



CUET UG Math Practice Test 1 with Answers PDF

- The domain of definition of $f(x) = \frac{\log_2(x+3)}{x^2+3x+2}$ is:
 - $R - \{-1, -2\}$
 - $(-2, \infty)$
 - $R - \{-1, -2, -3\}$
 - $(-3, \infty) - \{-1, -2\}$
- How many roots the equation $x - \frac{2}{x-1} = 1 - \frac{2}{x-1}$ have
 - One
 - Two
 - Infinite
 - None of these
- From the following find the correct relation
 - $(AB)' = A'B$
 - $(AB)' = B'A$
 - $A^{-1} = \frac{\text{adj } A}{A}$
 - $(AB)^{-1} = A^{-1}B^{-1}$
- If the roots of the cubic equation $ax^3 + bx^2 + cx + d = 0$ are in G.P., then
 - $c^3a = b^3d$
 - $ca^3 = bd^3$
 - $a^3b = c^3d$
 - $ab^3 = cd^3$
- $C_1 + 2C_2 + 3C_3 + 4C_4 + \dots + nC_n =$
 - 2^n
 - $n \cdot 2^n$
 - $n \cdot 2^{n-1}$
 - $n \cdot 2^{n+1}$
- $1 + \frac{(\log_e n)^2}{2!} + \frac{(\log_e n)^4}{4!} + \dots =$
 - n
 - $1/n$
 - $\frac{1}{2}(n + n^{-1})$
 - $\frac{1}{2}(e^n + e^{-n})$
- How many words can be made from the letters of the word INSURANCE, if all vowels come together.
 - 18270
 - 17280
 - 12780
 - None of these
- There are four machines and it is known that exactly two of them are faulty. They are tested, one by one, in a random order till both the faulty machines are identified. Then, the probability that only two tests are needed, is
 - $\frac{1}{3}$
 - $\frac{1}{6}$
 - $\frac{1}{2}$
 - $\frac{1}{4}$
- Find real part of $\cosh^{-1}(1)$
 - 1
 - 1
 - 0
 - None of these
- From a 60 meter high tower angles of depression of the top and bottom of a house are α and β respectively. If the height of the house is $\frac{60\sin(\beta - \alpha)}{x}$, then $x =$
 - $\sin \alpha \sin \beta$
 - $\cos \alpha \cos \beta$
 - $\sin \alpha \cos \beta$
 - $\cos \alpha \sin \beta$
- The function $f(x) = \frac{\log(1+ax) - \log(1-bx)}{x}$ is not defined at $x=0$. The value which should be assigned to f at $x=0$ so that it is continuous at $x=0$, is
 - $a-b$
 - $a+b$
 - $\log a + \log b$
 - $\log a - \log b$
- If $x = a \cos^4 \theta, y = a \sin^4 \theta$, then $\frac{dy}{dx}$, at $\theta = \frac{3\pi}{4}$, is
 - 1
 - 1
 - $-a^2$
 - a^2
- $\int \frac{e^{\tan^{-1}x}}{1+x^2} dx =$
 - $\log(1+x^2) + c$
 - $\log e^{\tan^{-1}x} + c$
 - $e^{\tan^{-1}x} + c$
 - $\tan^{-1} e^{\tan^{-1}x} + c$
- The solution of the equation $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$ is
 - $e^y = e^x + \frac{x^3}{3} + c$
 - $e^y = e^x + 2x + c$
 - $e^y = e^x + x^3 + c$
 - $y = e^x + c$
- The distance between $4x + 3y = 11$ and $8x + 6y = 15$, is
 - $\frac{7}{2}$
 - 4
 - $\frac{7}{10}$
 - None of these
- The area of a circle whose centre is (h, k) and radius a is
 - $\pi(h^2 + k^2 - a^2)$
 - $\pi a^2 hk$
 - πa^2
 - None of these

17. The locus of the mid-point of the line segment joining the focus to a moving point on the parabola $y^2 = 4ax$ is another parabola with directrix
- a. $x = -a$ b. $x = -\frac{a}{2}$
c. $x = 0$ d. $x = \frac{a}{2}$
18. If $\vec{a} = (2, 5)$ and $\vec{b} = (1, 4)$, then the vector parallel to $(\vec{a} + \vec{b})$ is
- a. (3, 5) b. (1, 1) c. (1, 3) d. (8, 5)
19. The acute angle between the line joining the points (2, 1, -3), (-3, 1, 7) and a line parallel to $\frac{x-1}{3} = \frac{y}{4} = \frac{z+3}{5}$ through the point (-1, 0, 4) is
- a. $\cos^{-1}\left(\frac{7}{5\sqrt{10}}\right)$ b. $\cos^{-1}\left(\frac{1}{\sqrt{10}}\right)$
c. $\cos^{-1}\left(\frac{3}{5\sqrt{10}}\right)$ d. $\cos^{-1}\left(\frac{1}{5\sqrt{10}}\right)$
20. $\sin\left(\frac{\pi}{10}\right)\sin\left(\frac{3\pi}{10}\right) =$
- a. 1/2 b. -1/2 c. 1/4 d. 1
21. The minimum value of $[(5+x)(2+x)]/[1+x]$ for non-negative real x is
- a. 12 b. 1
c. 9 d. 8
22. If ω is the cube root of unity, then $(3+5\omega+3\omega^2)^2 + (3+3\omega+5\omega^2)^2 =$
- a. 4 b. 0
c. -4 d. None of these
23. The measurement of the area bounded by the co-ordinate axes and the curve $y = \log_e x$ is
- a. 1 b. 2
c. 3 d. ∞
24. The number of solutions of the system of equations $2x+y-z=7, x-3y+2z=1, x+4y-3z=5$ is
- a. 3 b. 2
c. 1 d. 0
25. The n^{th} term of the series $3 + 10 + 17 + \dots$ and $63 + 65 + 67 + \dots$ are equal, then the value of n is
- a. 11 b. 12
c. 13 d. 15
26. Let $f'(x) = \frac{192x^3}{2 + \sin^4 \pi x}$ for all $x \in \mathbb{R}$ with $f\left(\frac{1}{2}\right) = 0$. If $m \leq \int_{1/2}^1 f(x) dx \leq M$, then the possible values of m and M are
- a. $m=13, M=24$
b. $m = \frac{1}{4}, M = \frac{1}{2}$
c. $m=-11, M=0$
d. $m=1, M=12$
27. Let S be the set of all non-zero real numbers α such that the quadratic equation $\alpha x^2 - x + \alpha = 0$ has two distinct real roots x_1 and x_2 satisfying the inequality $|x_1 - x_2| < 1$. Which of the following intervals is(are) a subset(s) of S?
- a. $\left(-\frac{1}{2}, -\frac{1}{\sqrt{5}}\right)$ b. $\left(-\frac{1}{\sqrt{5}}, 0\right)$
c. $\left(0, \frac{1}{\sqrt{5}}\right)$ d. $\left(\frac{1}{\sqrt{5}}, \frac{1}{2}\right)$
28. If $\alpha = 3\sin^{-1}\left(\frac{6}{11}\right)$ and $\beta = 3\cos^{-1}\left(\frac{4}{9}\right)$, where the inverse trigonometric functions take only the principal values, then the correct option(s) is (are)
- a. $\cos \beta > 0$ b. $\sin \beta < 0$
c. $\cos(\alpha + \beta) > 0$ d. $\cos \alpha < 0$
29. Let E_1 and E_2 be two ellipse whose centers are at the origin. The major axes of E_1 and E_2 lie along the x-axis and the y-axis, respectively. Let S be the circle $x^2 + (y-1)^2 = 2$. The straight line $x+y=3$ touches the curves S, E_1 and E_2 at P, Q and R, respectively suppose that $PQ = PR = \frac{2\sqrt{2}}{3}$. If e_1 and e_2 are the eccentricities of E_1 and E_2 , respectively, then the correct expression(s) is(are)
- a. $e_1^2 + e_2^2 = \frac{43}{40}$ b. $e_1 e_2 = \frac{\sqrt{7}}{2\sqrt{10}}$
c. $|e_1^2 - e_2^2| = \frac{5}{8}$ d. $e_1 e_2 = \frac{\sqrt{3}}{4}$

