Previous Years Paper

27 May 2023 - (Shift 1)

Q1. $f(x) = x^3 + px^2 + qx + 10$ has a maximum at $x = -3$ and a minimum at $x = 1$. The values of p and q are:
(a) $p = -3, q = -9$
(b) $p = 3, q = 9$
(c) $p = -3, q = 9$
(d) $p = 3, q = -9$

Q2. Area of the region bounded by ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is:
(a) πab sq. units
(b) ab sq. units
(c) πa sq. units
(d) πb sq. units

Q3. If the feasible region of a system of linear inequalities can be enclosed within a circle then it is called
(a) Shaded area
(b) Bounded region
(c) Circular region
(d) Unbounded region

Q4. $y = \log_e\left(\frac{1-x^2}{1+x^2}\right)$, then $\frac{dy}{dx}$ is equal to:
(a) $\frac{4x^3}{1-x^4}$
(b) $\frac{-4x}{1-x^4}$
(c) $\frac{1}{4-x^4}$
(d) $\frac{-4x^3}{1-x^4}$

Q5. If $x = t^4, y = t$, then $\frac{d^2y}{dx^2}$ is given by ________ .
(a) $-\frac{3}{16t^7}$
(b) $\frac{3}{16t^7}$
(c) $-\frac{3}{4t^4}$
(d) $\frac{3}{16t^4}$

Q6. The value of the determinant $\begin{vmatrix} 66 & 18 & 36 \\ 1 & 3 & 4 \\ 11 & 3 & 6 \end{vmatrix}$ is:
(a) –1
(b) 1
(c) 0
(d) 2

Q7. Points at which normal to the curve $y = x^3 - 3x$ is parallel to y-axis are:
(a) $(1, 2)$ and $(1, -2)$
(b) $(1, -2)$ and $(-1, 2)$
(c) $(1, 2)$ and $(-1, -2)$
(d) $(-1, 2)$ and $(1, 2)$

Q8. One root of the equation $\begin{vmatrix} 3x-8 & 3 & 3 \\ 3 & 3x-8 & 3 \\ 3 & 3 & 3x-8 \end{vmatrix} = 0$ is:
(a) $\frac{8}{3}$
(b) $\frac{2}{3}$
(c) $\frac{1}{3}$
(d) $\frac{16}{3}$

Q9. The probability distribution of a random variable X is given by

X	0	1	2	3	4
P(X)	0.1	k	2k	2k	k

The value of k is:
(a) 0
(b) 0.1
(c) 1
(d) $\frac{3}{20}$

Q10. The inverse of the matrix $\begin{bmatrix} 2 & -1 \\ 1 & 0 \end{bmatrix}$ is:
(a) $\begin{bmatrix} 2 & -1 \\ 1 & 0 \end{bmatrix}$
(b) $\begin{bmatrix} -2 & 1 \\ -1 & 0 \end{bmatrix}$
(c) $\begin{bmatrix} 2 & 1 \\ -1 & 0 \end{bmatrix}$
(d) $\begin{bmatrix} 0 & 1 \\ -1 & 2 \end{bmatrix}$

Q11. $\int_0^2 (x^2 + 1)dx$ is equal to
(a) $\frac{14}{3}$
(b) 4
(c) 10
(d) 8

Q12. $\int \frac{x}{x^2+x-12} dx$ is equal to
(a) $\frac{3}{7}\log|x-3| + \frac{4}{7}\log|x+4| + C$
(b) $-\frac{3}{7}\log|x-3| + \frac{4}{7}\log|x+4| + C$
(c) $\frac{4}{7}\log|x-3| + \frac{3}{7}\log|x+4| + C$
(d) $\frac{4}{7}\log|x-3| - \frac{3}{7}\log|x+4| + C$

Q13. There are 4 bulbs out of which 2 are defective. Each bulb is tested in random order till both the defective bulbs are identified. The probability that only two tests are required to identify the defective bulb is:
(a) $\frac{1}{2}$
(b) $\frac{1}{3}$
(c) $\frac{1}{6}$
(d) $\frac{1}{4}$

Q14. Corner points of the feasible region for a liner programming problem are (0, 2), (3, 0), (6, 0) and (0,

5). Let F = 4x + 6y be the objective function. The minimum value of F occurs at:
(a) (0, 2) only
(b) (3, 0) only
(c) Any point on the line joining the points (0, 2) and (3, 0) only
(d) The mid - point of the segment joining the points (0, 2) and (3, 0) only.

Q15. Match List I with List II

	LIST I		LIST II
A.	$\frac{d^2y}{dx^2} = \left(\frac{dy}{dx}\right)^{\frac{3}{2}}$	I.	order + degree =2
B.	$2\left(\frac{d^3y}{dx^3}\right)^2 + 3\left(\frac{d^2y}{dx^2}\right) + y\left(\frac{dy}{dx}\right)^2 = e^x$		order +degree = 3
C.	$\frac{dy}{dx} + \frac{1}{\frac{dy}{dx}} = 3$	III.	order +degree =4
D.	$\frac{dy}{dx} + x^2 = 5$	IV.	order +degree =5

Choose the correct answer from the options given below:
(a) A-III, B-IV, C-II, D-I
(b) A-III, B-IV, C-I, D-II
(c) A-IV, B-III, C-I, D-II
(d) A-IV, B-III, C-II, D-I

Q16. For $x \in [-2,\ 2]$, let $f(x) = x^2 + 2$
A. $f(x)$ is continuous in $[-2, 2]$
B. $f(x)$ is differentiable in $(-2, 2)$
C. $f(-2) = f(2) = 6$
D. $f'(1) = 0$
Choose the correct answer from the options given below:
(a) A, D only
(b) B, C, D only
(c) A, B, C, D only
(d) A, B and C only

Q17. The area of region bounded by two curves $y^2 = x$ and $x^2 = y$ is:
(a) 1 sq. unit
(b) $\frac{1}{2}$ sq. unit
(c) $\frac{1}{3}$ sq. unit
(d) $\frac{2}{3}$ sq. unit

Q18. The value of $\begin{vmatrix} \sin 15° & \cos 15° & 2\sin 30° \\ \sin 30° & \cos 30° & \sin 45° \\ \cos 75° & \sin 75° & \sin 90° \end{vmatrix}$ is:
(a) 1
(b) 0
(c) $\frac{1}{2}$
(d) $\frac{\sqrt{3}}{2}$

