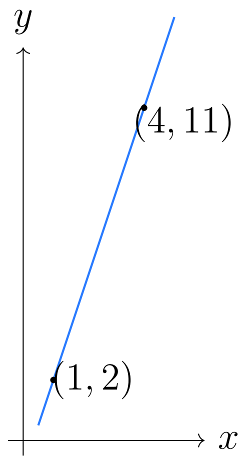
(A) $y = x + C$

(B) $y = \frac{x^2}{2} + C$

(C) $y = Ce^x$

(D) $y = 2x^2 + C$

Q30. The slope of the straight line passing through the points $(1, 2)$ and $(4, 11)$, shown below, is



(A) 3

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

(C) 9

(D) -3

Q31. The distance between the parallel lines $3x+4y-5=0$ and $3x+4y+5=0$ is

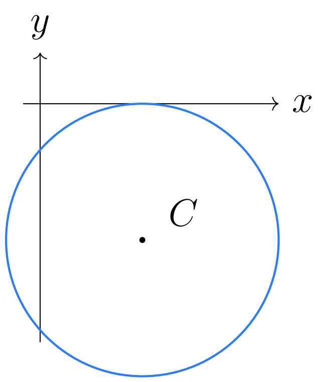
(A) 1

(B) 5

(C) 2

(D) 10

Q32. The centre of the circle $x^2+y^2-6x+8y+9=0$, shown below, is



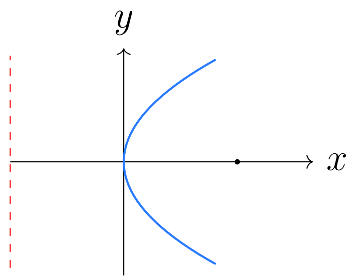
(A) $(-3, 4)$

(B) $(6, -8)$

(C) $(3, 4)$

(D) $(3, -4)$

Q33. The directrix of the parabola $y^2 = 12x$, shown below, is the line



(A) $x = -3$

(B) $x = 3$

(C) $y = -3$

(D) $x = -12$

Q34. The equations of the asymptotes of the hyperbola $\frac{x^2}{9} - \frac{y^2}{16} = 1$ are

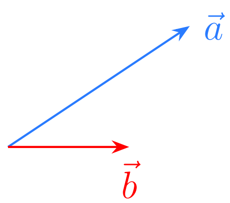
(A) $y = \pm\frac{3}{4}x$

(B) $y = \pm\frac{4}{3}x$

(C) $y = \pm\frac{16}{9}x$

(D) $y = \pm x$

Q35. The scalar projection of $\vec{a} = 3\hat{i} + 4\hat{j}$ on $\vec{b} = \hat{i}$ is



(A) 5

(B) 4

(C) 3

(D) 7

Q36. If $|\vec{a}| = 4$, $|\vec{b}| = 5$ and the angle between $\vec{a}$ and $\vec{b}$ is $30°$, then the area of the parallelogram with adjacent sides $\vec{a}$ and $\vec{b}$ is

(A) 20

(B) $\frac{20}{\sqrt{3}}$

(C) $10\sqrt{3}$

(D) 10

Q37. The midpoint of the line segment joining the points $(2, 4, 6)$ and $(6, 8, 2)$ is

(A) $(4, 6, 4)$

(B) $(8, 12, 8)$

(C) $(2, 2, 2)$

(D) $(4, 4, 4)$

Q38. The median of the data $3, 7, 8, 5, 12, 14, 21, 13, 18$ is

(A) 13

(B) 12

(C) 8

(D) 14

Q39. A fair coin is tossed once. The probability of getting a head is

(A) 1

(B) $\frac{1}{4}$

(C) 0

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

Q40. If $P(A \cap B) = \frac{1}{4}$ and $P(B) = \frac{1}{2}$, then the conditional probability $P(A \mid B)$ is

(A) $\frac{1}{8}$

(B) $\frac{1}{4}$

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

(D) 2

Detailed Solutions

Q1.

Solution

Concept — Number of subsets: A set with n elements has exactly 2^n subsets (each element is either in or out of a subset, giving 2 choices per element).

Step 1 — Write down the count of elements: The set A has $n = 5$ elements.

Step 2 — Write the subset formula: Number of subsets $= 2^n$.

Step 3 — Substitute $n = 5$: Number of subsets $= 2^5$.

Step 4 — Expand the power: $2^5 = 2 \times 2 \times 2 \times 2 \times 2$.

Step 5 — Multiply step by step: $2 \times 2 = 4$; $4 \times 2 = 8$; $8 \times 2 = 16$; $16 \times 2 = 32$.

Step 6 — State the result: Number of subsets $= 32$.

Why other options are wrong: 25 is 5^2 (it squares instead of taking a power of 2); 10 is 2×5 (it multiplies instead of using a power); 31 counts only the proper subsets ($2^5 - 1$), leaving out the set itself.

Final Answer: $2^5 = 32 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q1

Q2.

Solution

Concept — Domain of a function: The domain is the set of all x for which the expression is defined. Two rules apply here: (i) the quantity under a square root must be ≥ 0, and (ii) a denominator can never be 0.

Step 1 — Look at the square root: The expression contains $\sqrt{x-3}$, so we need $x - 3 \geq 0$.

Step 2 — Look at the denominator: The $\sqrt{x-3}$ sits in the denominator, so it cannot be 0; this forces $x - 3 \neq 0$.

Step 3 — Combine the two conditions: Together $x - 3 \geq 0$ and $x - 3 \neq 0$ give $x - 3 > 0$ (strictly greater than 0).

Step 4 — Isolate x: Add 3 to both sides of $x - 3 > 0$.