30. Consider the hyperbola $H : x^2 - y^2 = 1$ and a circle S with center $N(x_2, 0)$. Suppose that H and S touch each other at a point $P(x_1, y_1)$ with $x_1 > 1$ and $y_1 > 0$. The common tangent to H and S at P intersects the x -axis at point M . If (l, m) is the centroid of the triangle ΔPMN , then the correct expression(s) is (are)
- $\frac{dl}{dx_1} = 1 - \frac{1}{3x_1^2}$ for $x_1 > 1$
 - $\frac{dm}{dx_1} = \frac{x_1}{3(\sqrt{x_1^2 - 1})}$ for $x_1 > 1$
 - $\frac{dl}{dx_1} = 1 + \frac{1}{3x_1^2}$ for $x_1 > 1$
 - $\frac{dm}{dy_1} = \frac{1}{3}$ for $y_1 > 0$
31. The option(s) with the values of a and L that satisfy the following equation is(are)
- $$\frac{\int_0^{4\pi} (\sin^6 at + \cos^4 at) dt}{\int_0^{\pi} e^t (\sin^6 at + \cos^4 at) dt} = L?$$
- $a = 2, L = \frac{e^{4\pi} - 1}{e^{\pi} - 1}$
 - $a = 2, L = \frac{e^{4\pi} + 1}{e^{\pi} + 1}$
 - $a = 4, L = \frac{e^{4\pi} - 1}{e^{\pi} - 1}$
 - $a = 4, L = \frac{e^{4\pi} + 1}{e^{\pi} + 1}$
32. The quadratic equation $p(x) = 0$ with real coefficients has purely imaginary roots. Then the equation $p(p(x)) = 0$ has
- only purely imaginary roots
 - all real roots
 - two real and two purely imaginary roots
 - neither real nor purely imaginary roots
33. Let α and β be the roots of equation $x^2 - 6x - 2 = 0$. If $a_n = \alpha^n - \beta^n$, for $n \geq 1$, then the value of $\frac{a_{10} - 2a_8}{2a_9}$ is equal to:
- 6
 - 6
 - 3
 - 3
34. Let S be the set of all non-zero real numbers α such that the quadratic equation $\alpha x^2 - x + \alpha = 0$ has two distinct real roots x_1 and x_2 satisfying the inequality $|x_1 - x_2| < 1$. Which of the following intervals is(are) a subset(s) of S ?
- $\left(-\frac{1}{2}, -\frac{1}{\sqrt{5}}\right)$
 - $\left(-\frac{1}{\sqrt{5}}, 0\right)$
 - $\left(0, \frac{1}{\sqrt{5}}\right)$
 - $\left(\frac{1}{\sqrt{5}}, \frac{1}{2}\right)$
35. The sum of all real values of x satisfying the equation $(x^2 - 5x + 5)^{x^2 + 4x - 60} = 1$ is:
- 3
 - 4
 - 6
 - 5
36. The least value of $\alpha \in \mathbb{R}$ for which $4\alpha x^2 + \frac{1}{x} \geq 1$, for all $x > 0$, is
- $\frac{1}{64}$
 - $\frac{1}{32}$
 - $\frac{1}{27}$
 - $\frac{1}{25}$
37. Let $-\frac{\pi}{6} < \theta < -\frac{\pi}{12}$. Suppose α_1 and β_1 are the roots of the equation $x^2 - 2x \sec \theta + 1 = 0$ and α_2 and β_2 are the roots of the equation $x^2 + 2x \tan \theta - 1 = 0$. If $\alpha_1 > \beta_1$ and $\alpha_2 > \beta_2$, then $\alpha_1 + \beta_2$ equals
- $2(\sec \theta - \tan \theta)$
 - $2 \sec \theta$
 - $-2 \tan \theta$
 - 0
38. Let $a, \lambda, \mu \in \mathbb{R}$. Consider the system of linear equations $ax + 2y = \lambda, 3x - 2y = \mu$. Which of the following statement(s) is (are) correct?
- If $a = -3$, then the system has infinitely many solutions for all values of λ and μ
 - If $a \neq -3$, then the system has unique solutions for all values of λ and μ
 - If $\lambda + \mu = 0$, then the system has infinitely many solutions for $a = -3$
 - If $\lambda + \mu \neq 0$, then the system has no solutions for $a = -3$
39. If, for a positive integer n , the quadratic equation, $x(x+1) + (x+1)(x+2) + \dots + (x+n-1)(x+n) = 10n$ has two consecutive integral solutions, then n is equal to
- 10
 - 11
 - 12
 - 9
40. A line $L : y = mx + 3$ meets y -axis at $E(0, 3)$ and the arc of the parabola $y^2 = 16x, 0 \leq y \leq 6$ at the point $F(x_0, y_0)$. The tangent to the parabola at $F(x_0, y_0)$ intersects the

y-axis at $G(0, y_1)$. The slope m of the line L is chosen such that the area of the ΔEFG has a local maximum. Match Column I with Column II and select the correct answer using the code given below the Columns.