Q19. The area of the parallelogram of which $\hat{\imath}$ and $\hat{\imath} + \hat{\jmath}$ are adjacent sides is ________
(a) 1
(b) 2
(c) $\frac{1}{2}$
(d) $\sqrt{2}$

Q20. Match List I with List II

	LIST I		LIST II
A.	$\int \sin x \cos x\ dx$	I.	$\log(1 + \sin^2 x) + C$
B.	$\int \frac{dx}{\sin^2 \cos^2 x}$	II.	$\tan\frac{x}{2} + C$
C.	$\int \frac{\sin 2x}{1 + \sin^2 x} dx$	III.	$-\frac{1}{4}\cos 2x + C$
D.	$\int (1 - \cos x)\ cosec^2\ x\ dx$	IV.	$\tan x - \cot x + C$

Choose the correct answer from the options given below:
(a) A-III, B-IV, C-I, D-II
(b) A-IV, B-I, C-II, D-III
(c) A-III, B-II, C-IV, D-I
(d) A-II, B-III, C-IV, D-I

Q21. A card is picked at random from a pack of 52 playing cards. Given that the picked card is a queen, the probability of this card to be a card of spade is:
(a) $\frac{1}{3}$
(b) $\frac{4}{13}$
(c) $\frac{1}{4}$
(d) $\frac{1}{2}$

Q22. The integrating factor of the differential equation $x\frac{dy}{dx} - y = \sin x$ is:
(a) $-\frac{1}{x}$
(b) x
(c) $e^{\log x}$
(d) $\frac{1}{x}$

Q23. Area of the region bounded by the curve $y = \frac{1}{2}\cos x$ and x - axis between $x = 0$ and $x = 2\pi$ is:
(a) 2 sq. units
(b) 4 sq. units
(c) 3 sq. units
(d) 1 sq. units

Q24. The number of all possible matrices of order 2 × 2 with each entry 0, 1, 2, and 3 is:
(a) 16
(b) 64
(c) 256
(d) 1024

Q25. Match List I with List II

	LIST I		LIST II
A.	If $4\sin^{-1}x+\cos^{-1}x=\pi$, then x equal to	I.	$\frac{\pi}{2}$
B.	The value of $\frac{1-\tan^2 15°}{1+\tan^2 15°}$	II.	$\frac{1}{2}$
C.	If $x+\frac{1}{x}=2$, then principal value of $\sin^{-1}x$ is	III.	$\frac{3\pi}{4}$
D.	Two angles of a triangle are $\cot^{-1}2$ and $\cot^{-1}3$, then third angle is	IV.	$\frac{\sqrt{3}}{2}$

Choose the correct answer from the options given below:
(a) A-II, B-IV, C-I, D-III
(b) A-III, B-I, C-IV, D-II
(c) A-I, B-II, C-III, D-IV
(d) A-IV, B-III, C-II, D-I

Q26. The value of k for which the following system of equations does not possess a unique solution is:
$kx+3y-z=1$
$x+2y+z=2$
$-kx+y+2z=-1$
(a) $-\frac{7}{2}$
(b) $\frac{7}{2}$
(c) 7
(d) 7–

Q27. The direction cosines of the line
$x-y+z-5=0=x-3y-6=0$
(a) 2, –4, 1
(b) 3, 1, –2
(c) $\frac{3}{\sqrt{14}},\frac{1}{\sqrt{14}},\frac{-2}{\sqrt{14}}$
(d) $\frac{3}{\sqrt{14}},\frac{-4}{\sqrt{14}},\frac{1}{\sqrt{14}}$

Q28. The image of the point (3, –2, 1) in the plane $3x-y+4z=2$ is:
(a) (3, –1, 4)
(b) $(0,-1,-3)$
(c) $\left(\frac{3}{2},-\frac{5}{2},-1\right)$
(d) $(0,-1,3)$

Q29. $\int_0^{\frac{\pi}{4}}\frac{\sin 2x}{\cos^4 x+\sin^4 x}dx=$
(a) $\frac{\pi}{2}$
(b) $\frac{\pi}{4}$
(c) π
(d) 0

Q30. If $y=A\sin x+B\cos x$, then which of the following is correct?
(a) $\frac{d^2y}{dx^2}-y=0$
(b) $\frac{d^2y}{dx^2}+y=0$
(c) $\frac{d^2y}{dx^2}=\frac{dy}{dx}$
(d) $\frac{d^2y}{dx^2}=\frac{-dy}{dx}$

Q31. The feasible region of the constraints $x\geq 0,\ x+y\leq 1$ and $x-y\leq 1$ is situated in:
(a) I and II quadrant
(b) II and III quadrant
(c) I and IV quadrant
(d) I, II, III and IV quadrants

Q32. Match List I with List II

	LIST I		LIST II
A.	$\lim_{x\to 0}\frac{1-\cos 2x}{3x^2}$	I.	2
B.	$\lim_{x\to 4}\frac{x^2-16}{x-4}$	II.	8
C.	$\lim_{x\to 0}\frac{\sin ax+4x}{ax+\sin 4x}$	III.	1
D.	$\lim_{z\to 1}\frac{z^{\frac{1}{3}}-1}{z^{\frac{1}{6}}-1}$	IV.	$\frac{2}{3}$

Choose the correct answer from the options given below:
(a) A-I, B-II, C-II, D-IV
(b) A-IV, B-II, C-III, D-I
(c) A-IV, B-II, C-I, D-III
(d) A-III, B-I, C-IV, D-II

Q33. Match List I with List II

	LIST I		LIST II
A.	Range of $cosec^{-1}x$	I.	$(0,\pi)$
B.	Range of $\tan^{-1}x$	II.	$[0,\pi]-\left\{\frac{\pi}{2}\right\}$
C.	Range of $\sec^{-1}x$	III.	$\left[-\frac{\pi}{2},\frac{\pi}{2}\right]-\{0\}$
D.	Range of $\cot^{-1}x$	IV.	$\left(-\frac{\pi}{2},\frac{\pi}{2}\right)$

Choose the correct answer from the options given below:
(a) A-II, B-IV, C-III, D-I
(b) A-III, B-IV, C-II, D-I
(c) A-III, B-IV, C-I, D-II
(d) A-IV, B-III, C-I, D-II

Q34. If $f:R\to A$ given by $f(x)=x^2-6x+12$ is a surjective function, then the set A is:
(a) $(3,\infty)$
(b) $(-\infty,\ 3)$
(c) $[3,\infty)$
(d) $(-\infty,3)]$