Step 5 — Solve: $x > 3$.

Step 6 — Write in interval form: $x > 3$ means the interval $(3, \infty)$ (open at 3).

Why other options are wrong: $[3, \infty)$ wrongly includes 3, which makes the denominator 0; $(-\infty, 3)$ gives a negative quantity under the root; $\mathbb{R} \setminus \{3\}$ allows values like $x = 0$ where $x - 3 < 0$.

Final Answer: Domain $= (3, \infty) \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q2

Q3.

Solution

Concept — Argument of a complex number: For $z = a + bi$ lying in the first quadrant (both $a > 0$ and $b > 0$), the argument is $\arg z = \tan^{-1}\left(\frac{b}{a}\right)$.

Step 1 — Write z in the form $a + bi$: $z = 1 + i = 1 + 1 \cdot i$.

Step 2 — Read off a and b: The real part is $a = 1$ and the imaginary part is $b = 1$.

Step 3 — Check the quadrant: Both $a = 1 > 0$ and $b = 1 > 0$, so z is in the first quadrant and the formula applies directly.

Step 4 — Form the ratio $\frac{b}{a}$: $\frac{b}{a} = \frac{1}{1} = 1$.

Step 5 — Take the inverse tangent: $\arg z = \tan^{-1}(1)$.

Step 6 — Evaluate: Since $\tan\frac{\pi}{4} = 1$, we get $\tan^{-1}(1) = \frac{\pi}{4}$.

Why other options are wrong: $\frac{\pi}{6}$ comes from the ratio $\frac{1}{\sqrt{3}}$; $\frac{\pi}{3}$ from $\sqrt{3}$; $\frac{\pi}{2}$ is the argument of a purely imaginary number like i (where $a = 0$).

Final Answer: $\arg z = \frac{\pi}{4} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q3

Q4.

Solution

Concept — Powers of i: The powers of i repeat in a cycle of length 4: $i^1 = i$, $i^2 = -1$, $i^3 = -i$, $i^4 = 1$, then they repeat. So i^n depends only on the remainder when n is divided by 4.

Step 1 — Write the exponent: We want i^{10}, so the exponent is $n = 10$.

Step 2 — Divide the exponent by 4: $10 \div 4 = 2$ with a remainder, since $4 \times 2 = 8$.

Step 3 — Find the remainder: $10 - 8 = 2$, so $10 = 4 \times 2 + 2$.

Step 4 — Replace by the remainder power: Because $i^4 = 1$, we have $i^{10} = (i^4)^2 \cdot i^2 = 1^2 \cdot i^2 = i^2$.

Step 5 — Evaluate i^2: By definition $i = \sqrt{-1}$, so $i^2 = -1$.

Why other options are wrong: 1 matches remainder 0 (i^4); i matches remainder 1; $-i$ matches remainder 3. None of these is the remainder 2 we found.

Final Answer: $i^{10} = -1 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q4

Q5.

Solution

Concept — Equation from its roots: If a quadratic has roots α and β, the equation is $x^2 - (\alpha + \beta)x + (\alpha\beta) = 0$, i.e. $x^2 - (\text{sum})x + (\text{product}) = 0$.

Step 1 — Write down the roots: The roots are $\alpha = 2$ and $\beta = 5$.

Step 2 — Compute the sum of the roots: $\alpha + \beta = 2 + 5 = 7$.

Step 3 — Compute the product of the roots: $\alpha\beta = 2 \times 5 = 10$.

Step 4 — Put the sum into the formula: $x^2 - (7)x + (\text{product}) = 0$.

Step 5 — Put the product into the formula: $x^2 - 7x + 10 = 0$.

Why other options are wrong: $x^2 + 7x + 10 = 0$ flips the sign of the middle term (it should be minus the sum); $x^2 - 7x - 10 = 0$ has the wrong sign on the product; $x^2 + 3x + 10 = 0$ uses a wrong sum.

Final Answer: $x^2 - 7x + 10 = 0 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q5

Q6.

Solution

Concept — Identity matrix: The identity matrix I behaves like the number 1 does for ordinary multiplication. For any square matrix A of the same order, $AI = IA = A$.

Step 1 — Recall the defining property: I has 1's down its main diagonal and 0's elsewhere, so multiplying by it does not change the other matrix.

Step 2 — Apply it to the product AI: Multiplying A on the right by I leaves every entry of A unchanged.

Step 3 — State the result: Therefore $AI = A$.

Why other options are wrong: I would mean A disappears; the zero matrix O would mean the product is all zeros (that is AO, not AI); A^2 would require multiplying A by A, not by I.

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

Answer: (A) Go Back to Q6

Q7.

Solution

Concept — Minor of an element: The minor of an element is the determinant of the smaller matrix left after deleting the row and the column that contain that element.

Step 1 — Locate the element: The element 5 sits in row 1, column 2 of $\begin{vmatrix} 2 & 5 \\ 1 & 3 \end{vmatrix}$.

Step 2 — Delete its row: Removing row 1 $(2 \;\; 5)$ leaves the row $1 \;\; 3$.

Step 3 — Delete its column: From $1 \;\; 3$, removing column 2 (the 3) leaves only the entry 1.

Step 4 — Take the determinant: The determinant of the single entry 1 is just 1.

Why other options are wrong: 3 is the minor of the element 2 (delete row 1, column 1); 2 and 5 are entries of the matrix, not minors.

Final Answer: Minor of 5 is $1 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q7

Q8.

Solution

Concept — Invertibility: A square matrix has an inverse precisely when its determinant is non-zero.

Step 1 — Write the inverse formula: The inverse is $A^{-1} = \dfrac{1}{|A|} \operatorname{adj} A$.

