GUJCET Mathematics

Sample Paper – 4

Duration: 60 Minutes **Maximum Marks: 40**

Instructions

- This paper contains **40** Multiple Choice Questions (Single Correct Answer), modelled on the Mathematics portion of **GUJCET** entrance.
- Each correct answer carries **+1 mark**. There is a **negative marking of** -0.25 **mark** for each incorrect answer. Unattempted questions carry no penalty.
- Only **one** option is correct. Choose carefully.
- Syllabus level: **Class 12 NCERT (80%) + Class 11 NCERT/GSEB (20%) — Calculus, Algebra, Vectors, 3D Geometry, Probability, Coordinate Geometry, and more.**
- Use of mobile phones, calculators, log tables, or any electronic gadgets is strictly prohibited. Rough work may be done in the space provided on the answer sheet.

Q1. Which of the following statements about a non-empty set S and its relations is **CORRECT**?

(A) The identity relation $I_S = \{(a,a) : a \in S\}$ is reflexive, symmetric, and transitive (an equivalence relation).

(B) The void (empty) relation on S is always an equivalence relation.

(C) The universal relation $U = S \times S$ is not symmetric.

(D) The identity relation is transitive but not reflexive.

Q2. A binary operation $*$ on $\mathbb{R} \setminus \{0\}$ is defined by

$$a * b = \frac{2ab}{a+b}.$$

Which of the following is TRUE?

(A) $*$ is associative but not commutative.

(B) $*$ is commutative but not associative.

(C) $*$ is both commutative and associative.

(D) $*$ is neither commutative nor associative.

Q3. The domain of the function $f(x) = \sec^{-1}(2x - 1)$ is:

(A) $[-1, 1]$

(B) $(0, 1)$

(C) $(-\infty, 0] \cup [1, +\infty)$

(D) $[0, 1] \cup [2, +\infty)$

Q4. If $2\tan^{-1}\left(\frac{1}{3}\right) = \sin^{-1}(k)$, the value of k is:

(A) $\frac{4}{5}$

(B) $\frac{5}{13}$

(C) $\frac{2}{3}$

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

Q5. If $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ and $B = \begin{pmatrix} 5 & 6 \\ 7 & 8 \end{pmatrix}$, the matrix X satisfying $2X + A = B$ is:

(A) $\begin{pmatrix} 2 & 2 \\ 2 & 2 \end{pmatrix}$

(B) $\begin{pmatrix} 3 & 4 \\ 5 & 6 \end{pmatrix}$

(C) $\begin{pmatrix} 2 & 2 \\ 3 & 3 \end{pmatrix}$

(D) $\begin{pmatrix} 1 & 1 \\ 2 & 2 \end{pmatrix}$

Q6. The *trace* of a square matrix is the sum of its main-diagonal entries. The trace of $A = \begin{pmatrix} 3 & -1 & 2 \\ 0 & 5 & -3 \\ 1 & 4 & 7 \end{pmatrix}$ is:

(A) 10

(B) 15

(C) 12

(D) 18

Q7. Using the inverse-matrix method, the solution (x, y) of the system $x+y = 5,\ 2x - y = 4$ is:

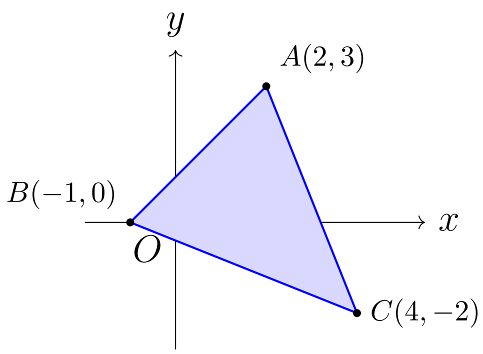
(A) (2, 3)

(B) (1, 4)

(C) (3, 2)

(D) (4, 1)

Q8.



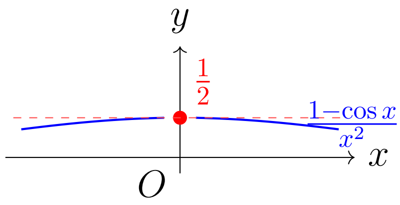
Using the determinant formula Area $= \dfrac{1}{2}\left|\det\begin{pmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{pmatrix}\right|$, the area of $\triangle ABC$ with $A(2,3)$, $B(-1,0)$, $C(4,-2)$ (in sq. units) is:

(A) $\dfrac{15}{2}$

(B) 9

(C) 12

(D) $\frac{21}{2}$



Q9. The value of $\lim_{x\to 0} \frac{1-\cos x}{x^2}$ is:

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

(B) 1

(C) 0

(D) 2

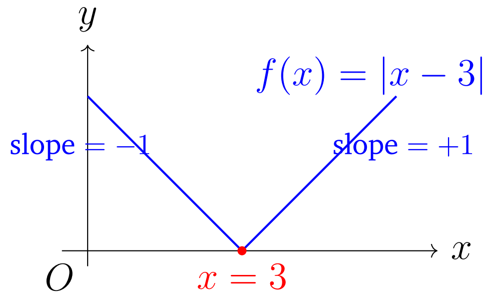
Q10. The value of $\lim_{x\to 4} \frac{\sqrt{x}-2}{x-4}$ is:

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

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

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

(D) 0



Q11. Consider $f(x) = |x-3|$. Which of the following is TRUE?

(A) f is both differentiable and continuous at $x = 3$.

(B) f is differentiable at $x = 3$ but not continuous there.

(C) f is continuous at $x = 3$ but not differentiable there.

(D) f is neither continuous nor differentiable at $x = 3$.

Q12. If $y = x^{\sin x}$, then $\frac{dy}{dx}$ equals:

(A) $x^{\sin x} \cdot \cos x \cdot \ln x$

(B) $(\sin x)\, x^{\sin x - 1}$

(C) $x^{\sin x}\left(\cos x + \frac{\sin x}{x}\right)$

(D) $x^{\sin x}\left(\cos x \ln x + \frac{\sin x}{x}\right)$

Q13. If $y = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$ for $|x| < 1$, then $\frac{dy}{dx}$ equals:

(A) $\frac{2}{1+x^2}$

(B) $\frac{1}{1+x^2}$

(C) $\frac{2x}{1+x^2}$

(D) $\frac{-2}{1+x^2}$

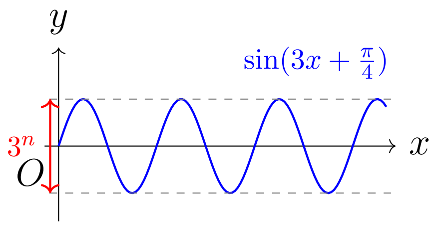
Q14. Rolle's theorem is applicable to $f(x) = x^2 - 4x + 3$ on $[1,\ 3]$. The value of $c \in (1, 3)$ such that $f'(c) = 0$ is:

(A) 1

(B) 2

(C) 3

(D) 4

Q15. 