Q35. Let $P=[a_{ij}]$ be a 3 × 3 matrix and let $Q=[b_{ij}]$ where $b_{ij}=2^{i+j}a_{ij}\ \forall\ 1\leq i,j\geq 3$. If the determinant of P is 2, then the determinant of Q is:
(a) 2^{13}
(b) 2^{12}
(c) 2^{11}
(d) 2^{10}

Q36. Suppose 10% of men and 0.5% of women have grey hair. A grey hair person is selected at random. If there are equal number of males and females, then the probability of the selected person being a female is

(a) $\frac{20}{21}$
(b) $\frac{1}{21}$
(c) $\frac{1}{200}$
(d) $\frac{1}{5}$

Q37. For $x < \frac{1}{2}$, derivative of $\tan^{-1}\left(\frac{1+2x}{1-2x}\right)$ with respect to $\sqrt{1+4x^2}$ is:

(a) $\frac{2x}{1+4x^2}$
(b) $\frac{1}{2x\sqrt{1+4x^2}}$
(c) $\frac{1}{x\sqrt{1+4x^2}}$
(d) $2x\sqrt{1+4x^2}$

Q38. Radius of a spherical balloon is increasing at the rate of 0.5 cm/sec; then the rate of increase of its volume when radius is 10 cm is

(a) $150\pi\ \text{cm}^3/\text{sec}$
(b) $200\pi\ \text{cm}^3/\text{sec}$
(c) $400\pi\ \text{cm}^3/\text{sec}$
(d) $300\pi\ \text{cm}^3/\text{sec}$

Q39. If the relation R: A → B, where A = {2, 3, 4} and B = {3, 4, 5} is defined by R $\{(x,y): x < y, x \in A, y \in B\}$ then

(a) R = {(2, 3), (2, 4), (3,4), (3, 5), (4, 4)}
(b) R = {(2, 3), (2, 4), (2,5), (3, 5), (4, 5)}
(c) R = {(2, 3), (2, 4), (2,5), (3, 4), (3, 5), (4, 5)}
(d) R = {(2, 3), (2, 5), (3,3), (3, 5), (4, 4), (4, 5)}

Q40. The slope of the normal to the curve $y = x^3 - 4\sin x$ at $x = 0$ is:

(a) −4
(b) $\frac{1}{4}$
(c) 4
(d) $-\frac{1}{4}$

Q41. If the difference of two unit vectors is again a unit vector, then the angle between them is _________.

(a) 30°
(b) 45°
(c) 60°
(d) 90°

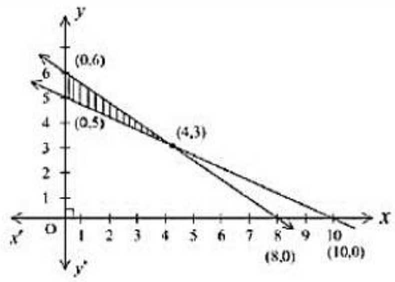
Q42. The function $f(x) = \cos x$ is strictly decreasing in:

(a) $\left(\frac{\pi}{2}, \frac{3\pi}{2}\right)$
(b) $(0, 2\pi)$
(c) $(\pi, 2\pi)$
(d) $(0, \pi)$

Q43. If order of matrices A, B and C are $4 \times 3, 5 \times 4$ and 3×7 respectively, then order of $C' \times (A' \times B')$ is _________.

(a) 7×5
(b) 4×5
(c) 4×3
(d) 5×7

Q44. According to the graph drawn here, identify the constraints of the associated linear programming problem:



(a) $x, y \geq 0,\ \ x + 2y \geq 10,\ \ 3x + 4y \geq 24$
(b) $x, y \geq 0,\ \ x + 2y \leq 10,\ \ 3x + 4y \leq 24$
(c) $x, y \geq 0,\ \ x + 2y \leq 10,\ \ 3x + 4y \geq 24$
(d) $x, y \geq 0,\ \ x + 2y \geq 10,\ \ 3x + 4y \leq 24$

Q45. Match List I with List II

	LIST I		LIST II
A.	If $A^{-1} = \begin{bmatrix} 3 & 4 \\ 5 & 6 \end{bmatrix}$, then A is	I.	$\begin{bmatrix} 5 & 2 \\ 7 & 3 \end{bmatrix}$
B.	If $A = \begin{bmatrix} 2 & -1 \\ 3 & 1 \end{bmatrix}$, then AA^T is	II.	$\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$
C.	If $A^{-1} = \begin{bmatrix} 5 & 7 \\ 2 & 3 \end{bmatrix}$, then $(A^T)^{-1}$ is	III.	$\begin{bmatrix} -3 & 2 \\ \frac{5}{2} & -\frac{3}{2} \end{bmatrix}$
D.	If $A = [a_{ij}]_{2\times 2}$ where $a_{ij} = (i-j)^2$, then A is	IV.	$\begin{bmatrix} 5 & 5 \\ 5 & 10 \end{bmatrix}$

Choose the correct answer from the options given below:

(a) A-II, B-IV, C-III, D-I
(b) A-IV, B-III, C-I, D-II
(c) A-III, B-IV, C-I, D-II
(d) A-I, B-IV, C-III, D-II

Q46. The maximum number of equivalence relations on the set $A = \{3, 5, 7\}$

(a) 1
(b) 2
(c) 3
(d) 5

Q47. The maximum value of $\frac{\log x^3}{3x}$ occurs at $x =$ _________

(a) e
(b) $\frac{1}{e}$
(c) 3e
(d) $\frac{3}{e}$

Q48. The function $f(x) = \frac{x}{(x-2)(x-3)(x-5)}, x \in \text{R}$ is

(a) continuous everywhere
(b) not continuous anywhere
(c) discontinuous at $x = 2, 3, 5$
(d) discontinuous at $x = 0$

Q49. The order and degree of differential equation $\sqrt[3]{2y + \frac{dy}{dx}} = \left(x + \frac{d^3y}{dx^3}\right)$ respectively are:

(a) 3, 1
(b) 3, 3
(c) 1, 1
(d) 2, 2

Q50. The projection of $\hat{\imath} - \hat{\jmath}$ on the vector $\hat{\imath} + \hat{\jmath}$ is:

(a) $\sqrt{2}$
(b) $\frac{1}{\sqrt{2}}$
(c) 2
(d) 0

SOLUTIONS

S1. Ans. (d)

Sol. Given function

$f(x) = x^3 + px^2 + qx + 10$

$f'(x) = 3x^2 + 2px + q$

$f(x) = x^3 + px^2 + qx + 10$ has a maximum at $x = -3$ and a minimum at $x = 1$.