Step 2 — Spot the division by $|A|$: This formula divides by $|A|$, and division is only possible when $|A| \neq 0$.

Step 3 — State the condition: Therefore A is invertible if and only if $|A| \neq 0$.

Why other options are wrong: Symmetry ($A = A^T$) says nothing about whether $|A|$ is zero; $|A| = 0$ is exactly the singular (non-invertible) case, the opposite of what we need.

Final Answer: Invertible iff $|A| \neq 0 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q8

Q9.

Solution

Concept — Arrangements with repetition: The number of distinct arrangements of n objects, where one kind repeats p times and another repeats q times, is $\frac{n!}{p!\,q!}$. We divide by the factorials of the repeats because swapping identical letters gives the same word.

Step 1 — List the letters: "LEVEL" has the letters L, E, V, E, L.

Step 2 — Count the total letters: There are $n = 5$ letters in all.

Step 3 — Count the repeats: L appears 2 times and E appears 2 times (V appears once).

Step 4 — Write the formula: Number of arrangements $= \frac{5!}{2!\,2!}$.

Step 5 — Evaluate $5!$: $5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$.

Step 6 — Evaluate the denominator: $2! = 2$ and $2! = 2$, so $2!\,2! = 2 \times 2 = 4$.

Step 7 — Divide: $\frac{120}{4} = 30$.

Why other options are wrong: 120 is $5!$ alone, ignoring the repeated letters; 60 divides by only one $2!$; 20 does not match any correct count.

Final Answer: 30 arrangements $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q9

Q10.

Solution

Concept — Combinations: The number of ways to choose r items from n is ${}^nC_r = \dfrac{n!}{r!\,(n-r)!}$. A handy short form is $\dfrac{n(n-1)(n-2)\cdots(r\text{ factors})}{r!}$.

Step 1 — Write down n and r: Here $n = 7$ and $r = 3$.

Step 2 — Write the formula: ${}^7C_3 = \dfrac{7!}{3!\,(7-3)!} = \dfrac{7!}{3!\,4!}$.

Step 3 — Cancel using the short form: Take 3 factors on top: ${}^7C_3 = \dfrac{7\times 6\times 5}{3\times 2\times 1}$.

Step 4 — Multiply the numerator: $7 \times 6 = 42$, then $42 \times 5 = 210$.

Step 5 — Multiply the denominator: $3 \times 2 \times 1 = 6$.

Step 6 — Divide: $\dfrac{210}{6} = 35$.

Why other options are wrong: 21 is ${}^7C_2$; 42 is the numerator before dividing fully; 70 is twice the correct value.

Final Answer: ${}^7C_3 = 35 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q10

Q11.

Solution

Concept — Middle term: The expansion of $(x+y)^n$ has $n+1$ terms. When n is even there is exactly one middle term, and its position number is $\dfrac{n}{2} + 1$.

Step 1 — Read off n: Here the power is $n = 6$, which is even.

Step 2 — Count the total terms: The expansion has $n + 1 = 6 + 1 = 7$ terms.

Step 3 — Write the position formula: Middle term number $= \dfrac{n}{2} + 1$.

Step 4 — Substitute $n = 6$: $= \dfrac{6}{2} + 1$.

Step 5 — Compute: $\dfrac{6}{2} = 3$, then $3 + 1 = 4$.

Step 6 — State the result: The middle term is the 4th term.

Why other options are wrong: The 2nd and 3rd terms come before the centre; the 7th term is the last term, not the middle.

Final Answer: The 4th term $\Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q11

Q12.

Solution

Concept — Common difference: In an arithmetic progression each term is found by adding a fixed number d to the previous term, so $d = a_2 - a_1 = a_3 - a_2 = \cdots$.

Step 1 — List the first few terms: $a_1 = 7$, $a_2 = 11$, $a_3 = 15$, $a_4 = 19$.

Step 2 — Subtract consecutive terms: $d = a_2 - a_1 = 11 - 7 = 4$.

Step 3 — Check with another pair: $a_3 - a_2 = 15 - 11 = 4$, and $a_4 - a_3 = 19 - 15 = 4$, so the difference is constant.

Step 4 — State the result: The common difference is $d = 4$.

Why other options are wrong: 7 and 11 are terms of the AP, not the gap between them; 3 comes from an incorrect subtraction.

Final Answer: $d = 4 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q12

Q13.

Solution

Concept — Geometric mean: The geometric mean of two positive numbers a and b is $\sqrt{ab}$ (multiply them, then take the square root).

Step 1 — Write down the numbers: $a = 4$ and $b = 9$.

Step 2 — Write the GM formula: $\text{GM} = \sqrt{ab} = \sqrt{4 \times 9}$.

Step 3 — Multiply inside the root: $4 \times 9 = 36$, so $\text{GM} = \sqrt{36}$.

Step 4 — Take the square root: $\sqrt{36} = 6$ (since $6 \times 6 = 36$).

Why other options are wrong: $\frac{13}{2}$ is the arithmetic mean $\frac{4+9}{2}$; 13 is the sum $4 + 9$; 36 is the product without taking the square root.

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

Answer: (A) Go Back to Q13

Q14.

Solution

Concept — Double-angle formula: One form of the cosine double-angle identity is $\cos 2\theta = 2\cos^2\theta - 1$. This lets us find $\cos 2\theta$ directly from $\cos\theta$.

Step 1 — Write down what is given: $\cos\theta = \dfrac{1}{2}$.

Step 2 — Write the formula: $\cos 2\theta = 2\cos^2\theta - 1$.

Step 3 — Substitute $\cos\theta = \frac{1}{2}$: $\cos 2\theta = 2\left(\dfrac{1}{2}\right)^2 - 1$.