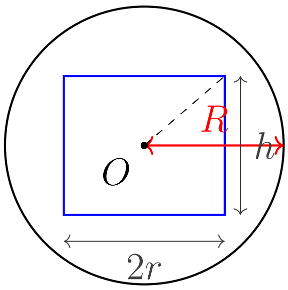
The n-th derivative $D^n\left[\sin\left(3x+\frac{\pi}{4}\right)\right]$ is:

(A) $3^n\cos\left(3x+\frac{\pi}{4}+\frac{n\pi}{2}\right)$

(B) $3^n\sin\left(3x+\frac{n\pi}{2}\right)$

(C) $3^n\sin\left(3x+\frac{\pi}{4}+\frac{n\pi}{2}\right)$

(D) $n\sin\left(3x+\frac{\pi}{4}\right)\cdot 3^{n-1}$

Q16. 

A right circular cylinder of **maximum volume** is inscribed in a sphere of radius R. The height h of this cylinder is:

(A) $\frac{R}{\sqrt{3}}$

(B) $R\sqrt{2}$

(C) $\frac{R\sqrt{2}}{2}$

(D) $\frac{2R}{\sqrt{3}}$

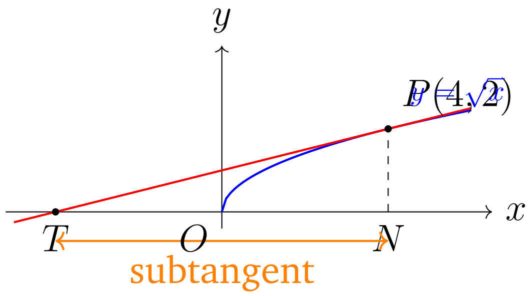
Q17. The function $f(x) = kx^3 + 9x^2 + 9x + 1$ is monotonically increasing for *all* $x \in \mathbb{R}$ if and only if:

(A) $k \geq 3$

(B) $k \leq 3$

(C) $-3 \leq k \leq 3$

(D) $k > 0$



Q18.

For the curve $y = \sqrt{x}$ at the point $P(4, 2)$, the length of the *subtangent* (the segment TN cut on the x-axis by the tangent line) is:

(A) 4

(B) 8

(C) 2

(D) 16

Q19. $\int x^3 \ln x \, dx$ equals:

(A) $\dfrac{x^4 \ln x}{4} + \dfrac{x^4}{16} + C$

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

(C) $\dfrac{x^4(4\ln x - 1)}{16} + C$

(D) $\dfrac{x^4 \ln x}{16} - \dfrac{x^4}{4} + C$

Q20. $\displaystyle\int \frac{dx}{x\sqrt{x^2 - 9}}$ equals:

(A) $\dfrac{1}{9} \sec^{-1}\left(\dfrac{x}{3}\right) + C$

(B) $\dfrac{1}{3} \csc^{-1}\left(\dfrac{x}{3}\right) + C$

(C) $\sec^{-1}\left(\dfrac{x}{3}\right) + C$

(D) $\dfrac{1}{3} \sec^{-1}\left(\dfrac{x}{3}\right) + C$

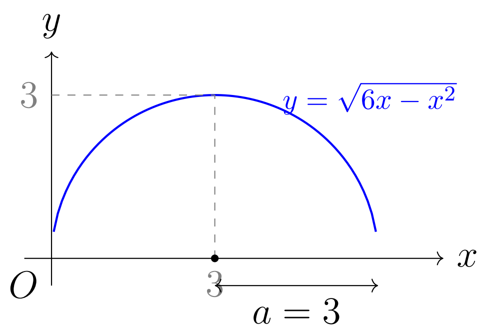
Q21. $\int \sin^2 x \cos^2 x \, dx$ equals:

(A) $\frac{x}{8} - \frac{\sin 4x}{32} + C$

(B) $\frac{x}{4} - \frac{\sin 2x}{8} + C$

(C) $\frac{\sin 4x}{32} + C$

(D) $\frac{x}{8} + \frac{\cos 4x}{32} + C$



Q22.

$\int \frac{dx}{\sqrt{6x - x^2}}$ equals (use completing the square: $6x - x^2 = 9 - (x-3)^2$):

(A) $\sin^{-1}\left(\frac{x-3}{6}\right) + C$

(B) $\sin^{-1}\left(\frac{x-3}{3}\right) + C$

(C) $\cos^{-1}\left(\frac{x-3}{3}\right) + C$

(D) $\frac{1}{3}\sin^{-1}\left(\frac{x-3}{3}\right) + C$

Q23. The value of $\int_0^{2\pi} \sin x \, dx$ is:

(A) 2

(B) 1

(C) 0

(D) -2

Q24. If $F(t) = \int_1^t \frac{e^x}{x}\,dx$, then $F'(t)$ equals:

(A) e^t

(B) te^t

(C) $\frac{e^t}{t^2}$

(D) $\frac{e^t}{t}$

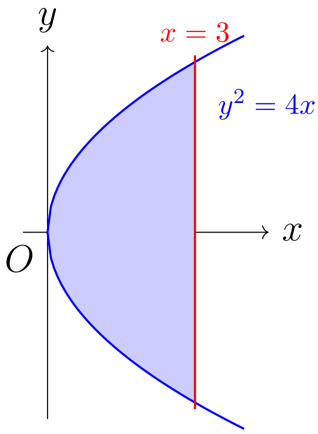
Q25. The value of $\int_0^{\pi/2} \sin^3 x\,dx$ is:

(A) $\frac{2}{3}$

(B) $\frac{3}{8}$

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

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



Q26.

The area (in sq. units) of the region bounded by the parabola $y^2 = 4x$ and the line $x = 3$ is:

(A) $4\sqrt{3}$

(B) $8\sqrt{3}$

(C) $12\sqrt{3}$

(D) $6\sqrt{3}$

Q27. If $\dfrac{dy}{dt} = 3y$ and $y(0) = 5$, then $y(t)$ is:

(A) $5e^{t}$

(B) $3e^{5t}$

(C) $5e^{3t}$

(D) $15e^{t}$

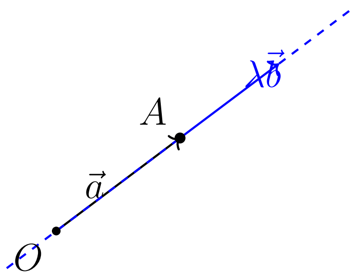
Q28. The general solution of $y'' - 5y' + 6y = 0$ is:

(A) $C_1e^{2x} + C_2e^{-3x}$

(B) $C_1e^{-2x} + C_2e^{3x}$

(C) $(C_1 + C_2x)\, e^{2x}$

(D) $C_1e^{2x} + C_2e^{3x}$

Q29. 