$3(-3)^2 + 2p(-3) + q = 0 \Rightarrow 27 - 6p + q = 0 \Rightarrow$

$6p - q = 27$ .... (i)

$3(1)^2 + 2p(1) + q = 0 \Rightarrow 3 + 2p + q = 0 \Rightarrow 2p + q = -3$ .... (ii)

Adding eq. (i) & (ii)

$8p = 24 \Rightarrow p = 3$

From eq. (ii)

$2(3) + q = -3 \Rightarrow p = -9$

S2. Ans. (a)

Sol. Given equation of ellipse

$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

$y = \frac{b}{a}\sqrt{a^2 - x^2}$

Area bounded by curve $= 4\int_0^a y dx =$

$4\frac{b}{a}\int_0^a \sqrt{a^2 - x^2}\, dx$

$= 4\frac{b}{a}\left\{\frac{x}{2}\sqrt{a^2 - x^2} + \frac{a^2}{2}\sin^{-1}\left(\frac{x}{a}\right)\right\}_0^a = 4\frac{b}{a} \times \frac{a^2}{2}\sin^{-1}\left(\frac{a}{a}\right) = 4\frac{ab}{2} \times \frac{\pi}{2} = \pi ab$ sq. unit

S3. Ans. (b)

Sol. If the feasible region of a system of linear inequalities can be enclosed within a circle then, it is called Bounded region

S4. Ans. (b)

Sol. We have

$y = \log_e\left(\frac{1-x^2}{1+x^2}\right) = \log(1 - x^2) - \log(1 + x^2)$

$\frac{dy}{dx} = \frac{1}{1-x^2} \times -2x - \frac{1}{1+x^2} \times 2x =$

$-2x\left(\frac{1+x^2+1-x^2}{(1-x^2)(1+x^2)}\right) = \frac{-4x}{1-x^4}$

S5. Ans. (a)

Sol. Given

$x = t^4, y = t$

$\frac{dx}{dt} = 4t^3, \frac{dy}{dt} = 1$

$\frac{dy}{dx} = \frac{1}{4t^3}$

$\frac{d^2y}{dx^2} = -\frac{3}{4}t^{-4}\frac{dt}{dx} = -\frac{3}{4t^4} \times \frac{1}{4t^3} = -\frac{3}{16t^7}$

S6. Ans. (c)

Sol. We have

$\begin{vmatrix} 66 & 18 & 36 \\ 1 & 3 & 4 \\ 11 & 3 & 6 \end{vmatrix} = 6\begin{vmatrix} 11 & 3 & 6 \\ 1 & 3 & 4 \\ 11 & 3 & 6 \end{vmatrix} = 6 \times 3 \times 2\begin{vmatrix} 11 & 1 & 3 \\ 1 & 1 & 2 \\ 11 & 1 & 3 \end{vmatrix}$

$= 36\{11(1) - 1(-19) + 3(-10)\}$

$36(30 - 30) = 0$

S7. Ans. (b)

Sol. Given curve

$y = x^3 - 3x$

$\frac{dy}{dx} = 3x^2 - 3$

If normal to the curve is parallel to the y – axis, then tangent to the curve is parallel to x – axis

$\Rightarrow \frac{dy}{dx} = 0 \Rightarrow 3x^2 - 3 = 0 \Rightarrow x = \pm 1$

$x = 1 \Rightarrow y = -2$

$x = -1 \Rightarrow y = 2$

So, required points are $(1, -2)$ & $(-1, 2)$

S8. Ans. (b)

Sol. We have

$\begin{vmatrix} 3x-8 & 3 & 3 \\ 3 & 3x-8 & 3 \\ 3 & 3 & 3x-8 \end{vmatrix} = 0$

$R_1 \to R_1 + R_2 + R_3$

$\begin{vmatrix} 3x-2 & 3x-2 & 3x-2 \\ 3 & 3x-8 & 3 \\ 3 & 3 & 3x-8 \end{vmatrix} = 0$

$(3x-2)\begin{vmatrix} 1 & 1 & 1 \\ 3 & 3x-8 & 3 \\ 3 & 3 & 3x-8 \end{vmatrix} = 0$

One root is $x = \frac{2}{3}$

S9. Ans. (d)

Sol. We have

$P(0) + P(1) + P(2) + P(3) + P(4) = 1$

$0.1 + k + 2k + 2k + k = 1$

$6k = 0.9 \Rightarrow k = \frac{0.9}{6} = \frac{9}{60} = \frac{3}{20}$

S10. Ans. (d)

Sol. Given

$\begin{bmatrix} 2 & -1 \\ 1 & 0 \end{bmatrix}$

$adj(A) = \begin{bmatrix} 0 & 1 \\ -1 & 2 \end{bmatrix}$

$|A| = 1$

$A^{-1} = \begin{bmatrix} 0 & 1 \\ -1 & 2 \end{bmatrix}$

S11. Ans. (a)

Sol. We have

$\int_0^2 (x^2 + 1)\, dx = \left\{\frac{x^3}{3} + x\right\}_0^2 = \frac{8}{3} + 2 = \frac{14}{3}$

S12. Ans. (a)

Sol. We have

$\int \frac{x}{x^2+x-12} dx$

$\frac{x}{x^2+x-12} = \frac{x}{(x-3)(x+4)}$

Let

$\frac{x}{(x-3)(x+4)} = \frac{A}{(x-3)} + \frac{B}{(x+4)}$

$x = A(x + 4) + B(x - 3)$

Put $x = 3$, we get

$A = \frac{3}{7}$

Put $x = -4$, we get

$B = \frac{4}{7}$

Now

$\int \frac{x}{x^2+x-12} dx = \frac{3}{7}\int \frac{dx}{x-3} + \frac{4}{7}\int \frac{dx}{x+4}$

$= \frac{3}{7}\log|x - 3| + \frac{4}{7}\log|x + 4| + C$

S13. Ans. (c)

Sol. Total bulbs = 4

Defective bulbs = 2

Probability of first be defective $= \frac{2}{4} = \frac{1}{2}$
Probability of second bulb to be defective $= \frac{1}{3}$
Required probability $= \frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$

S14. Ans. (c)