Step 4 — Square the fraction: $\left(\dfrac{1}{2}\right)^2 = \dfrac{1}{4}$, so $\cos 2\theta = 2 \times \dfrac{1}{4} - 1$.

Step 5 — Multiply: $2 \times \dfrac{1}{4} = \dfrac{2}{4} = \dfrac{1}{2}$, so $\cos 2\theta = \dfrac{1}{2} - 1$.

Step 6 — Subtract: $\dfrac{1}{2} - 1 = \dfrac{1}{2} - \dfrac{2}{2} = -\dfrac{1}{2}$.

Why other options are wrong: 1 would need $\theta = 0$; $\frac{1}{2}$ drops the -1 in the formula; 0 does not result from any correct step.

Final Answer: $\cos 2\theta = -\dfrac{1}{2} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q14

Q15.

Solution

Concept — General solution of $\tan\theta = k$: Because $\tan$ repeats every π, the full solution is $\theta = n\pi + \alpha$, where α is any angle with $\tan\alpha = k$ and n is any integer.

Step 1 — Write the equation: We are solving $\tan\theta = 1$.

Step 2 — Find the principal angle α: We need an angle whose tangent is 1. Since $\tan\dfrac{\pi}{4} = 1$, we take $\alpha = \dfrac{\pi}{4}$.

Step 3 — Apply the general-solution rule: Replace α in $\theta = n\pi + \alpha$.

Step 4 — Write the answer: $\theta = n\pi + \dfrac{\pi}{4}$, $n \in \mathbb{Z}$.

Why other options are wrong: $n\pi + \frac{\pi}{3}$ uses $\alpha = \frac{\pi}{3}$ (whose tangent is $\sqrt{3}$, not 1); $2n\pi + \frac{\pi}{4}$ wrongly uses the period 2π of sine/cosine instead of π; $n\pi$ gives $\tan\theta = 0$.

Final Answer: $\theta = n\pi + \dfrac{\pi}{4} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q15

Q16.

Solution

Concept — Principal value of $\sin^{-1}$: The function $\sin^{-1}$ returns the unique angle in the range $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ whose sine equals the given value.

Step 1 — State what we need: We want the angle θ in $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ with $\sin\theta = 1$.

Step 2 — Find the angle: Recall $\sin\frac{\pi}{2} = 1$, and $\frac{\pi}{2}$ lies in the allowed range.

Step 3 — Conclude: Therefore $\sin^{-1}(1) = \frac{\pi}{2}$.

Why other options are wrong: π is outside the principal range; 0 gives $\sin 0 = 0$; $\frac{\pi}{4}$ gives $\sin\frac{\pi}{4} = \frac{1}{\sqrt{2}}$, not 1.

Final Answer: $\sin^{-1}(1) = \frac{\pi}{2} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q16

Q17.

Solution

Concept — Angle of elevation: In the right triangle formed by the tower, the ground and the line of sight, $\tan(\text{elevation angle}) = \dfrac{\text{opposite}}{\text{adjacent}} = \dfrac{\text{height}}{\text{base distance}}$.

Step 1 — List the known quantities: The base distance is 30 m and the elevation angle is $60°$; let the height be h.

Step 2 — Write the tangent relation: $\tan 60° = \dfrac{h}{30}$.

Step 3 — Substitute the value of $\tan 60°$: Since $\tan 60° = \sqrt{3}$, we get $\sqrt{3} = \dfrac{h}{30}$.

Step 4 — Isolate h: Multiply both sides by 30: $h = 30 \times \sqrt{3}$.

Step 5 — Write the height: $h = 30\sqrt{3}$ m.

Why other options are wrong: 30 m would need $\tan = 1$ (a $45°$ angle); $15\sqrt{3}$ halves the distance by mistake; 60 m does not follow from the relation.

Final Answer: Height $= 30\sqrt{3}$ m $\Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q17

Q18.

Solution

Concept — Reducing to a known limit: We use the half-angle identity $1-\cos x = 2\sin^2\frac{x}{2}$ together with the standard limit $\lim_{u\to 0}\frac{\sin u}{u} = 1$.

Step 1 — Replace the numerator: Using $1-\cos x = 2\sin^2\frac{x}{2}$, the expression becomes $\frac{2\sin^2(x/2)}{x^2}$.

Step 2 — Rewrite x^2 to match the angle $x/2$: Write $x = 2\cdot\frac{x}{2}$, so $x^2 = 4\left(\frac{x}{2}\right)^2$. The expression becomes $\frac{2\sin^2(x/2)}{4\,(x/2)^2}$.

Step 3 — Pull out the constant: $= \frac{2}{4}\cdot\frac{\sin^2(x/2)}{(x/2)^2} = \frac{1}{2}\left(\frac{\sin(x/2)}{x/2}\right)^2$.

Step 4 — Take the limit as $x\to 0$: As $x\to 0$, $\frac{x}{2}\to 0$, so $\frac{\sin(x/2)}{x/2}\to 1$.

Step 5 — Substitute the limit: $= \frac{1}{2}\times(1)^2 = \frac{1}{2}$.

Why other options are wrong: 1, 0 and 2 all come from misapplying the standard limit or forgetting the factor $\frac{1}{2}$.

Final Answer: The limit $= \frac{1}{2} \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q18

Q19.

Solution

Concept — Removable discontinuity: A discontinuity at a point is removable if the function is undefined there but has a finite limit, which usually happens when a common factor cancels.

Step 1 — Factor the numerator: x^2-9 is a difference of squares, so $x^2-9 = (x-3)(x+3)$.

Step 2 — Write the function with the factored form: $f(x) = \frac{(x-3)(x+3)}{x-3}$.