Column I	Column II
(A) $m =$	1. $1/2$
(B) Maximum area of ΔEFG is	2. 4
(C) $y_0 =$	3. 2
(D) $y_1 =$	4. 1

- a. A→4; B→1; C→2; D→3 b. A→1; B→4; C→2; D→3
 c. A→1; B→2; C→3; D→4 d. A→4; B→1; C→3; D→2

41. Observe the following columns:

Column I	Column II
(A) $y = \sin^{-1}(3x - 4x^3)$, then $\frac{dy}{dx}$ is	1. $\frac{3}{1+x^2}, x \in \left(-\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}\right)$
(B) $y = \cos^{-1}(4x^3 - 3x)$, then $\frac{dy}{dx}$ is	2. $\frac{3}{1+x^2}, x \in \left(\frac{1}{\sqrt{3}}, \infty\right)$
(C) $y = \tan^{-1}\left(\frac{3x-x^3}{1-3x^2}\right)$, then $\frac{dy}{dx}$ is	3. $\frac{3}{\sqrt{1-x^2}}, x \in \left(-\frac{1}{2}, \frac{1}{2}\right)$
	4. $\frac{3}{1+x^2}, x \in \left(-\infty, -\frac{1}{\sqrt{3}}\right)$
	5. $\frac{3}{\sqrt{1-x^2}}, x \in \left(-1, \frac{1}{2} \cup \left(\frac{1}{2}, 1\right)\right)$

- a. A→3,5; B→3,5; C→1,2 b. A→3,5; B→3,5; C→1,2,4
 c. A→3,5; B→2,3; C→1,4 d. A→1,3; B→3,5; C→1,2

42. Match the statements given in Column I with the interval/union of intervals given in Column II

Column I	Column II
(A) The set $\left\{ \operatorname{Re}\left(\frac{2iz}{1-z^2}\right) \right\} : z$ is a complex number, $ z =1, z \neq \pm i$	1. $(-\infty, -1) \cup (1, \infty)$
(B) The domain of the function $f(x) = \sin^{-1}$	2. $(-\infty, 0) \cup (0, \infty)$

$\left(\frac{8(3)^{x-2}}{1-3^{2(x-1)}}\right)$ is	
$f(\theta) = \begin{vmatrix} 1 & \tan\theta & 1 \\ -\tan\theta & 1 & \tan\theta \\ -1 & -\tan\theta & 1 \end{vmatrix}$	3. $[2, \infty)$
(C) If then the set $\left\{ f(\theta) : 0 \leq \theta < \frac{\pi}{2} \right\}$ is	
(D) If $f(x) = x^3(3x+4), x \geq 0$, then $f(x)$ is increasing in	4. $(-\infty, -1] \cup [1, \infty)$
	5. $(-\infty, 0] \cup [2, \infty)$

- a. A→4; B→2, 4; C→4; D→2
 b. A→4; B→5; C→3; D→3
 c. A→2; B→1, 4; C→3; D→4
 d. A→1; B→2; C→5; D→4

43. Match the statements/expressions in Column I with the values given in Column II.

Column I	Column II
(A) The number of solutions of the equation $xe^{\sin x} - \cos x = 0$ in the interval $\left(0, \frac{\pi}{2}\right)$	1. 1
(B) Value (s) of k for which the plane $kx + 4y + z = 0, 4x + ky + 2z = 0$ and $2x + 2y + z = 0$ intersect in a straight line	2. 2
(C) Value (s) of k for which $ x-1 + x-2 + x+1 + x+2 = 4k$ has integer solution (s)	3. 3
(D) If $y'y+1$ and $y(0) = 1$ then value (s) of $y(\ln 2)$	4. 4
	5. 5

- a. A→1; B→2,3; C→2,3,4,5; D→3
 b. A→4; B→5; C→3; D→3
 c. A→2; B→1, 4; C→3; D→2,3,4,5
 d. A→1; B→2; C→5; D→4

44. Let ΔPQR be a triangle. Let $\vec{a} = \overrightarrow{QR}$, $\vec{b} = \overrightarrow{RP}$, and $\vec{c} = \overrightarrow{PQ}$. If $|\vec{a}| = 2$, $|\vec{b}| = 4\sqrt{3}$ and $\vec{b} \cdot \vec{c} = 24$, then which of the following is/are true?
- a. $\frac{|\vec{c}|^2}{2} - |\vec{a}| = 2$ b. $\frac{|\vec{c}|^2}{2} - |\vec{a}| = 30$
c. $|\vec{a} \times \vec{b} + \vec{c} \times \vec{a}| = 48\sqrt{3}$ d. $\vec{a} \cdot \vec{b} = -72$
45. Let X and Y be two arbitrary, 3×3 , non-zero, skew-symmetric matrices and Z be an arbitrary 3×3 , non-zero, symmetric matrix. Then which of the following matrices is (are) skew symmetric?
- a. $Y^3 Z^4 - Z^4 Y^3$ b. $X^{44} + Y^{44}$
c. $X^4 Z^3 - Z^3 X^4$ d. $X^{23} + Y^{23}$
46. Which of the following values of α satisfy the equation
- $$\begin{vmatrix} (1+\alpha)^2 & (1+2\alpha)^2 & (1+3\alpha)^2 \\ (2+\alpha)^2 & (2+2\alpha)^2 & (2+3\alpha)^2 \\ (3+\alpha)^2 & (3+2\alpha)^2 & (3+3\alpha)^2 \end{vmatrix} = -648\alpha ?$$
- a. -4 b. 9 c. -9 d. 4
47. In R^3 , consider the planes $P_1 : y = 0$ and $P_2 : x + z = 1$. Let P_3 be a plane, different from P_1 and P_2 which passes through the intersection of P_1 and P_2 . If the distance of the point $(0, 1, 0)$ from P_3 is 1 and the distance of a point (α, β, γ) from P_3 is 2, then which of the following relations is (are) true?
- a. $2\alpha + \beta + 2\gamma + 2 = 0$ b. $2\alpha - \beta + 2\gamma + 4 = 0$
c. $2\alpha + \beta - 2\gamma - 10 = 0$ d. $2\alpha - \beta + 2\gamma - 8 = 0$
48. In R^3 , let L be a straight line passing through the origin. Suppose that all the points on L are at a constant distance from the two planes $P_1 : x + 2y - z + 1 = 0$ and $P_2 : 2x - y + z - 1 = 0$. Let M be the locus of the feet of the perpendiculars drawn from the points on L to the plane P_1 . Which of the following points lie(s) on M ?
- a. $\left(0, -\frac{5}{6}, -\frac{2}{3}\right)$ b. $\left(-\frac{1}{6}, -\frac{1}{3}, \frac{1}{6}\right)$
c. $\left(-\frac{5}{6}, 0, \frac{1}{6}\right)$ d. $\left(-\frac{1}{3}, 0, \frac{2}{3}\right)$
49. Let P and Q be distinct points on the parabola $y^2 = 2x$ such that a circle with PQ as diameter passes through the vertex O of the parabola. If P lies in the first quadrant and the area of the triangle ΔOPQ is $3\sqrt{2}$, then which of the following is (are) the coordinates of P ?
- a. $(4, 2\sqrt{2})$ b. $(9, 3\sqrt{2})$ c. $\left(\frac{1}{4}, \frac{1}{\sqrt{2}}\right)$ d. $(1, \sqrt{2})$
50. If $\alpha, \beta \in C$ are the distinct roots, of the equation $x^2 - x + 1 = 0$, then $\alpha^{101} + \beta^{107}$ is equal to
- a. 2 b. -1
c. 0 d. 1

