# FIRE MATHEMATICS CLASSES

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## The Selection of Good Question 2025

### ➢ INVERSE TRIGONOMETRIC FUNCTION

**1. Find the Principle value of**

(i) $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$ (ii) $\cos^{-1}\left(\frac{-1}{2}\right)$ (iii) $\tan^{-1}(-1)$

**2. Prove that**

(a) $\tan^{-1}x + \cot^{-1}x = \frac{\pi}{2}$

(b) $\cos\{\sec^{-1}x + \operatorname{cosec}^{-1}x\} = 0$

(c) $\sin\left\{\sin^{-1}\frac{1}{2} + \cos^{-1}\frac{1}{2}\right\} = 1$

(d) $\tan^{-1}\frac{1}{5} + \tan^{-1}\frac{1}{7} + \tan^{-1}\frac{1}{3} + \tan^{-1}\frac{1}{8} = \frac{\pi}{4}$

(e) $\sin^{-1}\frac{8}{17} + \sin^{-1}\frac{3}{5} = \tan^{-1}\frac{77}{36}$

(f) $2\sin^{-1}\frac{3}{5} = \tan^{-1}\frac{24}{7}$

(g) $2\tan^{-1}\frac{1}{2} + \tan^{-1}\frac{1}{7} = \tan^{-1}\frac{31}{17}$

3. $\sin^{-1}\left\{\sin\frac{2\pi}{3}\right\} = ?$

4. $\cos^{-1}\left\{\cos\frac{7\pi}{6}\right\} = ?$

5. $\tan^{-1}\sqrt{3} - \sec^{-1}(-2) = ?$

6. $\tan^{-1}\frac{1}{2} + \tan^{-1}\frac{2}{11} = \tan^{-1}p$ find p.

7. $2\tan^{-1}\frac{1}{3} + \tan^{-1}\frac{1}{7} = \frac{\pi}{4}$

8. $4\left(\cot^{-1}3 + \operatorname{cosec}^{-1}\sqrt{5}\right) = \pi$

9. $\frac{9\pi}{8} - \frac{9}{4}\sin^{-1}\frac{1}{3} = \frac{9}{4}\sin^{-1}\frac{2\sqrt{2}}{3}$

10. $\cot^{-1}\left\{\tan\frac{\pi}{4}\right\} = ?$

11. $\cot^{-1}\left\{\frac{\sqrt{1+\sin x}+\sqrt{1-\sin x}}{\sqrt{1+\sin x}-\sqrt{1-\sin x}}\right\} = \frac{x}{2}$

❖ Solve or, find the value of x.

12. $\tan^{-1}2x + \tan^{-1}3x = \frac{\pi}{4}$

13. $2\tan^{-1}(\cos x) = \tan^{-1}(2\operatorname{cosec} x)$

14. $\tan^{-1}\left\{\frac{\cos x-\sin x}{\cos x+\sin x}\right\}$

15. $\tan\left\{\sin^{-1}\frac{3}{5} + \cot^{-1}\frac{3}{2}\right\}$

16. $tan^{-1}\left[2\cos\left(2\,sin^{-1}\frac{1}{2}\right)\right]$

17. $\sin\left\{\frac{\pi}{3} - sin^{-1}\left(\frac{-1}{2}\right)\right\}$

18. $\sin^{-1}(1-x) - 2\sin^{-1}x = \frac{\pi}{2}$ then the vlaue of x

### ➢ DIFFERENTIATION ** 2ND DELIVATE

1. $y = \log x$

2. $y = e^x.\sin x$

3. $y = (tan^{-1}x)^2$

4. y = log (logx)

5. prove that y = 500 $e^{7x}$ + 600 $e^{-7x}$ $\frac{d_2y}{dx^2} = 49\ y$

6. If $e^y(x+1)$ then prove that $\left(\frac{d_2y}{dx^2} = \frac{dy}{dx}\right)^2$

7. If y = $(tan^{-1}x)^2$ then prove that $(x^2+1)\ y_2 + 2x\ (x^2+1)y_1 = 2$

8. If y = A sin x + B cos x then prove that $\frac{d_2y}{dx^2} + y = 0$

## ➢ *MATRICES*

1. If A = $\begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix}$ then prove that $(A')' = A$

2. $\begin{bmatrix} cos^2x & sin^2x \\ sin^2x & cos^2x \end{bmatrix} + \begin{bmatrix} sin^2x & cos^2x \\ cos^2x & sin^2x \end{bmatrix} = ?$