Step 3 — Cancel the common factor: For $x\neq 3$ the factor $(x-3)$ cancels, leaving $f(x) = x+3$.

Step 4 — Take the limit at $x = 3$: $\lim_{x\to 3}(x+3) = 3+3 = 6$, which is finite.

Step 5 — Check the value at $x = 3$: The original f has $x - 3$ in the denominator, so $f(3)$ is undefined ($\frac{0}{0}$).

Step 6 — Classify: A finite limit but no defined value means the gap can be filled by defining $f(3) = 6$; this is a removable discontinuity.

Why other options are wrong: There is no jump (the one-sided limits agree) and no infinite blow-up; the function is not even defined at 3, so it cannot be differentiable there.

Final Answer: Removable discontinuity $\Rightarrow \boxed{C}$

Answer: (C) Go Back to Q19

Q20.

Solution

Concept — Differentiability at a corner: A function is differentiable at a point only when its left-hand derivative equals its right-hand derivative. If the two one-sided derivatives are different, the derivative does not exist there.

Step 1 — Read the given information: The curve is continuous, but at the corner the left-hand derivative and the right-hand derivative are unequal.

Step 2 — Picture an example: The graph of $|x|$ at $x = 0$ has slope -1 from the left and $+1$ from the right; these differ.

Step 3 — Apply the differentiability test: Since the two one-sided derivatives are not equal, the derivative fails to exist at that point.

Step 4 — Conclude: The function is continuous there but not differentiable.

Why other options are wrong: It is stated to be continuous, so "discontinuous" is wrong; unequal one-sided slopes rule out "differentiable"; a corner is not necessarily a flat "constant" piece.

Final Answer: Not differentiable $\Rightarrow \boxed{D}$

Answer: (D) Go Back to Q20

Q21.

Solution

Concept — Chain rule: To differentiate a composite function, $\frac{d}{dx}f(g(x)) = f'(g(x)) \cdot g'(x)$: differentiate the outer function (keeping the inside unchanged), then multiply by the derivative of the inside.

Step 1 — Identify outer and inner functions: The outer function is $\sin(\,\cdot\,)$ and the inner function is $u = x^2$.

Step 2 — Differentiate the outer function: $\frac{d}{du}\sin u = \cos u = \cos(x^2)$.

Step 3 — Differentiate the inner function: $\frac{du}{dx} = \frac{d}{dx}(x^2) = 2x$.

Step 4 — Multiply the two results: $\frac{d}{dx}\sin(x^2) = \cos(x^2) \cdot 2x$.

Step 5 — Write neatly: $= 2x\cos(x^2)$.

Why other options are wrong: $\cos(x^2)$ forgets to multiply by the inner derivative $2x$; $2x\sin(x^2)$ keeps $\sin$ instead of changing it to $\cos$; $\cos(2x)$ wrongly differentiates the argument inside the cosine.

Final Answer: $2x\cos(x^2) \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q21

Q22.

Solution

Concept — Slope of the normal: The normal is perpendicular to the tangent, so its slope is the negative reciprocal of the tangent slope: normal slope $= -\frac{1}{\text{tangent slope}}$.

Step 1 — Differentiate the curve: For $y = x^2$, $\frac{dy}{dx} = 2x$.

Step 2 — Evaluate at $x = 1$: Tangent slope $= 2(1) = 2$.

Step 3 — Take the negative reciprocal: Normal slope $= -\frac{1}{2}$.

Why other options are wrong: 2 is the tangent slope itself; $\frac{1}{2}$ forgets the minus sign; -2 uses the negative without taking the reciprocal.

Final Answer: Normal slope $= -\frac{1}{2} \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q22

Q23.

Solution

Concept — Minimum value of a parabola: For an upward parabola, completing the square as $(x-h)^2+k$ shows the minimum value is k, reached at $x = h$ (because a square is never negative).

Step 1 — Write the function: $f(x) = x^2 - 6x + 11$.

Step 2 — Take half the coefficient of x: The coefficient of x is -6; half of it is -3, and $(-3)^2 = 9$.

Step 3 — Add and subtract 9: $f(x) = (x^2 - 6x + 9) - 9 + 11$.

Step 4 — Write the perfect square: $x^2-6x+9 = (x-3)^2$, so $f(x) = (x-3)^2-9+11$.

Step 5 — Simplify the constants: $-9 + 11 = 2$, so $f(x) = (x - 3)^2 + 2$.

Step 6 — Find the minimum: The smallest value of $(x - 3)^2$ is 0 (at $x = 3$), so $f_{\min} = 0 + 2 = 2$.

Why other options are wrong: 11 is $f(0)$, not the minimum; 3 is the x-value where the minimum occurs, not the minimum itself; 0 ignores the added constant 2.

Final Answer: Minimum value $= 2 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q23

Q24.

Solution

Concept — Standard integral of $\sin x$: Integration reverses differentiation, so we look for a function whose derivative is $\sin x$.

Step 1 — Recall the derivative of $\cos x$: $\dfrac{d}{dx}(\cos x) = -\sin x$.

Step 2 — Flip the sign to get $\sin x$: Therefore $\dfrac{d}{dx}(-\cos x) = -(-\sin x) = \sin x$.

Step 3 — Write the antiderivative: Since differentiating $-\cos x$ gives $\sin x$, we have $\displaystyle\int \sin x\, dx = -\cos x + C$.

Step 4 — Add the constant: The $+C$ accounts for any constant that vanishes when differentiating.

Why other options are wrong: $\cos x$ has the wrong sign (its derivative is $-\sin x$); $\sin x$ and $-\sin x$ are not antiderivatives of $\sin x$.

Final Answer: $-\cos x + C \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q24

Q25.