The vector equation of the line passing through the point $(1, 2, 3)$ with direction vector $2\hat{i} - \hat{j} + 3\hat{k}$ is:

(A) $\vec{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + \lambda(2\hat{i} - \hat{j} + 3\hat{k})$

(B) $\vec{r} = (2\hat{i} - \hat{j} + 3\hat{k}) + \lambda(\hat{i} + 2\hat{j} + 3\hat{k})$

(C) $\vec{r} = \lambda(\hat{i} + 2\hat{j} + 3\hat{k})$

(D) $\vec{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + (2\hat{i} - \hat{j} + 3\hat{k})$

Q30. A force $\vec{F} = 3\hat{i} + 4\hat{j} - 2\hat{k}$ displaces a particle through $\vec{d} = 2\hat{i} - \hat{j} + 5\hat{k}$. The work done (in units) is:

(A) 12

(B) -8

(C) 8

(D) -12

Q31. If $\vec{r} = \hat{i} + 2\hat{j} + 3\hat{k}$ and $\vec{F} = 4\hat{i} - 3\hat{j} + 2\hat{k}$, the moment of force $\vec{M} = \vec{r} \times \vec{F}$ is:

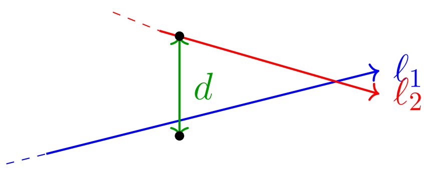
(A) $13\hat{i} - 10\hat{j} + 11\hat{k}$

(B) $-13\hat{i} + 10\hat{j} + 11\hat{k}$

(C) $13\hat{i} + 10\hat{j} - 11\hat{k}$

(D) $-13\hat{i} - 10\hat{j} + 11\hat{k}$

Q32.



The shortest distance between lines $\vec{r} = (\hat{i} + \hat{j}) + \lambda(2\hat{i} + \hat{j} + 4\hat{k})$ and $\vec{r} = (2\hat{i} + \hat{j} - \hat{k}) + \mu(3\hat{i} - \hat{j} + \hat{k})$ is:

(A) $\dfrac{1}{\sqrt{6}}$

(B) $\sqrt{6}$

(C) $2\sqrt{6}$

(D) $\dfrac{\sqrt{6}}{3}$

Q33. The equation of the plane passing through the line of intersection of $x + 2y + 3z = 4$ and $2x - y + z = 1$, and also passing through the origin, is:

(A) $7x - 6y + z = 0$

(B) $x + 6y - 7z = 0$

(C) $7x + 6y - z = 0$

(D) $x - 6y + 7z = 0$

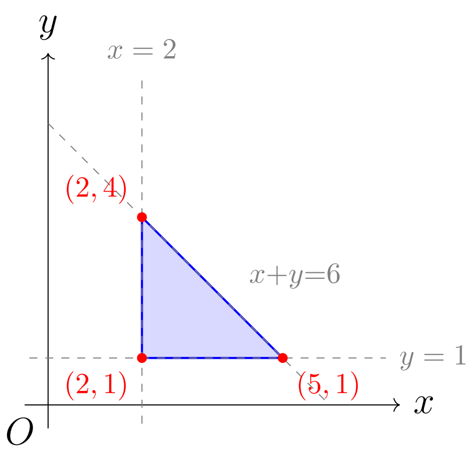
Q34. The image (reflection) of the point $P(1, 2, 3)$ in the plane $x + y + z = 9$ is:

(A) $(2,\ 3,\ 4)$

(B) $(3,\ 4,\ 5)$

(C) $(1,\ 2,\ 3)$

(D) $(4,\ 5,\ 6)$



Q35.

Maximise $Z = 5x + 3y$ subject to $x + y \leq 6,\ x \geq 2,\ y \geq 1$. The maximum value of Z is:

(A) 22

(B) 30

(C) 28

(D) 25

Q36. Events A and B are mutually exclusive. Given $P(A) = 0.4$ and $P(A \cup B) = 0.75$, then $P(B)$ equals:

(A) 0.30

(B) 0.45

(C) 0.25

(D) 0.35

Q37. Three balls are drawn at random from a bag containing 5 red and 4 blue balls. The probability that exactly 2 of the drawn balls are red is:

(A) $\frac{10}{21}$

(B) $\frac{5}{14}$

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

(D) $\frac{20}{63}$

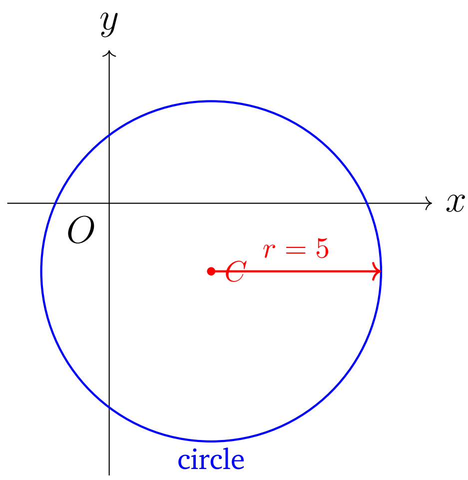
Q38. For a binomial distribution, the mean is 6 and the variance is 2. The value of n (number of trials) is:

(A) 6

(B) 9

(C) 12

(D) 18



Q39.

The centre of the circle $x^2 + y^2 - 6x + 4y - 12 = 0$ is:

(A) $(-3,\ 2)$

(B) $(6,\ -4)$

(C) $(3,\ -2)$

(D) $(-6,\ 4)$

Q40. The coefficient of x^5 in the expansion of $(x + 2)^8$ is:

(A) 56

(B) 224

(C) 168

(D) 448

Detailed Solutions

Q1.

Solution

Concept: Types of relations on a set — reflexive, symmetric, transitive, and equivalence relations.

Step 1: Analyse option (A). $I_S = \{(a,a) : a \in S\}$.

- *Reflexive*: $(a,a) \in I_S$ for every $a \in S$. ✓
- *Symmetric*: $(a,b) \in I_S \Rightarrow a = b \Rightarrow (b,a) = (a,a) \in I_S$. ✓
- *Transitive*: $(a,b),(b,c) \in I_S \Rightarrow a = b = c \Rightarrow (a,c) \in I_S$. ✓

So I_S is an equivalence relation.

Why other options are wrong:

- **(B)**: The void relation has no pair (a,a), so it is not reflexive; hence not an equivalence relation.
- **(C)**: $U = S \times S$ contains every ordered pair, so $(a,b) \in U \Rightarrow (b,a) \in U$; it IS symmetric.
- **(D)**: I_S IS reflexive (every element relates to itself).

Final Answer: (A)

Answer: (A) **Go Back to Q 1**

Q2.

Solution

Concept: Commutativity and associativity of a binary operation.

Step 1: Check commutativity. $b * a = \dfrac{2ba}{b+a} = \dfrac{2ab}{a+b} = a * b$. ✓ $*$ is commutative.

Step 2: Test associativity with $a = 1, b = 2, c = 3$.

$$1 * 2 = \frac{2(1)(2)}{1+2} = \frac{4}{3}, \quad (1*2)*3 = \frac{4}{3} * 3 = \frac{2 \cdot \frac{4}{3} \cdot 3}{\frac{4}{3} + 3} = \frac{8}{\frac{13}{3}} = \frac{24}{13}.$$

$$2 * 3 = \frac{12}{5}, \quad 1 * (2*3) = 1 * \frac{12}{5} = \frac{2 \cdot \frac{12}{5}}{1 + \frac{12}{5}} = \frac{\frac{24}{5}}{\frac{17}{5}} = \frac{24}{17}.$$

$\dfrac{24}{13} \neq \dfrac{24}{17}$, so $*$ is **not** associative.