3. A = $\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$ find adj. (A)

4. A = $\begin{bmatrix} 3 & 6 \\ 5 & -4 \end{bmatrix}$, $B = \begin{bmatrix} 7 & 8 \\ 5 & 6 \end{bmatrix}$ find 2A + 3B

5. If A = $\begin{bmatrix} 3 & 4 \\ 2 & 3 \end{bmatrix}$ find $A + A'$

6. If A = $\begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$ find $A^2$

7. If A = $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ find $A^2$

8. If $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} \cdot \begin{bmatrix} 3 & 2 \\ 2 & 5 \end{bmatrix} = \begin{bmatrix} 7 & 12 \\ k & 26 \end{bmatrix}$ find k.

9. $\begin{bmatrix} x^2 & -1 \\ 2 & -3 \end{bmatrix} + \begin{bmatrix} -2x & 3 \\ 4 & 5 \end{bmatrix} = \begin{bmatrix} -1 & 2 \\ 6 & 2 \end{bmatrix}$ find x.

10. If x + y = $\begin{bmatrix} 7 & 0 \\ 2 & 5 \end{bmatrix}$ and x – y = $\begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix}$ find x – y.

11. A = $\begin{bmatrix} a & 0 \\ 1 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 0 \\ 5 & 1 \end{bmatrix}$ Where $A^2$ = B find $a$.

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

13. If A = $\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$ find $A^{-1}$

14. If A = $\begin{bmatrix} 1 & 2 & 5 \\ 3 & 2 & 4 \\ 1 & 9 & 7 \end{bmatrix}$ find $A^{-1}$

15. If A = $\begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ then verify $A^2 - 4A - 5\ I = 0$

16. Express sum of symmetric and srew symmetric matric of $\begin{bmatrix} 3 & -2 & -4 \\ 3 & -2 & -5 \\ -1 & 1 & 2 \end{bmatrix}$

17. Using matrix solve of the eq$^n$ $x + y + z = 6,\ 2x + y - 3z = -5,\ 3x - 2y + z = 2$

## ➢ *DETERMINANTS*

1. $\begin{vmatrix} 2 & 3 & 5 \\ 0 & 4 & 7 \\ 0 & 0 & 5 \end{vmatrix} = ?$

2. $\begin{vmatrix} 1 & 2 \\ 3 & 4 \end{vmatrix} = ?$

3. $\begin{vmatrix} 102 & 18 & 36 \\ 1 & 3 & 4 \\ 17 & 3 & 6 \end{vmatrix} = ?$

4. $\begin{vmatrix} 3 & 1 & 7 \\ 5 & 0 & 2 \\ 2 & 5 & 3 \end{vmatrix} = ?$

5. $\begin{vmatrix} \sin 20° & -\cos 70° \\ \sin 70° & \cos 70° \end{vmatrix}$

6. $\begin{vmatrix} x & 8 \\ 3 & 3 \end{vmatrix} = 0$ find x

7. $\begin{vmatrix} 1-x & 2 \\ 18 & 6 \end{vmatrix} = \begin{vmatrix} 6 & 2 \\ 18 & 6 \end{vmatrix}$ find x

8. $A = \begin{bmatrix} 3 & 2 & 7 \\ 8 & 9 & 11 \\ 11 & 11 & 18 \end{bmatrix}$ find $|2A|$

9. $\begin{vmatrix} 1 & w & w^2 \\ w & w^2 & 1 \\ w^2 & 1 & w \end{vmatrix} = ?$

10. $\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^3 & b^3 & c^3 \end{vmatrix} = ?$

11. $\begin{vmatrix} 1 & a & a^2 \\ 1 & b & b^2 \\ 1 & c & c^2 \end{vmatrix} = ?$

12. $\begin{vmatrix} x & x^2 & x^3 \\ y & y^2 & y^3 \\ z & z^2 & z^3 \end{vmatrix} = ?$

13. If a, b, c are in A.P then $\begin{vmatrix} x+2 & x+3 & x+2a \\ x+3 & x+4 & x+2b \\ x+4 & x+5 & x+2c \end{vmatrix}$ is

**Prove that**

14. $\begin{vmatrix} x+y & 2x & 2x \\ 2x & x+y & 2x \\ 2x & x & x+y \end{vmatrix} = (5x+y)(4-x)^2$