Sol. We have
Corner points of the feasible region for a liner programming problem are (0, 2), (3, 0), (6, 0) and (0, 5)
& $F = 4x + 6y$
At $(0, 2)$, $F = 12$
At $(3, 0)$, $F = 12$
At $(6, 0)$, $F = 24$
At $(0, 5)$, $F = 30$
The minimum value of F occurs at any point on the line joining the points (0, 2) and (3, 0) only

S15. Ans. (a)

Sol. (A) $\frac{d^2y}{dx^2} = \left(\frac{dy}{dx}\right)^{\frac{3}{2}}$
Squaring both sides
$\left(\frac{d^2y}{dx^2}\right)^2 = \left(\frac{dy}{dx}\right)^3$
Order = 2 & degree = 2⇒ Order + degree = 4

(B) $2\left(\frac{d^3y}{dx^3}\right)^2 + 3\left(\frac{d^2y}{dx^2}\right) + y\left(\frac{dy}{dx}\right)^2 = e^x$
Order + degree = 3 + 2 =5

(C) We have
$\frac{dy}{dx} + \frac{1}{\frac{dy}{dx}} = 3 \Rightarrow \left(\frac{dy}{dx}\right)^2 + 1 = 3\left(\frac{dy}{dx}\right)$
Order + degree = 1 + 2 = 3

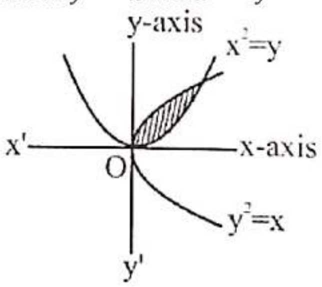
(D) We have
$\frac{dy}{dx} + x^2 = 5$
Order + degree = 1+1=2

S16. Ans. (d)

Sol. $f(x)$ is continuous in $[-2, 2]$
$f(x)$ is differentiable in $(-2, 2)$
$f(-2) = f(2) = 6$
But
$f'(1) \neq 0$, $1 \in (-2, 2)$

S17. Ans. (c)

Sol. Curve $y^2 = x$ and $x^2 = y$



then, Area $= \int_0^1 (\sqrt{x} - x^2)\, dx$
$= \frac{2}{3}[x^{\frac{3}{2}}]_0^1 - \left[\frac{x^3}{3}\right]_0^1$
$= \frac{2}{3}(1 - 0) - \left(\frac{1}{3} - 0\right)$
$= \frac{2}{3} - \frac{1}{3} = \frac{1}{3}$

S18. Ans. (b)

Sol. We have
$\begin{vmatrix} \sin 15° & \cos 15° & 2\sin 30° \\ \sin 30° & \cos 30° & \sin 45° \\ \cos 75° & \sin 75° & \sin 90° \end{vmatrix} =$
$\begin{vmatrix} \sin(45° - 30°) & \cos(45° - 30°) & 2 \times \frac{1}{2} \\ \frac{1}{2} & \frac{\sqrt{3}}{2} & \frac{1}{\sqrt{2}} \\ \cos(45° + 30°) & \sin(45° + 30°) & 1 \end{vmatrix}$
$= \begin{vmatrix} \frac{\sqrt{3}-1}{2\sqrt{2}} & \frac{\sqrt{3}+1}{2\sqrt{2}} & 1 \\ \frac{1}{2} & \frac{\sqrt{3}}{2} & \frac{1}{\sqrt{2}} \\ \frac{\sqrt{3}-1}{2\sqrt{2}} & \frac{\sqrt{3}+1}{2\sqrt{2}} & 1 \end{vmatrix} = 0$ {since R_1 & R_3 are same}

S19. Ans. (a)

Sol. The area of the parallelogram of which $\hat{\imath}$ and $\hat{\imath} + \hat{\jmath}$ are adjacent sides is
$|\hat{\imath} \times (\hat{\imath} + \hat{\jmath})| = |\hat{k}| = 1$sq. unit

S20. Ans. (a)

Sol. (A) $\int \sin x \cos x\; dx = \frac{1}{2}\int 2\sin x \cos x\, dx =$
$\frac{1}{2}\int \sin 2x\, dx = \frac{1}{2}\left\{\frac{-\cos 2x}{2}\right\} = -\frac{1}{4}\cos 2x + C$

(B) $\int \frac{dx}{\sin^2 \cos^2 x} = \int \frac{\sin^2 x + \cos^2 x}{\sin^2 x \cos^2 x} dx = \int \sec^2 x\, dx +$
$\int cosec^2 x\, dx = \tan x - \cot x + C$

(C) $\int \frac{\sin 2x}{1 + \sin^2 x} dx = \int \frac{2\sin x \cos x}{1 + \sin^2 x} dx$
Put $\sin x = t \Rightarrow \cos x\, dx = dt$
$= \int \frac{2tdt}{1+t^2}$
Put $1 + t^2 = u \Rightarrow 2tdt = du$
$= \int \frac{du}{u} = \log u = \log(1 + t^2) = \log(1 + \sin^2 x)$

(D) $\int (1 - \cos x)\, cosec^2\, x\, dx = \int (cosec^2 x -$
$\cos x\; cosec^2 x)dx$
$= \int cosec^2 x\, dx - \int \frac{\cos x}{\sin^2 x} dx$
Put $\sin x = t \Rightarrow \cos x\, dx = dt$
$= -\cot x - \int \frac{dt}{t^2} = -\cot x - \frac{t^{-1}}{-1} + C = -\cot x +$
$\frac{1}{\sin x} + C$
$\frac{1}{sinx} - \frac{\cos x}{\sin x} + C = \frac{1 - \cos x}{\sin x} + C$
$= \frac{1 - \left(1 - 2\sin^2 \frac{x}{2}\right)}{2\sin\frac{x}{2}\cos\frac{x}{2}} + C$
$= \tan\frac{x}{2} + C$

S21. Ans. (c)

Sol. Total cards = 52
Cards of queen = 4
Cards of spade = 13
E: Spade cards
F: Cards of queen
$n(E) = 13$, $n(F) = 4, n(E \cap F) = 1$
$P(E \cap F) = \frac{1}{52}$ & $P(F) = \frac{4}{52}$
Required probability $P\left(\frac{E}{F}\right) = \frac{P(E \cap F)}{P(F)} = \frac{\frac{1}{52}}{\frac{4}{52}} = \frac{1}{4}$

S22. Ans. (d)