Answers and Solutions

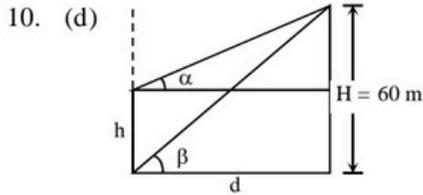
1. (d) $x + 3 > 0$ and $x^2 + 3x + 2 \neq 0$
2. (d) If $x \neq 1$, multiplying each term by $(x-1)$, the given equation reduces to $x(x-1) = (x-1)$ or $(x-1)^2 = 0$ or $x = 1$, which is not possible as considering $x \neq 1$. Thus given equation has no roots.
3. (b) It is understandable.
4. (a) Let $\frac{A}{R}$, A , AR be the roots of the equation $ax^3 + bx^2 + cx + d = 0$
- then $A^3 = \text{Product of the roots} = -\frac{d}{a}$
- $$\Rightarrow A = -\left(\frac{d}{a}\right)^{1/3}$$
- Since A is a root of the equation.
- $\therefore aA^3 + bA^2 + cA + d = 0$
- $$\Rightarrow a\left(-\frac{d}{a}\right) + b\left(-\frac{d}{a}\right)^{2/3} + c\left(-\frac{d}{a}\right)^{1/3} + d = 0$$
- $$\Rightarrow b\left(\frac{d}{a}\right)^{2/3} = c\left(\frac{d}{a}\right)^{1/3} \Rightarrow b^3 \frac{d^2}{a^2} = c^3 \frac{d}{a} \Rightarrow b^3 d = c^3 a$$
5. (c) Trick: Put $n = 1, 2, 3, \dots$ $S_1 = 1, S_2 = 2 + 2 = 4$
Now by alternate (c), put $n = 1, 2$
 $S_1 = 1.2^0 = 1, S_2 = 2.2^1 = 4$
6. (c) $1 + \frac{(\log_e n)^2}{2!} + \frac{(\log_e n)^4}{4!} + \dots = \frac{e^{\log_e n} + e^{-\log_e n}}{2} = \frac{n + n^{-1}}{2}$
7. (d) IUAENSRNC Obviously required number of words are $\frac{6!}{2!} \times 4! = 8640$
8. (b) The probability that only two tests are needed = probability that the first machine tested is faulty \times

probability that the second machine tested is faulty

$$= \frac{2}{4} \times \frac{1}{3} = \frac{1}{6}$$

9. (c) We know that $\cosh^{-1} x = \log(x + \sqrt{x^2 - 1})$

$$\therefore \cosh^{-1}(1) = \log(1 + \sqrt{1^2 - 1}) = \log 1 = 0.$$



$$H = d \tan \beta \text{ and } H - h = d \tan \alpha$$

$$\Rightarrow \frac{60}{60 - h} = \frac{\tan \beta}{\tan \alpha} \Rightarrow -h = \frac{60 \tan \alpha - 60 \tan \beta}{\tan \beta}$$

$$\Rightarrow h = \frac{60 \sin(\beta - \alpha)}{\cos \alpha \cos \beta} \Rightarrow x = \cos \alpha \sin \beta.$$

11. (b) Since limit of a function is $a + b$ as $x \rightarrow 0$, therefore to be continuous at a function, its value must be $a + b$ at $x = 0$

$$\Rightarrow f(0) = a + b.$$

12. (a) $y = a \sin^4 \theta \Rightarrow \frac{dy}{d\theta} = 4a \sin^3 \theta \cos \theta$

and $x = a \cos^4 \theta$

$$\Rightarrow \frac{dx}{d\theta} = -4a \cos^3 \theta \sin \theta$$

$$\therefore \frac{dy}{dx} = \frac{dy/d\theta}{dx/d\theta} = \frac{-\sin^2 \theta}{\cos^2 \theta} = -\tan^2 \theta$$

$$\therefore \left(\frac{dy}{dx}\right)_{\theta = \frac{3\pi}{4}} = -\tan^2\left(\frac{3\pi}{4}\right) = -1.$$

13. (c) Putting $t = \tan^{-1} x \Rightarrow dt = \frac{1}{1+x^2} dx$, we get

$$\int \frac{e^{\tan^{-1} x}}{1+x^2} dx = \int e^t dt = e^t + c = e^{\tan^{-1} x} + c.$$

14. (a) $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y} = e^{-y} (e^x + x^2)$

$$\Rightarrow e^y dy = (x^2 + e^x) dx$$

Now integrating both sides, we get $e^y = \frac{x^3}{3} + e^x + c.$

15. (c) $4x + 3y = 11$ and $4x + 3y = \frac{15}{2}$

$$D = \frac{|C_1 - C_2|}{\sqrt{A^2 + B^2}} = \frac{\left|11 - \frac{15}{2}\right|}{\sqrt{4^2 + 3^2}}$$

$$\text{Therefore, } D = \left| \frac{11 - \frac{15}{2}}{5} \right| = \frac{7}{10}.$$

16. (c) Since area = πr^2 , where $r = a$

$$\Rightarrow \text{Area} = \pi a^2.$$

17. (c) Let $P(h, k)$ be the mid-point of the line segment joining the focus $(a, 0)$ and a general point $Q(x, y)$ on the parabola.

$$\text{Then } h = \frac{x+a}{2}, k = \frac{y}{2} \Rightarrow x = 2h - a, y = 2k.$$

Put these values of x and y in $y^2 = 4ax$, we get

$$4k^2 = 4a(2h - a)$$

$$\Rightarrow 4k^2 = 8ah - 4a^2 \Rightarrow k^2 = 2ah - a^2$$

So, locus of $P(h, k)$ is $y^2 = 2ax - a^2$

$$\Rightarrow y^2 = 2a\left(x - \frac{a}{2}\right)$$

Its directrix is

$$x - \frac{a}{2} = -\frac{a}{2} \Rightarrow x = 0.$$

18. (c) $\vec{a} + \vec{b} = 3\hat{i} + 9\hat{j} = 3(\hat{i} + 3\hat{j})$. Hence it is parallel to $(1, 3)$.