15. $\begin{vmatrix} a & b & c \\ a^2 & b^2 & c^2 \\ z^3 & b^3 & c^3 \end{vmatrix} = abc\,(a-b)(b-c)(c-a)$

16. $\begin{vmatrix} 1 & bc & a(b+c) \\ 1 & ca & b(c+a) \\ 1 & ab & c(a+b) \end{vmatrix} = 0$

17. $\begin{vmatrix} \frac{1}{a} & 1 & ac \\ \frac{1}{b} & 1 & ca \\ \frac{1}{c} & 1 & ab \end{vmatrix} = 0$

18. $\begin{vmatrix} 2 & 7 & 65 \\ 3 & 8 & 75 \\ 5 & 9 & 86 \end{vmatrix} = 0$

19. $\begin{vmatrix} 1 & a & b+c \\ 1 & b & c+a \\ 1 & c & a+b \end{vmatrix} = 0$

## ➢ लली POPवाला मुखरा

**Find $\frac{dy}{dx}$**

1. $y = \sqrt{x + \sqrt{x + \sqrt{x + \sqrt{x + \cdots \ldots}}}}$ to $\infty$
2. $y = x^x$
3. $y = (\sin x)^{\cos x} + (\cos x)^{\sin x}$
4. $x^{x^{x^{\ldots\ldots\infty}}}$
5. $y = e^{e+e^{x+e^{x}+\cdots\ldots to\ \infty}}$
6. $y = \sqrt{\sin x + \sqrt{\sin x + \sqrt{\sin x + \cdots \ldots \ldots}}}$ to $\infty$
7. $y = x^{\sin x} + (\sin x)^{\cos x}$
8. $x^y = y^x \frac{dy}{dx}$
9. $(\cos x)^y = (\cos y)^x$ find $\frac{dy}{dx}$
10. $xy = e^{x-y}$ find $\frac{dy}{dx}$
11. $y = 3e^{2x} + 2e^{3x}$ show that $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = 0$
12. $y = \sin[\cos\{\tan(\cot x)\}]$ find $\frac{dy}{dx}$
13. $y = \sqrt{\sin\sqrt{x}}$
14. $y = e^{\tan^{-1}x}$
15. $x^y . y^x = 1$
16. $y = \sin(\cos x)$
17. $x^m . y^n = (x-y)^{m+n}$
18. $y = e^{x^x}$
19. $y = \sin(\cos^{-1}x)$
20. $y = \tan x^0$
21. $y = \tan^{-1}\frac{2x}{1-x^2}$
22. $y = \log\{x^2\sqrt{x^2+1}\}$
23. $y = \cos x . \cos 2x . \cos 3x$
24. $y = \cos\sqrt{x}$
25. $y = \sqrt{\log x + \sqrt{\log x + \sqrt{\log x + \cdots \ldots \ldots}}}$ to $\infty$
26. $y = e^x + e^{x^2} + e^{x^3} + \cdots + e^{x^5}$
27. $x^2 + xy + y^2 = 100$
28. $y + \sin y = \cos x$
29. $x - y = \pi$
30. $y = (\tan^{-1}x)^2$