Sol. The differential equation is
$x\frac{dy}{dx} - y = \sin x$
$\frac{dy}{dx} - \frac{y}{x} = \frac{\sin x}{x}$

$P = -\frac{1}{x}$

Integrating factor $= e^{\int P dx} = e^{\int -\frac{1}{x} dx} = e^{-\log x} = \frac{1}{x}$

S23. Ans. (a)

Sol. Given curve

$y = \frac{1}{2}\cos x$

Area of bounded curve $= \int_0^{2\pi} \frac{1}{2}\cos x\, dx =$

$2\int_0^{\pi} \frac{1}{2}\cos x\, dx = 4 \times \frac{1}{2}\int_0^{\frac{\pi}{2}} \cos x\, dx = 2[\sin x]_0^{\frac{\pi}{2}} =$

$2 \times 1 = 2$sq. unit

S24. Ans. (c)

Sol. Order of matrix $= 2 \times 2$

Number of elements $= 4$

Number of entries = 4

Number of possible matrices $= 4^4 = 256$

S25. Ans. (a)

Sol. (A) $4\sin^{-1} x + \cos^{-1} x = \pi$

$3\sin^{-1} x + \sin^{-1} x + \cos^{-1} x = \pi$

$3\sin^{-1} x + \frac{\pi}{2} = \pi$

$3\sin^{-1} x = \frac{\pi}{2}$

$\sin^{-1} x = \frac{\pi}{6}$

$x = \frac{1}{2}$

(B) We have

$\frac{1-\tan^2 15°}{1+\tan^2 15°} = \cos 2(15°) = \cos 30° = \frac{\sqrt{3}}{2}$

(C) We have

$x + \frac{1}{x} = 2 \Rightarrow x^2 - 2x + 1 = 0 \Rightarrow (x-1)^2 = 0$

$x = 1$

Now principal value of $\sin^{-1} x = \sin^{-1}(1) = \frac{\pi}{2}$

(D) Let

$\cot^{-1} 2 = \alpha, \cot^{-1} 3 = \beta$

$\cot\alpha = 2 \Rightarrow tan\alpha = \frac{1}{2}$

$\cot\beta = 3 \Rightarrow \tan\beta = \frac{1}{3}$

$\tan(\alpha+\beta) = \frac{\frac{1}{2}+\frac{1}{3}}{1-\frac{1}{2}\times\frac{1}{3}} = \frac{\frac{5}{6}}{\frac{5}{6}} = 1$

$\alpha + \beta = \frac{\pi}{4}$

Suppose third angle be θ

$\alpha + \beta + \theta = \pi$

$\theta = \pi - \frac{\pi}{4} = \frac{3\pi}{4}$

S26. Ans. (a)

Sol. Given

$kx + 3y - z = 1$

$x + 2y + z = 2$

$-kx + y + 2z = -1$

Here

$A = \begin{bmatrix} k & 3 & -1 \\ 1 & 2 & 1 \\ -k & 1 & 2 \end{bmatrix}$

If $|A| = 0$, then the system of equations does not have unique solution

$\begin{vmatrix} k & 3 & -1 \\ 1 & 2 & 1 \\ -k & 1 & 2 \end{vmatrix} = 0$

$k(3) - 3(2+k) - 1(1+2k) = 0$

$3k - 6 - 3k - 1 - 2k = 0$

$-7 - 2k = 0$

$k = -\frac{7}{2}$

S27. Ans. (c)

Sol. Given

$x - y + z - 5 = 0$ .... (i)

$x - 3y - 6 = 0$ .... (ii)

Direction ratios of line $(\hat{\imath} - \hat{\jmath} + \hat{k}) \times (\hat{\imath} - 3\hat{\jmath}) = 3\hat{\imath} + \hat{\jmath} - 2\hat{k}$

Direction ratios are $3, 1, -2$

So, direction cosines are

$\frac{3}{\sqrt{(3)^2+(1)^2+(-2)^2}}, \frac{1}{\sqrt{(3)^2+(1)^2+(-2)^2}}, -\frac{2}{\sqrt{(3)^2+(1)^2+(-2)^2}}$

i.e.

$\frac{3}{\sqrt{14}}, \frac{1}{\sqrt{14}}, -\frac{2}{\sqrt{14}}$

S28. Ans. (b)

Sol. Given equation of plane is

$3x - y + 4z = 2$ & given points are $(3, -2, 1)$

If image of (α, β, γ) with respect to the plane $ax + by + cz + d = 0$ is (x, y, z), then

$\frac{x-\alpha}{a} = \frac{y-\beta}{b} = \frac{z-\gamma}{c} = \frac{-2(a\alpha+b\beta+c\gamma+d)}{a^2+b^2+c^2}$

i.e.

$\frac{x-3}{3} = \frac{y+2}{-1} = \frac{z-1}{4}$

$= \frac{-2(3\times3+(-1)\times(-2)+4\times1-2)}{(3)^2+(-1)^2+(4)^2}$

$\frac{x-3}{3} = \frac{y+2}{-1} = \frac{z-1}{4} = \frac{-26}{26}$

$\frac{x-3}{3} = \frac{y+2}{-1} = \frac{z-1}{4} = -1$

$x = 0, y = -1, z = -3$

S29. Ans. (b)

Sol. We have

$\int_0^{\frac{\pi}{4}} \frac{\sin 2x}{\cos^4 x + \sin^4 x} dx$

$= \int_0^{\frac{\pi}{4}} \frac{\sin 2x}{(\sin^2 x + \cos^2 x)^2 - 2\sin^2 x\cos^2 x} dx$

$= \int_0^{\frac{\pi}{4}} \frac{\sin 2x}{1 - \frac{1}{2}\times 4\sin^2 x\cos^2 x} dx$

$= \int_0^{\frac{\pi}{4}} \frac{\sin 2x}{1 - \frac{1}{2}(\sin 2x)^2} dx$

$= \int_0^{\frac{\pi}{4}} \frac{\sin 2x}{1 - \frac{1}{2}\sin^2 2x} dx$

$$= \int_0^{\frac{\pi}{4}} \frac{\sin 2x}{1 - \frac{1}{2}(1 - \cos^2 2x)} dx = \int_0^{\frac{\pi}{4}} \frac{\sin 2x}{\frac{1}{2}(1 + \cos^2 2x)} dx$$

$$= 2\int_0^{\frac{\pi}{4}} \frac{\sin 2x}{(1 + \cos^2 2x)} dx$$

Put $\cos 2x = t \Rightarrow -2sin2xdx = dt \Rightarrow 2\sin 2x\, dx = -dt$

If $x = 0, then\ t = 1$

If $x = \frac{\pi}{4}, then\ t = 0$

$$= -\int_1^0 \frac{dt}{1 + t^2} = -\{\tan^{-1} t\}_1^0 = \frac{\pi}{4}$$

S30. Ans. (b)