Solution

Concept — Integration by substitution: If part of the integrand is the derivative of another part, set that inner part as u to simplify the integral.

Step 1 — Choose the substitution: Let $u = x^2 + 1$.

Step 2 — Differentiate u: $\dfrac{du}{dx} = 2x$, so $du = 2x\,dx$.

Step 3 — Spot the match in the integral: The integrand $2x\,(x^2+1)^3\,dx$ contains exactly $(x^2+1)^3 \cdot (2x\,dx) = u^3\,du$.

Step 4 — Rewrite the integral in u: $\displaystyle\int 2x\,(x^2+1)^3\,dx = \int u^3\,du$.

Step 5 — Integrate the power: $\displaystyle\int u^3\,du = \frac{u^{3+1}}{3+1} + C = \frac{u^4}{4} + C$.

Step 6 — Substitute $u = x^2 + 1$ back: $= \dfrac{(x^2+1)^4}{4} + C$.

Why other options are wrong: The option with power 3 skips the integration; $4(x^2+1)^4$ multiplies by 4 instead of dividing by 4; the last option drops the $\frac{1}{4}$ factor.

Final Answer: $\dfrac{(x^2+1)^4}{4} + C \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q25

Q26.

Solution

Concept — Definite integral of a power: Use the power rule $\displaystyle\int x^n\,dx = \frac{x^{n+1}}{n+1}$, then evaluate the antiderivative at the upper limit minus the lower limit.

Step 1 — Integrate x^2: With $n = 2$, $\displaystyle\int x^2\,dx = \frac{x^{2+1}}{2+1} = \frac{x^3}{3}$.

Step 2 — Write with limits: $\displaystyle\int_0^1 x^2\,dx = \left[\frac{x^3}{3}\right]_0^1$.

Step 3 — Plug in the upper limit: At $x = 1$: $\dfrac{1^3}{3} = \dfrac{1}{3}$.

Step 4 — Plug in the lower limit: At $x = 0$: $\frac{0^3}{3} = 0$.

Step 5 — Subtract: $\frac{1}{3} - 0 = \frac{1}{3}$.

Why other options are wrong: 1 forgets to divide by 3; $\frac{1}{2}$ integrates x instead of x^2; $\frac{2}{3}$ is twice the answer.

Final Answer: The integral $= \frac{1}{3} \Rightarrow \boxed{A}$

Answer: (A) Go Back to Q26

Q27.

Solution

Concept — Area under a curve: The area between $y = f(x)$ and the x-axis from $x = a$ to $x = b$ is $\int_a^b f(x)\,dx$.

Step 1 — Set up the integral: Area $= \int_0^3 x^2\,dx$.

Step 2 — Integrate x^2: $\int x^2\,dx = \frac{x^3}{3}$, so Area $= \left[\frac{x^3}{3}\right]_0^3$.

Step 3 — Plug in the upper limit: At $x = 3$: $\frac{3^3}{3} = \frac{27}{3}$.

Step 4 — Plug in the lower limit: At $x = 0$: $\frac{0^3}{3} = 0$.

Step 5 — Subtract: $\frac{27}{3} - 0 = \frac{27}{3} = 9$.

Why other options are wrong: 27 is 3^3 without dividing by 3; 6 and 3 come from using wrong limits.

Final Answer: Area $= 9 \Rightarrow \boxed{C}$

Answer: (C) Go Back to Q27

Q28.

Solution

Concept — Degree of a differential equation: Once the equation is free of radicals and fractions involving derivatives, the degree is the power (exponent) of the highest-order derivative present.

Step 1 — Check the form: The equation $\left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^3 + y = 0$ already has no radicals or derivative fractions.

Step 2 — Find the highest-order derivative: The orders present are 2 (from $\frac{d^2y}{dx^2}$) and 1 (from $\frac{dy}{dx}$); the highest order is 2, so the highest-order derivative is $\frac{d^2y}{dx^2}$.

Step 3 — Read its exponent: The term $\left(\frac{d^2y}{dx^2}\right)^2$ shows this derivative raised to the power 2.

Step 4 — State the degree: Therefore the degree is 2.

Why other options are wrong: 1 ignores the square; 3 is the power of the first-order derivative (which is not the highest order); 4 does not arise from any correct reading of the equation.

Final Answer: Degree $= 2 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q28

Q29.

Solution

Concept — Direct integration: When $\frac{dy}{dx}$ is given purely as a function of x, integrate both sides with respect to x to recover y.

Step 1 — Write the equation: $\frac{dy}{dx} = x$.

Step 2 — Integrate both sides: $y = \int x\,dx$.

Step 3 — Apply the power rule: With $n = 1$, $\int x\,dx = \frac{x^{1+1}}{1+1} = \frac{x^2}{2}$.

Step 4 — Add the constant: $y = \frac{x^2}{2} + C$, the general solution.

Why other options are wrong: $y = x + C$ would integrate a constant, not x; $y = Ce^x$ solves $\frac{dy}{dx} = y$; $y = 2x^2 + C$ has the wrong coefficient (it should be $\frac{1}{2}$, not 2).

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

Answer: (B) Go Back to Q29

Q30.

Solution

Concept — Slope from two points: The slope of the line through (x_1, y_1) and (x_2, y_2) is $m = \dfrac{y_2 - y_1}{x_2 - x_1}$ (rise over run).

Step 1 — Label the points: $(x_1, y_1) = (1, 2)$ and $(x_2, y_2) = (4, 11)$.

Step 2 — Write the formula: $m = \dfrac{y_2 - y_1}{x_2 - x_1}$.

Step 3 — Substitute the values: $m = \dfrac{11 - 2}{4 - 1}$.