## ➢ INDEFINITE

**Find the following in integrals**

1. $\int \frac{1}{\sqrt{x}}\, dx$
2. $\int cose\, 2x\, dx$
3. $\int e^{ax} dx$
4. $\int (ax^2 + bx + c) dx$
5. $\int x^2 \left(1 - \frac{1}{x^2}\right) \mathrm{dx}$
6. $\int \left(\sqrt{x} - \frac{1}{\sqrt{x}}\right)^2\, dx$
7. $\int \sqrt{x}\,(1 - x) dx$
8. $\int \sec x\,(\sec x + \tan x)\, dx$
9. $\int 0\, dx$
10. $\int \left(x^{\frac{3}{2}} + 2\, e^x - \frac{1}{x}\right)\, dx$
11. $\int \frac{x^3 - 1}{x^2}\, dx$
12. $\int cosec\, x\,(cosec\, x + \cot x)\, dx$
13. $\int \frac{1 - \sin x}{\cos^2 x}\, dx$
14. $\int \frac{2 - 3\sin x}{\cos^2 x}\, dx$
15. $\int (3x^2 + 2x + 3)\sqrt{x}\, dx$
16. $\int \frac{sec^2 x}{cosec^2 x}\, dx$
17. $\int (\sin x + \cos x)^2\, dx$
18. $\int \frac{cosec\, x}{cosec\, x + \cot x}\, dx$
19. $\int \frac{x^2 + 5x - 4}{x^2}\, dx$
20. $\int \frac{x^3 - x^2 + x - 1}{x - 1}\, dx$
21. $\int \frac{1}{x + x\log x}\, dx$
22. $\int \frac{e^{tan^{-1}x}}{1 + x^2}\, dx$
23. $\int \frac{1}{x(\log x)^m}\, dx$
24. $\int \cot x \,.\log \sin x\, dx$
25. $\int \frac{\cos \sqrt{x}}{\sqrt{x}}\, dx$
26. $\int \frac{1}{x - \sqrt{x}}\, dx$
27. $\int \frac{10\, x^{10} + 10^x \log 10}{x^{10} + 10^x}\, dx$
28. $\int \frac{1}{\sin^2 x \,.\cos^2 x}\, dx$
29. $\int \frac{\sin^2 x - \cos^2 x}{\sin^2 x \,.\cos^2 x}\, dx$
30. $\int \frac{1}{\cos^2 x\,(1 - \tan x)^2}\, dx$
31. $\int \frac{\cos 2x + 2\sin x}{\cos^2 x}\, dx$
32. $\int \frac{\sin x}{(1 + \cos x)^2}\, dx$
33. $\int \sin 2x . \cos 3x\, dx$
34. $\int \tan x\, dx$
35. $\int \sec x\, dx$
36. $\int x^2 \,.e^{x^3} dx$
37. $\int \cos^2 x\, dx$
38. $\int \sin^3 dx$
39. $\int sin^{-1}(\cos x)\, dx$
40. $\int \frac{1 - \cos x}{1 + \cos x}\, dx$
41. $\int \frac{e^x (1 + x)}{\cos^2 (e^x . x)}\, dx$
42. $\int e^x \{\tan x + \log \cos x\}\, dx$
43. $\int \frac{x\, e^x}{(x+1)^2}\, dx$
44. $\int \frac{-1}{x^2 + a^2}\, \mathrm{dx}$
45. $\int \frac{1}{x^2 + a^2}\, dx$
46. $\int \frac{1}{1 + \sin x}\, dx$
47. $\int \frac{1}{x^2 - 16}\, \mathrm{dx}$
48. $\int \frac{1}{9 - 25\, x^2} dx$
49. $\int \frac{1}{x^2 + 2x + 2} dx$
50. $\int \frac{x}{(x+1)(x+2)} dx$
51. $\int \frac{(3x - 1)}{(x-1)\,(x-2)\,(x-3)}\, dx$
52. $\int \frac{\cos x}{(1 - \sin x)\,(2 - \sin x)}\, dx$
53. $\frac{\sec^2 x}{\sqrt{\tan^2 x + 4}}\, dx$
54. $\int \sqrt{x^2 + 4x + 6}\, \mathrm{dx}$
55. $\int e^x \{f(x) + f'(x)\}\, dx$
56. $\int e^x \{\frac{1}{x} - \frac{1}{x^2}\}\, dx$
57. $\int e^x \{tan^{-1}x + \frac{1}{1 + x^2}\}\, dx$
58. $\int e^x \{\sin x + \cos x\}\, dx$
59. $\int e^x \,.\sec x\,\{1 + \tan x\}\, dx$
60. $\int x \,.e^x\, dx$
61. $\int x \,.\log x\, dx$
62. $\int x \,.tan^{-1}x\, \mathrm{dx}$
63. $\int \log x\, dx$
64. $\int e^x .\sin x\, dx$
65. $\int e^x .\cos x\, dx$