Why other options are wrong:

- **(A)**: $*$ is commutative (shown above), so "not commutative" is false.
- **(C)**: Associativity fails (shown above).
- **(D)**: $*$ is commutative.

Final Answer: (B)

Answer: (B) Go Back to Q 2

Q3.

Solution

Concept: Domain of $\sec^{-1}(u)$ requires $|u| \geq 1$.

Step 1: Set $|2x - 1| \geq 1$.

$$2x - 1 \geq 1 \Rightarrow x \geq 1, \qquad \text{or} \qquad 2x - 1 \leq -1 \Rightarrow x \leq 0.$$

Step 2: Domain $= (-\infty, 0] \cup [1, +\infty)$.

Why other options are wrong:

- **(A)**: $[-1, 1]$ is the domain of $\sin^{-1}$, not $\sec^{-1}$.
- **(B)**: $(0, 1)$ gives $|2x - 1| < 1$, which is excluded.
- **(D)**: $[0, 1]$ includes points where $|2x - 1| < 1$.

Final Answer: (C)

Answer: (C) Go Back to Q 3

Q4.

Solution

Concept: Identity $2\tan^{-1} x = \sin^{-1}\left(\dfrac{2x}{1+x^2}\right)$ for $|x| \leq 1$.

Step 1: Here $x = \frac{1}{3}$, $|x| \leq 1$. Apply the formula:

$$2\tan^{-1}\tfrac{1}{3} = \sin^{-1}\left(\frac{2 \cdot \frac{1}{3}}{1 + \frac{1}{9}}\right) = \sin^{-1}\left(\frac{\frac{2}{3}}{\frac{10}{9}}\right) = \sin^{-1}\left(\frac{2}{3} \cdot \frac{9}{10}\right) = \sin^{-1}\left(\frac{3}{5}\right).$$

Step 2: $k = \dfrac{3}{5}$.

Why other options are wrong:

- **(A)** $\frac{4}{5}$: Would require $\tan^{-1}\frac{1}{2}$, not $\frac{1}{3}$.
- **(B)** $\frac{5}{13}$: Arises from $\tan^{-1}\frac{5}{12}$.
- **(C)** $\frac{2}{3}$: Numerator before simplification, not the final value.

Final Answer: (D)

Answer: (D) Go Back to Q 4

Q5.

Solution

Concept: Solving a matrix equation $2X = B - A$.

Step 1:

$$B - A = \begin{pmatrix} 5-1 & 6-2 \\ 7-3 & 8-4 \end{pmatrix} = \begin{pmatrix} 4 & 4 \\ 4 & 4 \end{pmatrix}.$$

Step 2:

$$X = \tfrac{1}{2}(B - A) = \begin{pmatrix} 2 & 2 \\ 2 & 2 \end{pmatrix}.$$

Why other options are wrong:

- **(B)**: $\frac{1}{2}(B + A)$ gives wrong result.
- **(C)**, **(D)**: Do not satisfy $2X + A = B$.

Final Answer: (A)

Answer: (A) Go Back to Q 5

Q6.

Solution

Concept: Trace of a matrix = sum of main-diagonal elements.

Step 1: Main diagonal entries of A: $3, 5, 7$.

Step 2: $\text{tr}(A) = 3 + 5 + 7 = 15$.

Why other options are wrong:

- **(A)** 10: Omits the $(3,3)$ entry or miscounts.
- **(C)** 12: Confuses off-diagonal elements.

- **(D)** 18: Includes an off-diagonal element.

Final Answer: (B)

Answer: (B) Go Back to Q 6

Q7.

Solution

Concept: Solve $AX = B$ via $X = A^{-1}B$.

Step 1: Form coefficient matrix. $A = \begin{pmatrix} 1 & 1 \\ 2 & -1 \end{pmatrix}$, $\det A = -1 - 2 = -3 \neq 0$.

Step 2: Find inverse. $A^{-1} = \dfrac{1}{-3}\begin{pmatrix} -1 & -1 \\ -2 & 1 \end{pmatrix} = \begin{pmatrix} \frac{1}{3} & \frac{1}{3} \\ \frac{2}{3} & -\frac{1}{3} \end{pmatrix}$.

Step 3: Solve. $x = \frac{1}{3}(5) + \frac{1}{3}(4) = 3, \quad y = \frac{2}{3}(5) - \frac{1}{3}(4) = 2.$

Why other options are wrong:

- **(A)** $(2, 3)$: Satisfies $2x - y = 1 \neq 4$.
- **(B)** $(1, 4)$: $x + y = 5$ holds but $2(1) - 4 = -2 \neq 4$.
- **(D)** $(4, 1)$: $x + y = 5$ holds but $2(4) - 1 = 7 \neq 4$.

Final Answer: (C)

Answer: (C) Go Back to Q 7

Q8.

Solution

Concept: Area of triangle via determinant formula.

Step 1: Expand the 3×3 determinant.

$$\Delta = \det\begin{pmatrix} 2 & 3 & 1 \\ -1 & 0 & 1 \\ 4 & -2 & 1 \end{pmatrix} = 2(0\cdot 1 - 1\cdot(-2)) - 3((-1)\cdot 1 - 1\cdot 4) + 1((-1)(-2) - 0\cdot 4).$$

$= 2(2) - 3(-5) + 1(2) = 4 + 15 + 2 = 21.$

Step 2: Area $= \frac{1}{2}|\Delta| = \dfrac{21}{2}$ sq. units.

Why other options are wrong:

- **(A)** $\frac{15}{2}$: Arises from sign error in the second cofactor.

- **(B)** 9, **(C)** 12: Arithmetic errors in cofactor expansion.

Final Answer: (D)

Answer: (D) Go Back to Q 8

Q9.

Solution

Concept: Indeterminate form $\frac{0}{0}$; use the half-angle identity.

Step 1: $1 - \cos x = 2\sin^2 \frac{x}{2}$.

Step 2:

$$\lim_{x\to 0} \frac{1-\cos x}{x^2} = \lim_{x\to 0} \frac{2\sin^2(x/2)}{x^2} = 2 \cdot \frac{1}{4} \lim_{x\to 0} \left(\frac{\sin(x/2)}{x/2}\right)^2 = \frac{1}{2} \cdot 1 = \frac{1}{2}.$$

Why other options are wrong:

- **(B)** 1: Confuses with $\lim_{x\to 0} \dfrac{\sin x}{x} = 1$.
- **(C)** 0: Cancels incorrectly.
- **(D)** 2: Misapplies factor of 2.

Final Answer: (A)

Answer: (A) Go Back to Q 9

Q10.

Solution

Concept: Rationalise to remove the indeterminate form.