19. (a) Direction ratio of the line joining the point $(2, 1, -3), (-3, 1, 7)$ are (a, b, c)

$$\Rightarrow (-3 - 2, 1 - 1, 7 - (-3))$$

$$\Rightarrow (-5, 0, 10)$$

Direction ratio of the line parallel to line

$$\frac{x-1}{3} = \frac{y}{4} = \frac{z+3}{5} \text{ are}$$

$$(a_2, b_2, c_2)$$

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

Angle between two lines,

$$\cos \theta = \frac{a_1 a_2 + b_1 b_2 + c_1 c_2}{\sqrt{a_1^2 + b_1^2 + c_1^2} \sqrt{a_2^2 + b_2^2 + c_2^2}}$$

$$\cos \theta = \frac{(-5 \times 3) + (0 \times 4) + (10 \times 5)}{\sqrt{25 + 0 + 100} \sqrt{9 + 16 + 25}}$$

$$\Rightarrow \cos \theta = \frac{35}{25\sqrt{10}}$$

$$\Rightarrow \theta = \cos^{-1}\left(\frac{7}{5\sqrt{10}}\right)$$

20. (c) $\sin \frac{\pi}{10} \sin \frac{3\pi}{10} = \sin 18^\circ \sin 54^\circ$

$$= \sin 18^\circ \cos 36^\circ = \frac{\sqrt{5}-1}{4} \cdot \frac{\sqrt{5}+1}{4} = \frac{1}{4}$$

21. (c) Given $f(x) = \frac{[(5+x)(2+x)]}{[1+x]}$

$$f(x) = 1 + \frac{4}{1+x} + (5+x) = (6+x) + \frac{4}{(1+x)}$$

$$\Rightarrow f'(x) = 1 - \frac{4}{(1+x)^2} = 0;$$

$$x^2 + 2x - 3 = 0$$

$$\Rightarrow x = -3, 1$$

$$\text{Now } f''(x) = \frac{8}{(1+x)^3},$$

$$f''(-3) = -ve$$

$$f''(1) = +ve$$

Hence minimum value at $x = 1$

$$f(1) = \frac{(5+1)(2+1)}{(1+1)} = \frac{6 \times 3}{2} = 9.$$

22. (c) $(3+5\omega+3\omega^3)^2 + (3+3\omega+5\omega^3)^2$

$$= (3+3\omega+3\omega^2+2\omega)^2 + (3+3\omega+3\omega^2+2\omega^3)^2$$

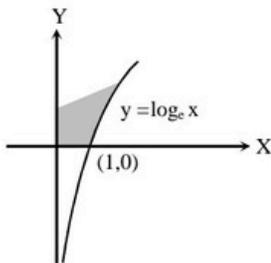
$$(1+\omega+\omega^2=0, \omega^3=1)$$

$$= (2\omega)^2 + (2\omega^3)^2 = 4\omega^2 + 4\omega^4 = 4(1) = 4.$$

23. (d) Area

$$A = \int_0^\infty \log x \, dx$$

$$= (x \log x - x)_0^\infty = \infty$$



24. (d) $\Delta = \begin{vmatrix} 2 & 1 & -1 \\ 1 & -3 & 2 \\ 1 & 4 & -3 \end{vmatrix}$

$$= 2(9-8) - 1(-3-2) - 1(4+3) = 7 - 7 = 0$$

Hence, number of solutions is zero.

25. (c) n^{th} term of 1st series $= 3 + (n-1)7 = 7n - 4$

$$n^{\text{th}} \text{ term of } 2^{\text{nd}} \text{ series} = 63 + (n-1) = 2n + 61$$

$$\therefore \text{ we have, } 7n - 4 = 2n + 61$$

$$\Rightarrow n = 13$$

26. (d) $\frac{192}{3} \int_{1/2}^x t^3 dt \leq f(x) \leq \frac{192}{2} \int_{1/2}^x t dt$

$$16x^4 - 1 \leq f(x) \leq 24x^2 - \frac{3}{2}$$

$$\int_{1/2}^1 (16x^4 - 1) dx \leq \int_{1/2}^1 f(x) dx \leq \int_{1/2}^1 \left(24x^2 - \frac{3}{2}\right) dx$$

$$1 < \frac{26}{10} \leq \int_{1/2}^1 f(x) dx \leq \frac{39}{10} < 12$$

27. (a, d) Here, $0 < (x_1 - x_2)^2 < 1$

$$\Rightarrow 0 < (x_1 + x_2)^2 - 4x_1x_2 < 1 \Rightarrow 0 < \frac{1}{\alpha^2} - 4 < 1$$

$$\Rightarrow \alpha \in \left(-\frac{1}{2}, -\frac{1}{\sqrt{5}}\right) \cup \left(\frac{1}{\sqrt{5}}, \frac{1}{2}\right)$$

28. (b, c, d) $\frac{\pi}{2} < \alpha < \pi, \pi < \beta < \frac{3\pi}{2}$

$$\Rightarrow \frac{3\pi}{2} < \alpha + \beta < \frac{5\pi}{2} \Rightarrow \sin \beta < 0; \cos \alpha < 0$$

$$\Rightarrow \cos(\alpha + \beta) > 0.$$

29. (a, b) For the given line, point of contact for

$$E_1: \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \text{ is } \left(\frac{a^2}{3}, \frac{b^2}{3}\right)$$

$$\text{and for } E_2: \frac{x^2}{B^2} + \frac{y^2}{A^2} = 1 \text{ is } \left(\frac{B^2}{3}, \frac{A^2}{3}\right)$$

Point of contact $x + y = 3$ of and circle is (1, 2)

Also, general point on $x + y = 3$ can be taken as

$$\left(1 \mp \frac{r}{\sqrt{2}}, 2 \pm \frac{r}{\sqrt{2}}\right) \text{ where, } r = \frac{2\sqrt{2}}{3}$$

$$\text{So, required points are } \left(\frac{1}{3}, \frac{8}{3}\right) \text{ and } \left(\frac{5}{3}, \frac{4}{3}\right)$$

Comparing with points of contact of ellipse,

$$a^2 = 5, B^2 = 8 \quad b^2 = 4, A^2 = 1$$

$$\therefore e e_2 = \frac{\sqrt{7}}{2\sqrt{10}} \text{ and } e_1^2 + e_2^2 = \frac{43}{40}$$

30. (a, b, d) tangent at P, $xx_1 - yy_1 = 1$ intersects x axis at

$$M\left(\frac{1}{x_1}, 0\right)$$

$$\text{Slope of normal} = -\frac{y_1}{x_1} = \frac{y_1 - 0}{x_1 - x_2}$$

$$\Rightarrow x_2 = 2x_1 \Rightarrow N \equiv (2x_1, 0)$$

$$\text{For centroid } \ell = \frac{3x_1 + \frac{1}{3}}{3}, m = \frac{y_1}{3}$$

$$\frac{d\ell}{dx_1} = 1 - \frac{1}{3x_1^2}$$

$$\frac{dm}{dy_1} = \frac{1}{3}, \frac{dm}{dx_1} = \frac{1}{3} \frac{dy_1}{dx_1} = \frac{x_1}{3\sqrt{x_1^2 - 1}}$$

$$31. (a, c) \text{ Let } \int_0^\pi e^t (\sin^6 at + \cos^4 at) dt = A$$

$$I = \int_\pi^{2\pi} e^t (\sin^6 at + \cos^4 at) dt$$

$$\text{Put } t = \pi + x \quad dt = dx$$

for $a = 2$ as well as $a = 4$

Similarly

$$\int_{2\pi}^{3\pi} e^t (\sin^6 at + \cos^4 at) dt = e^{2\pi} A$$

$$\text{So, } L = \frac{A + e^\pi A + e^{2\pi} A + e^{3\pi} A}{A} = \frac{e^{3\pi} - 1}{e^\pi - 1}$$