Step 4 — Compute the numerator: $11 - 2 = 9$.

Step 5 — Compute the denominator: $4 - 1 = 3$.

Step 6 — Divide: $m = \dfrac{9}{3} = 3$.

Why other options are wrong: $\frac{1}{3}$ inverts the ratio (run over rise); 9 uses only the numerator; -3 has the wrong sign.

Final Answer: Slope $= 3 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q30

Q31.

Solution

Concept — Distance between parallel lines: For two parallel lines $ax + by + c_1 = 0$ and $ax + by + c_2 = 0$ (same a, b), the distance is $d = \dfrac{|c_1 - c_2|}{\sqrt{a^2 + b^2}}$.

Step 1 — Read the coefficients: From $3x + 4y - 5 = 0$ and $3x + 4y + 5 = 0$, $a = 3$, $b = 4$, $c_1 = -5$, $c_2 = 5$.

Step 2 — Write the formula: $d = \dfrac{|c_1 - c_2|}{\sqrt{a^2 + b^2}}$.

Step 3 — Compute the numerator: $|c_1 - c_2| = |-5 - 5| = |-10| = 10$.

Step 4 — Compute inside the root: $a^2 + b^2 = 3^2 + 4^2 = 9 + 16 = 25$.

Step 5 — Take the square root: $\sqrt{25} = 5$.

Step 6 — Divide: $d = \dfrac{10}{5} = 2$.

Why other options are wrong: 1 halves the answer wrongly; 5 is just the denominator $\sqrt{a^2 + b^2}$; 10 is the numerator without dividing.

Final Answer: Distance $= 2 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q31

Q32.

Solution

Concept — Centre of a circle: The general circle $x^2 + y^2 + 2gx + 2fy + c = 0$ has centre $(-g, -f)$. So we match the given equation to this form to read off g and f.

Step 1 — Match the x-term: The given equation has $-6x$, and the general form has $2gx$, so $2g = -6$.

Step 2 — Solve for g: $g = \dfrac{-6}{2} = -3$.

Step 3 — Match the y-term: The given equation has $+8y$, and the general form has $2fy$, so $2f = 8$.

Step 4 — Solve for f: $f = \dfrac{8}{2} = 4$.

Step 5 — Write the centre: Centre $= (-g, -f) = (-(-3), -(4)) = (3, -4)$.

Why other options are wrong: $(-3, 4)$ uses (g, f) without flipping the signs; $(6, -8)$ forgets to halve $2g$ and $2f$; $(3, 4)$ has the wrong sign on the y-coordinate.

Final Answer: Centre $= (3, -4) \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q32

Q33.

Solution

Concept — Directrix of $y^2 = 4ax$: For the standard right-opening parabola $y^2 = 4ax$, the directrix is the vertical line $x = -a$ (and the focus is at $x = +a$).

Step 1 — Compare with the standard form: Match $y^2 = 12x$ with $y^2 = 4ax$, so $4a = 12$.

Step 2 — Solve for a: $a = \dfrac{12}{4} = 3$.

Step 3 — Write the directrix: The directrix is $x = -a = -3$.

Why other options are wrong: $x = 3$ is the focus side, not the directrix; $y = -3$ uses the wrong axis (the directrix here is vertical); $x = -12$ wrongly uses $4a$ instead of a.

Final Answer: Directrix $x = -3 \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q33

Q34.

Solution

Concept — Asymptotes of a hyperbola: For $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$, the asymptotes are the two lines $y = \pm\frac{b}{a}x$.

Step 1 — Read off a^2 and b^2: Comparing $\frac{x^2}{9} - \frac{y^2}{16} = 1$ gives $a^2 = 9$ and $b^2 = 16$.

Step 2 — Take square roots: $a = \sqrt{9} = 3$ and $b = \sqrt{16} = 4$.

Step 3 — Form the ratio $\frac{b}{a}$: $\frac{b}{a} = \frac{4}{3}$.

Step 4 — Write the asymptotes: $y = \pm\frac{4}{3}x$.

Why other options are wrong: $\pm\frac{3}{4}x$ uses $\frac{a}{b}$ (the ratio inverted); $\pm\frac{16}{9}x$ uses $\frac{b^2}{a^2}$ without taking square roots; $\pm x$ ignores the actual values of a and b.

Final Answer: $y = \pm\frac{4}{3}x \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q34

Q35.

Solution

Concept — Scalar projection: The scalar projection of $\vec{a}$ onto $\vec{b}$ is $\frac{\vec{a}\cdot\vec{b}}{|\vec{b}|}$.

Step 1 — Write the components: $\vec{a} = 3\hat{\imath} + 4\hat{\jmath}$ and $\vec{b} = 1\hat{\imath} + 0\hat{\jmath}$.

Step 2 — Compute the dot product: $\vec{a}\cdot\vec{b} = (3)(1) + (4)(0) = 3 + 0 = 3$.

Step 3 — Compute $|\vec{b}|$: $|\vec{b}| = \sqrt{1^2 + 0^2} = \sqrt{1} = 1$.

Step 4 — Divide: Projection $= \frac{3}{1} = 3$.

Why other options are wrong: 5 is the magnitude $|\vec{a}| = \sqrt{3^2 + 4^2}$; 4 is the $\hat{\jmath}$-component of $\vec{a}$; 7 wrongly adds the two components $3 + 4$.

Final Answer: Projection $= 3 \Rightarrow \boxed{\text{C}}$

Answer: (C) Go Back to Q35

Q36.

Solution

Concept — Area of a parallelogram: If two adjacent sides are vectors $\vec{a}$ and $\vec{b}$, the area is $|\vec{a} \times \vec{b}| = |\vec{a}|\,|\vec{b}|\,\sin\theta$, where θ is the angle between them.