Step 1: Multiply numerator and denominator by $(\sqrt{x} + 2)$:

$$\frac{\sqrt{x}-2}{x-4} = \frac{(\sqrt{x}-2)(\sqrt{x}+2)}{(x-4)(\sqrt{x}+2)} = \frac{x-4}{(x-4)(\sqrt{x}+2)} = \frac{1}{\sqrt{x}+2}.$$

Step 2:

$$\lim_{x\to 4} \frac{1}{\sqrt{x}+2} = \frac{1}{\sqrt{4}+2} = \frac{1}{4}.$$

Why other options are wrong:

- **(A)** $\frac{1}{2}$: Substituting $x = 4$ directly without rationalising gives $\frac{0}{0}$; halving the denominator incorrectly gives this.

- **(C)** $\frac{1}{8}$: Extra factor of 2 in denominator.
- **(D)** 0: Incorrectly sets numerator limit to 0.

Final Answer: (B)

Answer: (B) Go Back to Q 10

Q11.

Solution

Concept: A function can be continuous at a point without being differentiable there (a "cusp").

Step 1: Continuity at $x = 3$. $\lim_{x\to 3^-}(3-x) = 0$ and $\lim_{x\to 3^+}(x-3) = 0$; $f(3) = 0$. ✓Continuous.

Step 2: Differentiability at $x = 3$.

$$LHD = \lim_{h\to 0^+} \frac{f(3-h) - f(3)}{-h} = \frac{h}{-h} = -1.$$

$$RHD = \lim_{h\to 0^+} \frac{f(3+h) - f(3)}{h} = \frac{h}{h} = +1.$$

$LHD \neq RHD \Rightarrow$ not differentiable at $x = 3$.

Why other options are wrong:

- **(A)**: Differentiability fails (shown above).
- **(B)**: Differentiability implies continuity, so (B) is logically impossible.
- **(D)**: Continuity is established in Step 1.

Final Answer: (C)

Answer: (C) Go Back to Q 11

Q12.

Solution

Concept: Logarithmic differentiation for variable-exponent functions.

Step 1: Take ln: $\ln y = \sin x \cdot \ln x$.

Step 2: Differentiate both sides w.r.t. x:

$$\frac{1}{y}\frac{dy}{dx} = \cos x \cdot \ln x + \sin x \cdot \frac{1}{x}.$$

Step 3: Multiply by $y = x^{\sin x}$:

$$\frac{dy}{dx} = x^{\sin x}\left(\cos x \ln x + \frac{\sin x}{x}\right).$$

Why other options are wrong:

- **(A)**: Omits the $\sin x/x$ term.
- **(B)**: Power-rule formula; valid only when exponent is a constant.
- **(C)**: Omits $\ln x$ from the $\cos x$ term.

Final Answer: (D)

Answer: (D) Go Back to Q 12

Q13.

Solution

Concept: Substitution $x = \tan\theta$ simplifies $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$.

Step 1: Let $x = \tan\theta$, $\theta \in (-\frac{\pi}{2}, \frac{\pi}{2})$:

$$\frac{2x}{1+x^2} = \frac{2\tan\theta}{1+\tan^2\theta} = \sin 2\theta.$$

Step 2: $y = \sin^{-1}(\sin 2\theta) = 2\theta = 2\tan^{-1} x$.

Step 3: $\dfrac{dy}{dx} = \dfrac{2}{1+x^2}$.

Why other options are wrong:

- **(B)**: Missing the factor of 2.
- **(C)**: Result of differentiating $\frac{2x}{1+x^2}$ itself, not y.
- **(D)**: Wrong sign; the function is increasing on $|x| < 1$.

Final Answer: (A)

Answer: (A) Go Back to Q 13

Q14.

Solution

Concept: Rolle's theorem: if f is continuous on $[a, b]$, differentiable on (a, b), and $f(a) = f(b)$, there exists $c \in (a, b)$ with $f'(c) = 0$.

Step 1: Verify conditions. $f(1) = 1 - 4 + 3 = 0,\ f(3) = 9 - 12 + 3 = 0.$ Equal end-values. ✓

Step 2: Find c**.** $f'(x) = 2x - 4 = 0 \ \Rightarrow\ c = 2 \in (1, 3)$. ✓

Why other options are wrong:

- **(A)** $c = 1$: Endpoint, not in the open interval.
- **(C)** $c = 3$: Endpoint, not in the open interval.
- **(D)** $c = 4$: Outside the interval $[1, 3]$.

Final Answer: (B)

Answer: (B) Go Back to Q 14

Q15.

Solution

Concept: $D^n[\sin(ax + b)] = a^n \sin\left(ax + b + \dfrac{n\pi}{2}\right)$.

Step 1: Here $a = 3$, $b = \dfrac{\pi}{4}$.

Step 2:

$$D^n\left[\sin\left(3x + \tfrac{\pi}{4}\right)\right] = 3^n \sin\left(3x + \tfrac{\pi}{4} + \tfrac{n\pi}{2}\right).$$

Verification for $n = 1$**:** $D[\sin(3x + \frac{\pi}{4})] = 3\cos(3x + \frac{\pi}{4}) = 3\sin(3x + \frac{\pi}{4} + \frac{\pi}{2})$. ✓

Why other options are wrong:

- **(A)**: Uses $\cos$ instead of $\sin$.
- **(B)**: Drops the phase $\frac{\pi}{4}$.
- **(D)**: Power-rule form; incorrect for trigonometric functions.

Final Answer: (C)

Answer: (C) Go Back to Q 15

Q16.

Solution

Concept: Constrained optimisation; cylinder inside a sphere.

Step 1: Constraint. If r = cylinder radius and h = height, then $r^2 + \left(\frac{h}{2}\right)^2 = R^2$, so $r^2 = R^2 - \frac{h^2}{4}$.

Step 2: Volume. $V = \pi r^2 h = \pi\left(R^2 - \frac{h^2}{4}\right)h = \pi R^2 h - \frac{\pi h^3}{4}$.

Step 3: Optimise. $\frac{dV}{dh} = \pi R^2 - \frac{3\pi h^2}{4} = 0 \Rightarrow h^2 = \frac{4R^2}{3} \Rightarrow h = \frac{2R}{\sqrt{3}}$.

Step 4: Confirm maximum ($d^2V/dh^2 < 0$ at this h). ✓

Why other options are wrong:

- **(A)** $R/\sqrt{3}$: Half the correct value.
- **(B)** $R\sqrt{2}$: Arises from ignoring the factor of 4 in the constraint.
- **(C)** $R\sqrt{2}/2 = R/\sqrt{2}$: Different incorrect optimisation.

Final Answer: (D)

Answer: (D) Go Back to Q 16

Q17.

Solution

Concept: f is monotonically increasing $\Leftrightarrow f'(x) \geq 0$ for all x.

Step 1: $f'(x) = 3kx^2 + 18x + 9 = 3(kx^2 + 6x + 3)$.