Sol. We have

$y = A\sin x + B\cos x$

$\frac{dy}{dx} = A\cos x - B\sin x$

$\frac{d^2y}{dx^2} = -A\sin x - B\cos x$

$\frac{d^2y}{dx^2} + y = -A\sin x - B\cos x + A\sin x + B\cos x = 0$

S31. Ans. (c)

Sol. Given constraints

$x \geq 0,\ x + y \leq 1$ and $x - y \leq 1$

$x + y = 1$ .... (i)

$x - y = 1$ .... (ii)

From eq. (i), we get

$(1, 0)$ & $(0, 1)$

From eq. (ii), we get

$(1, 0)$ & $(0, -1)$

Feasible region is situated in I and IV quadrant

S32. Ans. (b)

Sol. (A) We have

$\lim_{x\to 0} \frac{1-\cos 2x}{3x^2}$ {form $\frac{0}{0}$}

Using L' Hospital rule

$\lim_{x\to 0} \frac{2\sin 2x}{6x}$ {form $\frac{0}{0}$}

Again, Using L' Hospital rule

$\lim_{x\to 0} \frac{4\cos 2x}{6} = \frac{4}{6} = \frac{2}{3}$

(B) We have

$\lim_{x\to 4} \frac{x^2 - 16}{x - 4} = \lim_{x\to 4} \frac{(x + 4)(x - 4)}{x - 4} = 4 + 4 = 8$

(C) We have

$\lim_{x\to 0} \frac{\sin ax + 4x}{ax + \sin 4x}$ {form $\frac{0}{0}$}

$\lim_{x\to 0} \frac{a\cos ax + 4}{a + 4\cos 4x} = \frac{a + 4}{a + 4} = 1$

(D) We have

$\lim_{z\to 1} \frac{z^{\frac{1}{3}}-1}{z^{\frac{1}{6}}-1}$

Put $z^{\frac{1}{6}} = x$ $z \to 1$ as $x \to 1$

$\lim_{x\to 1} \frac{x^2-1}{x-1} = \lim_{x\to 1} \frac{(x+1)(x-1)}{x-1} = 2$

S33. Ans. (b)

Sol. (A) Range of $cosec^{-1}x$ is $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right] - \{0\}$

(B) Range of $\tan^{-1} x$ is $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

(C) Range of $\sec^{-1} x$ is $[0, \pi] - \left\{\frac{\pi}{2}\right\}$

(D) Range of $\cot^{-1} x$ is $(0, \pi)$

S34. Ans. (c)

Sol. Given

$f: \mathrm{R} \to \mathrm{A}$ given by $\mathrm{f(x)} = \mathrm{x}^2 - 6x + 12$

Let

$y = x^2 - 6x + 12 = x^2 - 6x + 9 + 3 = (x - 3)^2 + 3$

If $f: \mathrm{R} \to \mathrm{A}$ given by $\mathrm{f(x)} = \mathrm{x}^2 - 6x + 12$ is a surjective function, then the set A is $[3, \infty)$.

S35. Ans. (a)

Sol. Let

$P = \begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$

$Q = [b_{ij}]$, where $b_{ij} = 2^{i+j}a_{ij}$ for $1 \leq i, j \leq 3$.

$Q = \begin{bmatrix} 2^2a_{11} & 2^3a_{12} & 2^4a_{13} \\ 2^3a_{21} & 2^4a_{22} & 2^5a_{23} \\ 2^4a_{31} & 2^5a_{32} & 2^6a_{33} \end{bmatrix}$

$|Q| = \begin{vmatrix} 2^2a_{11} & 2^3a_{12} & 2^4a_{13} \\ 2^3a_{21} & 2^4a_{22} & 2^5a_{23} \\ 2^4a_{31} & 2^5a_{32} & 2^6a_{33} \end{vmatrix} = 2^2 \times 2^3 \times$

$2^4 \begin{vmatrix} a_{11} & 2a_{12} & 2^2a_{13} \\ a_{21} & 2a_{22} & 2^2a_{23} \\ a_{31} & 2a_{32} & 2^2a_{33} \end{vmatrix}$

$= 2^9 \times 2 \times 2^2 \begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix} = 2^{12} \times |P| = 2^{12} \times$

$2 = 2^{13}$ {since $|P| = 2$}

S36. Ans. (b)

Sol. Let

M: Male

F: Female

G: Grey hair person

Probability of the selected person being a female is

$$P(F|G) = \frac{P(F)P(G|F)}{P(M)P(G|M) + P(F)P(G|F)}$$

Here

$P(M) = \frac{1}{2}, P(G) = \frac{1}{2}, P(G|M) = \frac{10}{100} = \frac{1}{10}$ & $P(G|F) = \frac{0.5}{100}$

$$P(F|G) = \frac{\frac{1}{2} \times \frac{0.5}{100}}{\frac{1}{2} \times \frac{1}{10} + \frac{1}{2} \times \frac{0.5}{100}} = \frac{\frac{0.5}{200}}{\frac{1}{20} + \frac{0.5}{200}} = \frac{1}{21}$$

S37. Ans. (b)

Sol. Let

$u = \tan^{-1}\left(\frac{1+2x}{1-2x}\right) = \tan^{-1}(1) + \tan^{-1} 2x = \frac{\pi}{4} + \tan^{-1} 2x$

$v = \sqrt{1 + 4x^2}$

$\frac{du}{dx} = \frac{1}{1 + 4x^2} \times 2 = \frac{2}{1 + 4x^2}$

$\frac{dv}{dx} = \frac{1}{2\sqrt{1 + 4x^2}} \times 8x = \frac{4x}{\sqrt{1 + 4x^2}}$

$$\frac{du}{dv} = \frac{\frac{du}{dx}}{\frac{dv}{dx}} = \frac{\frac{2}{1 + 4x^2}}{\frac{4x}{\sqrt{1 + 4x^2}}} = \frac{1}{2x\sqrt{1 + 4x^2}}$$

S38. Ans. (b)