For both $a = 2, 4$

$$32. (d) P(x) = ax^2 + b \text{ with } a, b \text{ of same sign.}$$

$$P(P(x)) = a(ax^2 + b)^2 + b$$

If $x \in \mathbb{R}$ or $ix \in \mathbb{R}$

$$\Rightarrow x^2 \in \mathbb{R}$$

$$\Rightarrow P(x) \in \mathbb{R} \Rightarrow P(P(x)) \neq 0$$

Hence real or purely imaginary number cannot satisfy

$$P(P(x)) = 0.$$

$$33. (c) x^2 - 6x - 2 = 0$$

$$\Rightarrow x^{10} - 6x^9 - 2x^8 = 0$$

$$'a', \beta \text{ roots } \Rightarrow a^{10} - 6a^8 - 2a^8 = 0 \quad \dots (i)$$

$$\text{and } \beta^{10} - 6\beta^8 - 2\beta^8 = 0 \quad \dots (ii)$$

Equation (i) and (ii) we get,

$$\alpha^{10} - \beta^{10} - 6(\alpha^8 - \beta^8) - 2(\alpha^8 - \beta^8) = 0$$

$$\Rightarrow a_{10} - 6a_8 - 2a_8 = 0$$

$$\Rightarrow \frac{a_{10} - 2a_8}{2a_8} = 3$$

$$34. (a, d) \text{ Here, } 0 < (x_1 - x_2)^2 < 1$$

$$\Rightarrow 0 < (x_1 + x_2)^2 - 4x_1x_2 < 1$$

$$\Rightarrow 0 < \frac{1}{\alpha^2} - 4 < 1$$

$$\Rightarrow \alpha \in \left(-\frac{1}{2}, -\frac{1}{\sqrt{5}}\right) \cup \left(\frac{1}{\sqrt{5}}, \frac{1}{2}\right)$$

$$35. (a) (x^2 - 5x + 5)^{x^2 + 4x - 60} = 1$$

$$x^2 - 5x + 5 = 1 \quad x^2 + 4x - 60 = 0 \quad x^2 - 5x + 5 = -1$$

$$x^2 - 5x + 4 = 0 \quad x = -10, x = 6 \quad x^2 - 5x + 6 = 0$$

$$x = 1, x = 4$$

$$\text{at } x = 2, x^2 + 4x - 60 = -48 \text{ (even)}$$

$\therefore x = 2$ is valid

$$\text{at } x = 3, x^2 + 4x - 60 = -39 \text{ (odd)}$$

$$x = 3 \text{ is invalid} \quad x = 1, 2, 4, 6, -10$$

$$36. (c) 4ax^2 + \frac{1}{x} \geq 1 \quad \Rightarrow y = 4ax^2 + \frac{1}{x}$$

$$\Rightarrow y = \frac{dy}{dx} 8ax - \frac{1}{x^2} = 0 \quad \Rightarrow x = \left(\frac{1}{8a}\right)^{1/3}$$

$$\Rightarrow f(x) = \frac{4ax^3 + 1}{x} = \frac{1/2 + 1}{1/(8a)^{1/3}} \Rightarrow \frac{3}{2} \times (8a)^{1/3} \geq 1$$

$$\Rightarrow \alpha^{1/3} \geq \frac{1}{3} \Rightarrow \alpha \geq \frac{1}{27}$$

$$37. (c) x^2 - 2x \sec \theta + 1 = 0$$

$$\Rightarrow x = \frac{2 \sec \theta \pm \sqrt{4 \sec^2 \theta - 4}}{2}$$

$$\Rightarrow x = \sec \theta + \tan \theta \sec \theta - \tan \theta \Rightarrow \alpha_1 = \sec \theta - \tan \theta$$

$$\text{now } x^2 + 2x \tan \theta - 1 = 0$$

$$\Rightarrow x = \frac{-2 \tan \theta \pm \sqrt{4 \tan^2 \theta + 4}}{2}$$

$$\Rightarrow x = -\tan \theta \pm \sec \theta$$

$$\Rightarrow \alpha_2 = (\sec \theta - \tan \theta)$$

$$\Rightarrow \beta_2 = -(\sec \theta + \tan \theta)$$

$$\therefore \alpha_1 + \beta_2 = -2 \tan \theta$$

$$\text{Alternate: (i) } x^2 - 2x \cos \theta + 1 = 0$$

$$x = \frac{2 \sec \theta \pm \sqrt{4 \sec^2 \theta - 4}}{2} = \sec \theta \pm \tan \theta$$

$$\Rightarrow \alpha_1 = \sec \theta - \tan \theta$$

$$\Rightarrow \beta_1 = \sec \theta + \tan \theta$$

$$(ii) x^2 + 2x \tan \theta - 1 = 0$$

$$\Rightarrow x = \frac{-\tan \theta \pm \sqrt{4 \tan^2 \theta + 4}}{2}$$

$$\Rightarrow x = -\tan \theta \pm \sec \theta$$

$$\Rightarrow \alpha_2 = -\tan \theta + \sec \theta \quad \beta_2 = -\tan \theta - \sec \theta$$

$$\Rightarrow \alpha_1 + \beta_2 = -2 \tan \theta$$

$$38. (b, c, d) ax + 2y = \lambda \quad 3x - 2y = \mu$$

(a) $a = -3$ gives $\lambda = -\mu$ or $\lambda + \mu = 0$ not for all λ, μ

(b) $a \neq -3$

$$\Rightarrow \Delta \neq 0 \text{ where } \Delta = \begin{vmatrix} a & 2 \\ 3 & -2 \end{vmatrix} = -2a - 6$$