For $f'(x) \geq 0\ \forall x$ we need $k > 0$ and the discriminant of $kx^2 + 6x + 3$ to be ≤ 0:

$$\Delta = 36 - 4 \cdot k \cdot 3 = 36 - 12k \leq 0 \ \Rightarrow\ k \geq 3.$$

Step 2: Check $k = 0$**:** $f'(x) = 18x + 9$ changes sign. Not monotone. **Check** $k < 0$**:** $f'(x) \to -\infty$ as $x \to \pm\infty$. Not monotone.

So the condition is $k \geq 3$.

Why other options are wrong:

- **(B)** $k \leq 3$: Includes $k < 0$ which fails.
- **(C)**: Includes $k < 3$ which fails (e.g. $k = 0$).
- **(D)** $k > 0$: $k = 1 < 3$ gives $\Delta > 0$, so f' has real roots and changes sign.

Final Answer: (A)

Answer: (A) Go Back to Q 17

Q18.

Solution

Concept: Length of subtangent $= \left|\dfrac{y}{dy/dx}\right|$.

Step 1: $y = \sqrt{x} \Rightarrow \dfrac{dy}{dx} = \dfrac{1}{2\sqrt{x}}$. At $P(4,2)$: $\dfrac{dy}{dx} = \dfrac{1}{4}$.

Step 2: Subtangent $= \left|\dfrac{y}{dy/dx}\right| = \dfrac{2}{1/4} = 8$.

Geometric check: Tangent at P: $y-2 = \frac{1}{4}(x-4) \Rightarrow y = \frac{x}{4}+1$. Sets $y=0$: $x=-4$. Foot is $N(4,0)$, tangent meets x-axis at $T(-4,0)$. $TN = |4-(-4)| = 8$. ✓

Why other options are wrong:

- **(A)** 4: Equals the x-coordinate, not the subtangent.
- **(C)** 2: Equals y, the ordinate of P.
- **(D)** 16: Doubled incorrectly.

Final Answer: (B)

Answer: (B) Go Back to Q 18

Q19.

Solution

Concept: Integration by parts: $\int u\,dv = uv - \int v\,du$.

Step 1: Choose $u = \ln x$, $dv = x^3\,dx$. $du = \dfrac{1}{x}dx$, $v = \dfrac{x^4}{4}$.

Step 2:

$$\int x^3 \ln x\,dx = \frac{x^4}{4}\ln x - \int \frac{x^4}{4}\cdot\frac{1}{x}\,dx = \frac{x^4 \ln x}{4} - \frac{1}{4}\int x^3\,dx = \frac{x^4\ln x}{4} - \frac{x^4}{16} + C.$$

Step 3: Factor. $= \dfrac{x^4(4\ln x - 1)}{16} + C$.

Why other options are wrong:

- **(A)**: Sign error; $-x^4/16$ became $+x^4/16$.
- **(B)**: Denominator should be 16, not 4.

- **(D)**: Coefficient of $\ln x$ term is wrong.

Final Answer: (C)

Answer: (C) Go Back to Q 19

Q20.

Solution

Concept: Standard formula $\int \frac{dx}{x\sqrt{x^2-a^2}} = \frac{1}{a}\sec^{-1}\left(\frac{x}{a}\right) + C$.

Step 1: Identify $a^2 = 9$, so $a = 3$.

Step 2: Apply the formula:

$$\int \frac{dx}{x\sqrt{x^2-9}} = \frac{1}{3}\sec^{-1}\left(\frac{x}{3}\right) + C.$$

Why other options are wrong:

- **(A)**: Coefficient $\frac{1}{9} = \frac{1}{a^2}$ instead of $\frac{1}{a} = \frac{1}{3}$.
- **(B)**: $\csc^{-1}$ is an alternative notation used in some textbooks but with a different sign; NCERT standard uses $\sec^{-1}$.
- **(C)**: Missing the $\frac{1}{a}$ factor; coefficient should be $\frac{1}{3}$.

Final Answer: (D)

Answer: (D) Go Back to Q 20

Q21.

Solution

Concept: Convert product to single angle using double-angle formulas.

Step 1: $\sin^2 x \cos^2 x = \frac{1}{4}\sin^2(2x) = \frac{1}{4}\cdot\frac{1-\cos 4x}{2} = \frac{1-\cos 4x}{8}$.

Step 2:

$$\int \frac{1-\cos 4x}{8}\,dx = \frac{x}{8} - \frac{\sin 4x}{32} + C.$$

Why other options are wrong:

- **(B)**: Uses $\sin^2 x = \frac{1-\cos 2x}{2}$ on $\sin^2 x$ alone, omitting the $\cos^2 x$ factor.
- **(C)**: Omits the $x/8$ term (constant-of-integration issue).
- **(D)**: Sign error on the cosine term.

Final Answer: (A)

Answer: (A) Go Back to Q 21

Q22.

Solution

Concept: Complete the square, then use $\int \frac{du}{\sqrt{a^2 - u^2}} = \sin^{-1}\frac{u}{a} + C$.

Step 1: $6x - x^2 = -(x^2 - 6x) = -(x^2 - 6x + 9 - 9) = 9 - (x - 3)^2$.

Step 2: Let $u = x - 3$, $a = 3$:

$$\int \frac{dx}{\sqrt{9 - (x-3)^2}} = \sin^{-1}\left(\frac{x-3}{3}\right) + C.$$

Why other options are wrong:

- **(A)**: Denominator 6 is $2a$ instead of $a = 3$.
- **(C)**: $\cos^{-1}$ differs from $\sin^{-1}$ by $\pi/2$; the antiderivative is $\sin^{-1}$.
- **(D)**: Extra factor $\frac{1}{3}$ in front is incorrect here (a is already absorbed in the argument).

Final Answer: (B)

Answer: (B) Go Back to Q 22

Q23.

Solution

Concept: Definite integral of $\sin x$ over a complete period is zero.

Step 1: Direct computation.

$$\int_0^{2\pi} \sin x\,dx = \left[-\cos x\right]_0^{2\pi} = -\cos(2\pi) + \cos(0) = -1 + 1 = 0.$$

Step 2: Periodicity insight. The positive area from 0 to π equals the negative area from π to 2π; they cancel exactly.

Why other options are wrong:

- **(A)** 2: This is $\int_0^{\pi} \sin x\,dx$, only the positive half.
- **(B)** 1: Arithmetic error.
- **(D)** -2: This is $\int_{\pi}^{2\pi} \sin x\,dx$, only the negative half.

Final Answer: (C)

Answer: (C) Go Back to Q 23

Q24.

Solution

Concept: Leibniz rule (Fundamental Theorem of Calculus Part 1): $\frac{d}{dt}\int_a^t f(x)\,dx = f(t)$.

Step 1: Here $f(x) = \frac{e^x}{x}$ and the lower limit is a constant $a = 1$.

Step 2: $F'(t) = \frac{e^t}{t}$.

Why other options are wrong:

- **(A)** e^t: Forgetting to divide by t.
- **(B)** te^t: Multiplied instead of dividing.
- **(C)** e^t/t^2: Applied quotient rule incorrectly to the integrand.

Final Answer: (D)

Answer: (D) Go Back to Q 24

Q25.

Solution

Concept: Reduction formula or direct substitution for $\sin^n x$.