Step 1 — List the given values: $|\vec{a}| = 4$, $|\vec{b}| = 5$, $\theta = 30^\circ$.

Step 2 — Write the formula: Area $= |\vec{a}|\,|\vec{b}|\,\sin\theta$.

Step 3 — Substitute: Area $= 4 \times 5 \times \sin 30^\circ$.

Step 4 — Put in $\sin 30^\circ$: Since $\sin 30^\circ = \dfrac{1}{2}$, Area $= 4 \times 5 \times \dfrac{1}{2}$.

Step 5 — Multiply the magnitudes: $4 \times 5 = 20$, so Area $= 20 \times \dfrac{1}{2}$.

Step 6 — Multiply by $\frac{1}{2}$: $20 \times \dfrac{1}{2} = 10$.

Why other options are wrong: 20 would use $\sin 90^\circ = 1$; $\frac{20}{\sqrt{3}}$ and $10\sqrt{3}$ come from using $\tan$ or $\cos$ instead of $\sin$.

Final Answer: Area $= 10 \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q36

Q37.

Solution

Concept — Midpoint in 3D: The midpoint of the segment joining (x_1, y_1, z_1) and (x_2, y_2, z_2) is found by averaging each coordinate: $\left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2}, \dfrac{z_1 + z_2}{2}\right)$.

Step 1 — Label the points: $(x_1, y_1, z_1) = (2, 4, 6)$ and $(x_2, y_2, z_2) = (6, 8, 2)$.

Step 2 — Average the x-coordinates: $\dfrac{2+6}{2} = \dfrac{8}{2} = 4$.

Step 3 — Average the y-coordinates: $\dfrac{4+8}{2} = \dfrac{12}{2} = 6$.

Step 4 — Average the z-coordinates: $\dfrac{6+2}{2} = \dfrac{8}{2} = 4$.

Step 5 — Write the midpoint: $(4, 6, 4)$.

Why other options are wrong: $(8, 12, 8)$ is the sum of coordinates without halving; $(2, 2, 2)$ and $(4, 4, 4)$ do not come from averaging the given coordinates correctly.

Final Answer: Midpoint $= (4, 6, 4) \Rightarrow \boxed{\text{A}}$

Answer: (A) Go Back to Q37

Q38.

Solution

Concept — Median: First arrange the data in increasing order. For an odd number n of values, the median is the value at position $\frac{n+1}{2}$.

Step 1 — Sort the data: Arranging $3, 7, 8, 5, 12, 14, 21, 13, 18$ in increasing order gives $3, 5, 7, 8, 12, 13, 14, 18, 21$.

Step 2 — Count the values: There are $n = 9$ values, which is odd.

Step 3 — Find the middle position: Position $= \frac{n+1}{2} = \frac{9+1}{2} = \frac{10}{2} = 5$.

Step 4 — Read the 5th value: Counting 3(1st), 5(2nd), 7(3rd), 8(4th), 12(5th), the 5th value is 12.

Why other options are wrong: 13 (6th) and 14 (7th) are past the centre; 8 is the 4th value, just before the centre.

Final Answer: Median $= 12 \Rightarrow \boxed{\text{B}}$

Answer: (B) Go Back to Q38

Q39.

Solution

Concept — Classical probability: When all outcomes are equally likely, $P(\text{event}) = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$.

Step 1 — List all outcomes: A single coin toss has the outcomes $\{\text{Head}, \text{Tail}\}$, so the total number of outcomes is 2.

Step 2 — Count favourable outcomes: "Getting a head" is satisfied by exactly 1 outcome (Head).

Step 3 — Apply the formula: $P(\text{head}) = \frac{\text{favourable}}{\text{total}} = \frac{1}{2}$.

Why other options are wrong: 1 means a certain event; $\frac{1}{4}$ is the probability of two heads in two tosses; 0 means an impossible event.

Final Answer: $P(\text{head}) = \frac{1}{2} \Rightarrow \boxed{\text{D}}$

Answer: (D) Go Back to Q39

Q40.

Solution

Concept — Conditional probability: The probability of A given that B has occurred is $P(A \mid B) = \dfrac{P(A \cap B)}{P(B)}$.

Step 1 — List the given values: $P(A \cap B) = \dfrac{1}{4}$ and $P(B) = \dfrac{1}{2}$.

Step 2 — Write the formula: $P(A \mid B) = \dfrac{P(A \cap B)}{P(B)}$.

Step 3 — Substitute the values: $P(A \mid B) = \dfrac{1/4}{1/2}$.

Step 4 — Divide fractions by multiplying by the reciprocal: $\dfrac{1/4}{1/2} = \dfrac{1}{4} \times \dfrac{2}{1}$.

Step 5 — Multiply: $\dfrac{1}{4} \times \dfrac{2}{1} = \dfrac{2}{4}$.

Step 6 — Simplify: $\dfrac{2}{4} = \dfrac{1}{2}$.

Why other options are wrong: $\frac{1}{8}$ comes from multiplying the two probabilities; $\frac{1}{4}$ is just $P(A \cap B)$; 2 flips the fraction the wrong way.

Final Answer: $P(A \mid B) = \dfrac{1}{2} \Rightarrow \boxed{C}$

Answer: (C) Go Back to Q40

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	2	B	3	C	4	D	5	B
6	A	7	D	8	C	9	A	10	B
11	C	12	D	13	A	14	B	15	C
16	D	17	A	18	B	19	C	20	D
21	B	22	C	23	A	24	D	25	B
26	A	27	C	28	D	29	B	30	A
31	C	32	D	33	A	34	B	35	C
36	D	37	A	38	B	39	D	40	C