\therefore (b) is correct

(c) correct

(d) if $\lambda + \mu \neq 0$

$$\Rightarrow -3x + 2y = \lambda \quad \dots(i)$$

$$\& \quad 3x - 2y = \mu \quad \dots(ii)$$

Inconsistent \Rightarrow (d) correct

39. (b) We have $\sum_{r=1}^n (x+r-1)(x+r) = 0n$

$$\Rightarrow \sum_{r=1}^n (x^2 + (2r-1)x + (r^2 - r)) = 0n$$

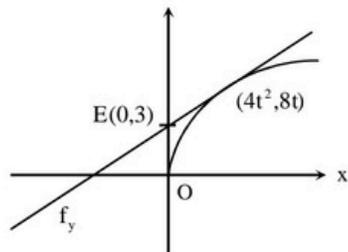
$$\therefore \text{On solving, we get } x^2 + nx + \left(\frac{n^2 - 31}{3}\right) = 0$$

$$\therefore (2\alpha + 1) = -n \Rightarrow \alpha = \frac{-(n+1)}{2} \quad \dots(i)$$

$$\text{And } \alpha(\alpha + 1) = \frac{n^2 - 31}{3} \quad \dots(ii)$$

Using equation (i) and (ii) $n^2 = 121$ or $n = 11$

40. (a) $A \rightarrow 4; B \rightarrow 1; C \rightarrow 2; D \rightarrow 3$



Here, $y^2 = 16x, 0 \leq y \leq 6$

Tangent at F, $yt = x + at^2$

at $x = 0, y = at = 4t$

Also, $(4t^2, 8t)$ satisfy

$$y = mx + c$$

$$\Rightarrow 8t = 4mt^2 + 3 \Rightarrow 4mt^2 - 8t + 3 = 0$$

$$\therefore \text{Area of } \Delta = \frac{1}{2} \begin{vmatrix} 0 & 3 & 1 \\ 0 & 4t & 1 \\ 4t^2 & 8t & 1 \end{vmatrix}$$

$$= \frac{1}{2} \cdot 4t^2(3 - 4t)$$

$$A = 2[3t^2 - 4t^3]$$

$$\therefore \frac{dA}{dt} = 2[6t - 12t^2] \\ = -12t(2t - 1)$$

\therefore Maximum at $t = \frac{1}{2}$ and

$$4mt^2 - 8t + 3 = 0$$

$$\Rightarrow m - 4 + 3 = 0 \Rightarrow (A) m = 1$$

$$G(0, 4) \Rightarrow G(0, 2)$$

$$(B) \text{ Area} = 2\left(\frac{3}{4} - \frac{1}{2}\right) = \frac{1}{2}$$

$$(x_0, y_0) = (4t^2, 8t) = (1, 4)$$

$$(C) y_0 = 4$$

$$(D) y_1 = 2$$

41. (b) $A \rightarrow 3, 5; B \rightarrow 3, 5; C \rightarrow 1, 2, 4$

$$(A) \therefore y = \sin^{-1}(3x - 4x^3)$$

$$= \begin{cases} -\pi - 3\sin^{-1} x, & -1 \leq x \leq -\frac{1}{2} \\ 3\sin^{-1} x, & -\frac{1}{2} \leq x \leq \frac{1}{2} \\ \pi - 3\sin^{-1} x, & \frac{1}{2} \leq x \leq 1 \end{cases}$$

$$\therefore \frac{dy}{dx} = \begin{cases} -\frac{3}{\sqrt{1-x^2}}, & -1 \leq x \leq -\frac{1}{2} \\ \frac{3}{\sqrt{1-x^2}}, & -\frac{1}{2} \leq x \leq \frac{1}{2} \\ -\frac{3}{\sqrt{1-x^2}}, & \frac{1}{2} \leq x \leq 1 \end{cases} (R, T)$$

$$(B) \therefore y = \cos^{-1}(4x^2 - 3x)$$

$$= \begin{cases} 3\cos^{-1} x - 2\pi, & -1 \leq x \leq -\frac{1}{2} \\ 2\pi - 3\cos^{-1} x, & -\frac{1}{2} \leq x \leq \frac{1}{2} \\ 3\cos^{-1} x, & \frac{1}{2} \leq x \leq 1 \end{cases}$$

$$\therefore \frac{dy}{dx} = \begin{cases} -\frac{3}{\sqrt{1-x^2}}, & -1 \leq x \leq -\frac{1}{2} \\ \frac{3}{\sqrt{1-x^2}}, & -\frac{1}{2} \leq x \leq \frac{1}{2} \\ -\frac{3}{\sqrt{1-x^2}}, & \frac{1}{2} \leq x \leq 1 \end{cases} (R, T)$$

$$(C) \therefore y = \tan^{-1}\left(\frac{3x - x^3}{1 - 3x^2}\right)$$

$$= \begin{cases} 3\tan^{-1} x & , \quad -\frac{1}{\sqrt{3}} < x < \frac{1}{\sqrt{3}} \\ \pi + 3\tan^{-1} x & , \quad x < -\frac{1}{\sqrt{3}} \\ -\pi + 3\tan^{-1} x & , \quad x > \frac{1}{\sqrt{3}} \end{cases}$$

$$\therefore \frac{dy}{dx} = \begin{cases} \frac{3}{1+x^2} & , \quad -\frac{1}{\sqrt{3}} < x < \frac{1}{\sqrt{3}} \\ \frac{3}{1+x^2} & , \quad x < -\frac{1}{\sqrt{3}} \\ \frac{3}{1+x^2} & , \quad x > \frac{1}{\sqrt{3}} \end{cases}$$

42. (b) A → 4; B → 5; C → 3; D → 3

$$(A) z = \frac{2i(x+iy)}{1-(x+iy)^2} = \frac{2i(x+iy)}{1-(x^2-y^2+2ixy)}$$

Using $1-x^2=y^2$

$$Z = \frac{2ix-2y}{2y^2-2ixy} = -\frac{1}{y}$$

$$\therefore -1 \leq y \leq 1 \Rightarrow -\frac{1}{y} \leq -1 \text{ or } -\frac{1}{y} \geq 1.$$

$$(B) \text{ For domain } -1 \leq \frac{8 \cdot 3^{x-2}}{1-3^{2(x-1)}} \leq 1 \Rightarrow -1 \leq \frac{3^x - 3^{x-2}}{1-3^{2x-2}} \leq 1.$$

$$\text{Case-I: } \frac{3^x - 3^{x-2}}{1-3^{2x-2}} - 1 \leq 0$$

$$\Rightarrow \frac{(3^x-1)(3^{x-2}-1)}{(3^{2x-2}-1)} \geq 0 \Rightarrow x \in (-\infty, 0] \cup (1, \infty).$$

$$\text{Case-II: } \frac{3^x - 3^{x-2}}{1-3^{2x-2}} + 1 \geq 0$$

$$\Rightarrow \frac{(3^{x-2}-1)(3^x+1)}{(3^x \cdot 3^{x-2}-1)} \geq 0 \Rightarrow x \in (-\infty, 1) \cup [2, \infty).$$

So, $x \in (-\infty, 0] \cup [2, \infty)$.

$$(C) R_1 \rightarrow R_1 + R_3$$

$$f(\theta) = \begin{vmatrix} 0 & 0 & 2 \\ -\tan\theta & 1 & \tan\theta \\ -1 & -\tan\theta & 1 \end{vmatrix} = 2(\tan^2\theta + 1) = 2\sec^2\theta.$$

$$(D) f'(x) = \frac{3}{2}(x)^{1/2}(3x-10) + (x)^{3/2} \times 3 = \frac{15}{2}(x)^{1/2}(x-2)$$

Increasing, when $x \geq 2$.