Step 1: Write $\sin^3 x = \sin x(1 - \cos^2 x)$.

Step 2: Let $u = \cos x$, $du = -\sin x\,dx$:

$$\int_0^{\pi/2} \sin x(1-\cos^2 x)\,dx = \int_1^0 (1-u^2)(-du) = \int_0^1 (1-u^2)\,du = \left[u - \frac{u^3}{3}\right]_0^1 = 1-\frac{1}{3} = \frac{2}{3}.$$

Why other options are wrong:

- **(B)** $\frac{3}{8}$: Result for $\int_0^{\pi/2} \sin^4 x\,dx$ (Wallis formula).
- **(C)** $\frac{\pi}{4}$: Result for $\int_0^{\pi/2} \sin^2 x\,dx$.
- **(D)** $\frac{1}{2}$: Incorrect reduction.

Final Answer: (A)

Answer: (A) Go Back to Q 25

Q26.

Solution

Concept: Area by integration; symmetry about the x-axis.

Step 1: The parabola $y^2 = 4x$ gives $y = \pm 2\sqrt{x}$. By symmetry,

$$\text{Area} = 2\int_0^3 2\sqrt{x}\,dx = 4\int_0^3 x^{1/2}\,dx.$$

Step 2:

$$4\left[\frac{2x^{3/2}}{3}\right]_0^3 = \frac{8}{3}\cdot 3\sqrt{3} = 8\sqrt{3}.$$

Why other options are wrong:

- **(A)** $4\sqrt{3}$: Forgot the factor of 2 for symmetry.
- **(C)** $12\sqrt{3}$: Used an incorrect upper limit or an extra factor.
- **(D)** $6\sqrt{3}$: Arithmetic error in evaluation.

Final Answer: (B)

Answer: (B) Go Back to Q 26

Q27.

Solution

Concept: Separable ODE; exponential growth/decay.

Step 1: Separate variables. $\dfrac{dy}{y} = 3\,dt \;\Rightarrow\; \ln|y| = 3t + C_0 \;\Rightarrow\; y = Ae^{3t}$.

Step 2: Apply initial condition $y(0) = 5$: $A = 5$, so $y(t) = 5e^{3t}$.

Why other options are wrong:

- **(A)** $5e^{t}$: Rate is 1, not 3.
- **(B)** $3e^{5t}$: Initial value and rate are swapped.
- **(D)** $15e^{t}$: Multiplied the constants instead of using $A = 5$.

Final Answer: (C)

Answer: (C) Go Back to Q 27

Q28.

Solution

Concept: Characteristic equation of a second-order constant-coefficient homogeneous ODE.

Step 1: Characteristic equation: $m^2 - 5m + 6 = 0 \Rightarrow (m-2)(m-3) = 0$. Roots: $m_1 = 2$, $m_2 = 3$ (distinct real).

Step 2: General solution: $y = C_1 e^{2x} + C_2 e^{3x}$.

Why other options are wrong:

- **(A)**: Root -3 would give characteristic equation with $(m+3)$, not $(m-3)$.
- **(B)**: Root -2 similarly incorrect.
- **(C)**: Repeated-root form $(C_1 + C_2 x)e^{2x}$ applies when discriminant $= 0$, i.e. $m^2 - 4m + 4 = 0$.

Final Answer: (D)

Answer: (D) Go Back to Q 28

Q29.

Solution

Concept: Vector equation of a line: $\vec{r} = \vec{a} + \lambda\vec{b}$, where $\vec{a}$ is a position vector of a point on the line and $\vec{b}$ is the direction vector.

Step 1: Point on line: $(1, 2, 3) \Rightarrow \vec{a} = \hat{i} + 2\hat{j} + 3\hat{k}$.

Step 2: Direction: $\vec{b} = 2\hat{i} - \hat{j} + 3\hat{k}$.

Step 3: $\vec{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + \lambda(2\hat{i} - \hat{j} + 3\hat{k})$.

Why other options are wrong:

- **(B)**: $\vec{a}$ and $\vec{b}$ swapped.
- **(C)**: Misses the fixed point $\vec{a}$; passes through the origin instead.
- **(D)**: Adds the two vectors as constants; no parameter λ means it describes a point, not a line.

Final Answer: (A)

Answer: (A) Go Back to Q 29

Q30.

Solution

Concept: Work done $W = \vec{F} \cdot \vec{d}$ (dot product).

Step 1:

$$W = (3)(2) + (4)(-1) + (-2)(5) = 6 - 4 - 10 = -8.$$

Why other options are wrong:

- **(A)** 12: Only the $\hat{i}$-component contribution.
- **(C)** 8: Sign error; $(-2)(5)$ contributes -10, not $+10$.
- **(D)** -12: Extra negative from arithmetic.

Final Answer: (B)

Answer: (B) Go Back to Q 30

Q31.

Solution

Concept: Moment of force $\vec{M} = \vec{r} \times \vec{F}$ (cross product).

Step 1: Expand the determinant.

$$\vec{r} \times \vec{F} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 2 & 3 \\ 4 & -3 & 2 \end{vmatrix}.$$

Step 2: $\hat{i}$-component: $(2)(2) - (3)(-3) = 4 + 9 = 13$.
$\hat{j}$-component: $-[(1)(2) - (3)(4)] = -[2 - 12] = 10$.
$\hat{k}$-component: $(1)(-3) - (2)(4) = -3 - 8 = -11$.

$\vec{M} = 13\hat{i} + 10\hat{j} - 11\hat{k}$.

Why other options are wrong:

- **(A)**: $\hat{j}$ sign wrong (-10 vs $+10$).
- **(B)**: $\hat{i}$ sign wrong (-13 vs $+13$).
- **(D)**: Both $\hat{i}$ and $\hat{j}$ signs wrong.

Final Answer: (C)

Answer: (C) Go Back to Q 31

Q32.

Solution

Concept: Shortest distance $d = \dfrac{|(\vec{a}_2 - \vec{a}_1)\cdot(\vec{b}_1 \times \vec{b}_2)|}{|\vec{b}_1 \times \vec{b}_2|}$.

Step 1: $\vec{a}_1 = (1,1,0)$, $\vec{b}_1 = (2,1,4)$; $\vec{a}_2 = (2,1,-1)$, $\vec{b}_2 = (3,-1,1)$.

Step 2:

$$\vec{b}_1 \times \vec{b}_2 = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 1 & 4 \\ 3 & -1 & 1 \end{vmatrix} = (1+4)\hat{i} - (2-12)\hat{j} + (-2-3)\hat{k} = 5\hat{i} + 10\hat{j} - 5\hat{k}.$$

$|\vec{b}_1 \times \vec{b}_2| = \sqrt{25+100+25} = 5\sqrt{6}$.

Step 3: $\vec{a}_2 - \vec{a}_1 = (1,0,-1)$. $(\vec{a}_2 - \vec{a}_1)\cdot(5,10,-5) = 5+0+5 = 10$.