Sol. Radius of a spherical balloon is increasing at the rate of 0.5 cm/sec; then the rate of increase of its volume when radius is 10 cm is

Let r be the radius of spherical balloon, then

Volume $= \frac{4}{3}\pi r^3$

Given

$\frac{dr}{dt} = 0.5\text{cm/sec} \ \& \ r = 10cm$

$\frac{dV}{dt} = \frac{d}{dt}\left(\frac{4}{3}\pi r^3\right) = \frac{4}{3}\pi \times 3r^2 \times \frac{dr}{dt} = 4\pi \times (10)^2 \times 0.5 = 200\pi cm^3/sec.$

S39. Ans. (c)

Sol. Given

Relation R: A → B, where A = {2, 3, 4} and B = {3, 4, 5} is defined by R $\{(x, y): x < y, x \in A, y \in B\}$ then

R = {(2, 3), (2, 4), (2, 5), (3, 4), (3, 5), (4, 5)}

S40. Ans. (b)

Sol. Given curve

$y = x^3 - 4\sin x$

$\frac{dy}{dx} = 3x^2 - 4\cos x$

Slope of tangent at $x = 0$ is

$\left.\frac{dy}{dx}\right|_{x=0} = -4$

Slope of normal $= \frac{1}{4}$

S41. Ans. (c)

Sol. Let $|\vec{a}|$ & $|\vec{b}|$ be two unit vectors such that $|\vec{a} - \vec{b}| = 1$

$|\vec{a} - \vec{b}|^2 = |\vec{a}|^2 + |\vec{b}|^2 - 2\vec{a}.\vec{b}$

$1^2 = 1^2 + 1^2 - 2|\vec{a}|\,|\vec{b}|\cos\theta$

$1 = 2 - 2\cos\theta \Rightarrow cos\theta = \frac{1}{2} \Rightarrow \theta = 60°$

S42. Ans. (d)

Sol. Given function is

$f(x) = \cos x$

$f'(x) = -\sin x$

$\sin x > 0$ in $(0, \pi)$.

So, $-\sin x < 0$ in $(0, \pi)$

i.e. $f(x) = \cos x$ is strictly decreasing in $(0, \pi)$.

S43. Ans. (a)

Sol. Given order of matrices A, B and C are $4 \times 3, 5 \times 4$ and 3×7 respectively, then

Order of matrices A', B' and C' are $3 \times 4, 4 \times 5$ and 7×3.

Now

Order of $C' \times (A' \times B')$ is 7×5.

S44. Ans. (d)

Sol. $x, y \geq 0,\ x + 2y \geq 10,\ 3x + 4y \leq 24$

$x + 2y = 10$ .... (i)

$3x + 4y = 24$ .... (ii)

From eq. (i)

(10, 0) & (0, 5)

From eq. (ii)

(8, 0) & (0, 6)

From eq. (i) & (ii), we get

$x = 4$ & $y = 3$ are the intersection point.

S45. Ans. (c)

Sol. (A) Given

$A^{-1} = \begin{bmatrix} 3 & 4 \\ 5 & 6 \end{bmatrix}$

$(A^{-1})^{-1} = A = \begin{bmatrix} -3 & 2 \\ \frac{5}{2} & -\frac{3}{2} \end{bmatrix}$

(B) Given

$A = \begin{bmatrix} 2 & -1 \\ 3 & 1 \end{bmatrix} \Rightarrow A^T = \begin{bmatrix} 2 & 3 \\ -1 & 1 \end{bmatrix}$

$AA^T = \begin{bmatrix} 2 & -1 \\ 3 & 1 \end{bmatrix}\begin{bmatrix} 2 & 3 \\ -1 & 1 \end{bmatrix} = \begin{bmatrix} 5 & 5 \\ 5 & 10 \end{bmatrix}$

(C) Given

$A^{-1} = \begin{bmatrix} 5 & 7 \\ 2 & 3 \end{bmatrix}$

We have

$(A^T)^{-1} = (A^{-1})^T = \begin{bmatrix} 5 & 2 \\ 7 & 3 \end{bmatrix}$

(D) Given

$a_{ij} = (i - j)^2$

Then

$A = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

S46. Ans. (d)

Sol. Given set is $A = \{3, 5, 7\}$

Equivalence relations on A are

$\{(3,3), (5,5), (7,7)\}$

$\{(3,3), (5,5), (7,7), (3,5), (5,3)\}$

$\{(3,3), (5,5), (7,7), (5,7), (7,5)\}$

$\{(3,3), (5,5), (7,7), (3,7), (7,3)\}$

$\{(3,3), (5,5), (7,7), (3,5), (5,3), (5,7), (7,5), (3,7), (7,3)\}$

There are 5 equivalence relations.

S47. Ans. (a)

Sol. Given

$f(x) = \frac{\log x^3}{3x}$

$f'(x) = \frac{3x \times \frac{1}{x^3} \times 3x^2 - \log x^3 \times 3}{9x^2} = \frac{9 - 3\log x^3}{9x^2}$

For maxima or minima

$f'(x) = 0$

$\frac{9 - 3\log x^3}{9x^2} = 0$

$\log x^3 = 3$

$x^3 = e^3$

$x = e$

$\frac{9 - 3\log x^3}{9x^2}$ has maximum value at $x = e$

S48. Ans. (c)

Sol. $f(x) = \frac{x}{(x-2)(x-3)(x-5)}$ is not exist at $x = 2, 3, 5$. So, $f(x)$ is discontinuous at $x = 2, 3, 5$.

S49. Ans. (b)

Sol. Given differential equation is

$\sqrt[3]{2y + \frac{dy}{dx}} = \left(x + \frac{d^3y}{dx^3}\right)$

$\left(2y + \frac{dy}{dx}\right)^{\frac{1}{3}} = \left(x + \frac{d^3y}{dx^3}\right)$

Taking power '3' both sides

$\left(2y + \frac{dy}{dx}\right) = \left(x + \frac{d^3y}{dx^3}\right)^3$

Order = 3 & degree = 3

S50. Ans. (d)

Sol. The projection of $\hat{\imath} - \hat{\jmath}$ on the vector $\hat{\imath} + \hat{\jmath}$ is

$\frac{(\hat{\imath} - \hat{\jmath}).(\hat{\imath} + \hat{\jmath})}{|\hat{\imath} + \hat{\jmath}|} = \frac{1 - 1}{\sqrt{2}} = 0$