43. (a) A → 1; B → 2,3; C → 2,3,4,5; D → 3

$$(A) f'(x) > 0, \forall x \in (0, \pi/2)$$

$$f(0) < 0 \text{ and } f(\pi/2) > 0$$

So, one solution.

(B) Let (a, b, c) is direction ratio of the intersected line, then

$$ak + 4b + c = 0$$

$$4a + kb + 2c = 0$$

$$\frac{a}{8-k} = \frac{b}{4-2k} = \frac{c}{k^2-16}$$

We must have

$$2(8-k) + 2(4-2k) + (k^2-16) = 0 \Rightarrow k = 2, 4.$$

(C) Let $f(x) = |x+2| + |x-4| + |x+1| + |x-2|$

$$\Rightarrow k \text{ can take value } 2, 3, 4, 5.$$

$$(D) \int \frac{dy}{y+1} = \int dx$$

$$\Rightarrow f(x) = 2e^x - 1 \Rightarrow f(\ln 2) = 3$$

$$44. (a, c, d) |\vec{b} + \vec{c}| = |\vec{a}|$$

$$\Rightarrow |\vec{b}|^2 + |\vec{c}|^2 = 2\vec{b} \cdot \vec{c} + |\vec{a}|^2 \Rightarrow 48 + |\vec{c}|^2 + 48 = 144$$

$$\Rightarrow |\vec{c}| = 4\sqrt{3} \therefore \frac{|\vec{c}|^2}{2} - |\vec{a}| = 12$$

$$\text{Also, } |\vec{a} + \vec{b}| = |\vec{c}|$$

$$\Rightarrow |\vec{a}|^2 + |\vec{b}|^2 = 2\vec{a} \cdot \vec{b} + |\vec{c}|^2$$

$$\Rightarrow \vec{a} \cdot \vec{b} = -72 \quad \vec{a} + \vec{b} + \vec{c} = 0$$

$$\Rightarrow \vec{a} \times \vec{b} = \vec{c} \times \vec{a} \Rightarrow |\vec{a} \times \vec{b} + \vec{c} \times \vec{a}| = 2|\vec{b} \times \vec{c}| = 48\sqrt{3}$$

$$45. (c, d) (Y^3 Z^4 - Z^4 Y^3)^T$$

$$= (Z^T)^4 (Y^T)^3 - (Y^T)^3 (Z^T)^4$$

$$= -Z^4 Y^3 + Y^3 Z^4$$

$$\Rightarrow \text{symmetric } X^{44} + Y^{44} \text{ is symmetric}$$

$$X^4 Z^3 - Z^3 X^4 \text{ skew symmetric}$$

$$X^{23} + Y^{23} \text{ skew symmetric.}$$

$$46. (b, c) \text{ We get } \begin{vmatrix} (1+\alpha)^2 & (1+2\alpha)^2 & (1+3\alpha)^2 \\ 3+2\alpha & 3+4\alpha & 3+6\alpha \\ 5+2\alpha & 5+4\alpha & 5+6\alpha \end{vmatrix}$$

$$= -648\alpha (R_3 \rightarrow R_3 - R_2; R_2 \rightarrow R_2 - R_1)$$

$$\begin{vmatrix} \alpha^2 - 2 & 4\alpha^2 - 2 & 9\alpha^2 - 2 \\ 3+2\alpha & 3+4\alpha & 3+6\alpha \\ 2 & 2 & 2 \end{vmatrix}$$

$$= -648\alpha (R_1 \rightarrow R_1 - R_2; R_3 \rightarrow R_3 - R_2)$$

$$\Rightarrow \begin{vmatrix} -2\alpha^2 & -5\alpha^2 & -9\alpha^2 - 3 \\ -2\alpha & -2\alpha & 3+6\alpha \\ 0 & 0 & 2 \end{vmatrix} = -648\alpha$$

47. (b, d) Let the required plane be $x+z+\lambda y-1=0$

$$\Rightarrow \frac{|\lambda-1|}{\sqrt{\lambda^2+2}}=1 \Rightarrow \lambda=-\frac{1}{2}$$

$$\Rightarrow P_3 \equiv 2x-y+2z-2=0$$

Distance of P_3 from (α, β, γ) is 2

$$\frac{|2\alpha-\beta+2\gamma-2|}{\sqrt{4 \times 1+4}}=2$$

$$\Rightarrow 2\alpha-\beta+2\lambda+4=0 \text{ and } 2\alpha-\beta+2\lambda-8=0$$

48. (a, b) Line L will be parallel to the line of intersection of P_1 and P_2

Let a, b and c be the direction ratios of line L

$$\Rightarrow a+2b-c=0 \text{ and } 2a-b+c=0 \Rightarrow a:b:c::1:-3:5$$

$$\text{Equation of line L is } \frac{x-0}{1}=\frac{y-0}{-3}=\frac{z-0}{-5}$$

Again foot of perpendicular from origin to plane P_1 is

$$\left(-\frac{1}{6}, -\frac{1}{3}, \frac{1}{6}\right)$$

\therefore Equation of project of line L on plane P_1 is

$$\frac{x+\frac{1}{6}}{1}=\frac{y+\frac{2}{6}}{-3}=\frac{z-\frac{1}{6}}{-5}=k$$

Clearly points $\left(0, -\frac{5}{6}, -\frac{2}{3}\right)$ and $\left(-\frac{1}{6}, -\frac{1}{3}, \frac{1}{6}\right)$ satisfy the line of projection i.e. M

$$49. (a, d) P(at^2, 2at) \Rightarrow Q\left(\frac{16a}{t^2}, -\frac{8a}{t}\right)$$

$$\Delta OPQ = \frac{1}{2} OP \cdot OQ$$

$$\Rightarrow \frac{1}{2} \left| at\sqrt{t^2+4} \cdot \frac{a(4)}{t} \sqrt{\frac{6}{t^2}+4} \right| = 3\sqrt{2}$$

$$t^2 - 3\sqrt{2}t + 4 = 0 \Rightarrow t = \sqrt{2}, 2\sqrt{2}$$

$$\text{Hence, } P(at^2, 2at) = P\left(\frac{t^2}{2}, t\right)$$

$$t = \sqrt{2} \Rightarrow P(1, \sqrt{2})$$

$$t = 2\sqrt{2} \Rightarrow P(4, 2\sqrt{2})$$

50. (d) $x^2-x+1=0$

Roots are $-\omega, -\omega^2$

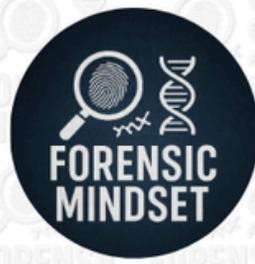
Let $\alpha = -\omega, \beta = -\omega^2$

$$\alpha^{101} + \beta^{107} = (-\omega)^{101} + (-\omega^2)^{107}$$

$$= -(\omega^{101} + \omega^{214})$$

$$= -(\omega^2 + \omega) = 1$$

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