Step 4: $d = \dfrac{10}{5\sqrt{6}} = \dfrac{2}{\sqrt{6}} = \dfrac{\sqrt{6}}{3}$.

Why other options are wrong:

- **(A)** $1/\sqrt{6}$: Missing a factor of 2 in the numerator.
- **(B)** $\sqrt{6}$, **(C)** $2\sqrt{6}$: Denominator error.

Final Answer: (D)

Answer: (D) Go Back to Q 32

Q33.

Solution

Concept: Family of planes through the intersection of two planes: $(P_1) + \lambda(P_2) = 0$.

Step 1: Write family. $(x+2y+3z-4) + \lambda(2x-y+z-1) = 0$.

Step 2: Substitute the origin $(0,0,0)$**.** $-4 + \lambda(-1) = 0 \Rightarrow \lambda = -4$.

Step 3: Substitute $\lambda = -4$**.** $(x+2y+3z-4) - 4(2x-y+z-1) = 0 \Rightarrow x+2y+3z-4-8x+4y-4z+4 = 0 \Rightarrow -7x+6y-z = 0 \Leftrightarrow 7x-6y+z = 0$.

Why other options are wrong:

- **(B)**, **(C)**, **(D)**: Arise from incorrect λ or sign errors.

Final Answer: (A)

Answer: (A) Go Back to Q 33

Q34.

Solution

Concept: Image P' of point P in plane: foot of perpendicular Q satisfies $Q = \frac{P+P'}{2}$.

Step 1: Parametric line through $P(1,2,3)$ perpendicular to $x+y+z=9$. Normal direction $(1,1,1)$: $(x,y,z) = (1+t,\ 2+t,\ 3+t)$.

Step 2: Find foot Q. $(1+t)+(2+t)+(3+t) = 9 \Rightarrow 6+3t = 9 \Rightarrow t = 1$. $Q = (2,3,4)$.

Step 3: Image. $P' = 2Q - P = (4-1,\ 6-2,\ 8-3) = (3,4,5)$.

Why other options are wrong:

- **(A)** $(2,3,4)$: This is the *foot* of perpendicular, not the image.
- **(C)** $(1,2,3)$: The original point P itself (lies on the plane? check: $1+2+3 = 6 \neq 9$, so P is not on the plane).
- **(D)** $(4,5,6)$: Adds $t = 1$ twice instead of reflecting.

Final Answer: (B)

Answer: (B) Go Back to Q 34

Q35.

Solution

Concept: For a bounded feasible region, the optimal value occurs at a corner point.

Step 1: Identify corner points.

- $x = 2,\ y = 1$: corner $(2,1)$.
- $x = 2,\ x+y = 6 \Rightarrow y = 4$: corner $(2,4)$.
- $y = 1,\ x+y = 6 \Rightarrow x = 5$: corner $(5,1)$.

Step 2: Evaluate $Z = 5x + 3y$.

- $(2,1)$: $Z = 10 + 3 = 13$.
- $(2,4)$: $Z = 10 + 12 = 22$.
- $(5,1)$: $Z = 25 + 3 = \mathbf{28} \leftarrow$ maximum.

Why other options are wrong:

- **(A)** 22: Value at $(2,4)$, not the global maximum.

- **(B)** 30: No feasible point gives $Z = 30$ (would require $x + y \approx 6$, $y = 0$ violating $y \geq 1$).
- **(D)** 25: Not a corner-point value.

Final Answer: (C)

Answer: (C) Go Back to Q 35

Q36.

Solution

Concept: For mutually exclusive events A and B: $P(A \cap B) = 0$, so $P(A \cup B) = P(A) + P(B)$.

Step 1: $P(B) = P(A \cup B) - P(A) = 0.75 - 0.40 = 0.35$.

Why other options are wrong:

- **(A)** 0.30: Subtraction error.
- **(B)** 0.45: Addition instead of subtraction.
- **(C)** 0.25: Incorrect arithmetic.

Final Answer: (D)

Answer: (D) Go Back to Q 36

Q37.

Solution

Concept: Classical probability; combinations.

Step 1: Favourable outcomes. Choose 2 red from 5 AND 1 blue from 4: $\binom{5}{2} \times \binom{4}{1} = 10 \times 4 = 40$.

Step 2: Total outcomes. $\binom{9}{3} = 84$.

Step 3: $P = \frac{40}{84} = \frac{10}{21}$.

Why other options are wrong:

- **(B)** $5/14 = 30/84$: Wrong numerator.
- **(C)** $2/7 = 24/84$: Omits the $\binom{4}{1}$ term.
- **(D)** $20/63$: Incorrect total or combination.

Final Answer: (A)

Answer: (A) Go Back to Q 37

Q38.

Solution

Concept: Binomial distribution: mean $\mu = np$, variance $\sigma^2 = npq$, $p + q = 1$.

Step 1: $q = \frac{\sigma^2}{\mu} = \frac{2}{6} = \frac{1}{3}$, so $p = 1 - \frac{1}{3} = \frac{2}{3}$.

Step 2: $n = \frac{\mu}{p} = \frac{6}{2/3} = 9$.

Why other options are wrong:

- **(A)** 6: This is μ itself, not n.
- **(C)** 12: Uses $q = 1/2$ (incorrect).
- **(D)** 18: Doubles the correct answer.

Final Answer: (B)

Answer: (B) Go Back to Q 38

Q39.

Solution

Concept: Complete the square to rewrite the circle equation in standard form.

Step 1: $(x^2-6x)+(y^2+4y) = 12$ $(x-3)^2-9+(y+2)^2-4 = 12$ $(x-3)^2+(y+2)^2 = 25$.

Step 2: Centre $= (3, -2)$, radius $= 5$.

Why other options are wrong:

- **(A)** $(-3, 2)$: Signs of both coordinates flipped.
- **(B)** $(6, -4)$: Used coefficients directly without halving.
- **(D)** $(-6, 4)$: Twice the coefficients with wrong signs.

Final Answer: (C)

Answer: (C) Go Back to Q 39

Q40.

Solution

Concept: Binomial theorem: the $(r+1)$-th term of $(x+a)^n$ is $T_{r+1} = \binom{n}{r} x^{n-r} a^r$.

Step 1: Identify the term with x^5 in $(x+2)^8$. $n - r = 5 \Rightarrow r = 3$.

Step 2: Calculate. $T_4 = \binom{8}{3}x^5 \cdot 2^3 = 56 \cdot 8 \cdot x^5 = 448\,x^5$.

Coefficient $= 448$.

Why other options are wrong:

- **(A)** 56: This is $\binom{8}{3}$ alone, omitting the $2^3 = 8$ factor.
- **(B)** 224: Uses $2^2 = 4$ instead of $2^3 = 8$.
- **(C)** 168: Incorrect combination of factors.

Final Answer: (D)

Answer: (D) Go Back to Q 40

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	2	B	3	C	4	D	5	A
6	B	7	C	8	D	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	A	22	B	23	C	24	D	25	A
26	B	27	C	28	D	29	A	30	B
31	C	32	D	33	A	34	B	35	C
36	D	37	A	38	B	39	C	40	D