## ➢ DEFINITE INTEGRATION

1. $\int_{-\frac{\pi}{2}}^{\pi/2} \sin^7 x\, dx$
2. $\int_0^1 x\,(x-x)^{99}\, dx$
3. $\int_{-\frac{\pi}{2}}^{\pi/2} \sin^2 x\, dx$
4. $\int_a^b x^5\, dx$
5. $\int_0^{\pi} \frac{x}{1+\sin x}\, dx$
6. $\int_0^1 \frac{1}{\sqrt{1-x^2}}\, dx$
7. $\int_0^{\pi/4} (\tan x - x)\tan^2 x\, dx$
8. $\int_2^4 \frac{1}{x}\, dx$
9. $\int_0^a \frac{\sqrt{x}}{\sqrt{x}+\sqrt{x-a}}\, dx$
10. $\int_0^1 x\,.\,e^{x^2}\, dx$
11. $\int_{-\pi/2}^{\pi/2} x^3 + x\cos x + \tan^5 x + 1)\, dx$
13. $\int_2^3 \frac{1}{x \log x}\, dx$
12. $\int_{-5}^{5} |x+2| dx$
14. $\int_0^{\pi} (\sin^2 \frac{x}{2} - \cos^2 \frac{x}{2})$
15. Prove that $\int_0^{\pi/2} \log \sin x\, dx = \int_0^{\pi/2} \log \cos x\, dx = -\frac{\pi}{2} \log_2$
16. Prove that $\int_0^{\pi/4} \log(1+\tan x)\, dx = \frac{\pi}{8} \log_2$
17. $\int_0^{\pi/2} (2 \log \sin 2x - \log \sin 2x)\, dx = -\frac{\pi}{2} \log 2 = \frac{x}{2} \log \frac{1}{2}$
18. $\int_0^{\pi/2} \frac{\sqrt{\cos x}}{\sqrt{\sin x}+\sqrt{\cos x}}\, dx = \frac{\pi}{4}$
20. $\int_0^{\pi/2} \log \cot x\, dx = 0$
19. $\int_0^{\pi/2} \frac{\cos^5 x}{\cos^5 x + \sin^5 x}\, dx = \frac{\pi}{4}$
21. $\int_0^{\pi/2} \sin 2x . \log(\tan x)\, dx = ?$

## ➢ L.P.P.

1. Minimize Z = 5x + 7y subject x + y $\leq$, $3x + 8y \leq 35$ and $x, y \geq 0$
2. Maximize Z = 5x +3y subject 3x + 5y $\leq$ 15, 5x + 2y $\geq$ 10 and $x \geq 0, y \geq 0$
3. Maximize Z = 45x + 80y Subject 5x + 20 y $\leq$ 400, 10x + 15y $\leq$ 400 and x $\geq 0, y \geq 0$
4. Minimize Z = 200x + 500y subjectt x + 2y $\geq 0, 3x + 4y \leq 24, x \geq 0, y \geq 0$
5. Maximize Z = x +2y subject 2x + y $\leq$ 200, x + 2y $\geq 100, 2x - y \leq 0, x' y \geq 0$
6. Min & Max Z = 5x+ 10y Subject x + 2y $\leq 120, x + y \geq 60, x - 2y \geq 0$ and $x, y \geq 0$
7. Min & Max Z = 3x + 9y subject x + 3y $\leq 60, x + y \geq 100, x \leq y, x, y \geq 0$

## ➢ VECTOR

1. The modulus of $2\hat{\imath} - 7\hat{\jmath} + 3\hat{k}$
2. If $\vec{a} = \hat{\imath} + \hat{\jmath} + \hat{k}$ find (a) $|\vec{a}|$ (b) $\hat{a}$ (c) D.r (d) D.C

3. If $\vec{a} = 2\hat{\imath} + 3\hat{\jmath} + 4\hat{k}$ and $\vec{b} = \hat{\imath} + \hat{\jmath} - \hat{k}$ find $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$

4. If $\vec{a} = 2\hat{\imath} - 5\hat{\jmath} + \hat{k}$ and $\vec{b} = 4\hat{\imath} + 2\hat{\jmath} + \hat{k}$ then $\vec{a}.\vec{b} = ?$

5. $\vec{a} = 2\hat{\imath} + \hat{\jmath} + 3\hat{k}$ and $\vec{b} = 3\hat{\imath} + 5\hat{\jmath} - 2\hat{k}$ find (i) $\vec{a} \times \vec{b} = ?$ (ii) $|\vec{a} \times \vec{b}| = ?$

6. The angle b/w the vector $2\hat{\imath} + 3\hat{\jmath} + 2\hat{k}$ and $\hat{\imath} - 4\hat{\jmath} + 5\hat{k}$ is

7. If $\vec{a} = 2\hat{\imath} - 3\hat{\jmath} - 5\hat{k}$ and $\vec{b} = -7\hat{\imath} + 6\hat{\jmath} + 8\hat{k}$ find (i) $\vec{a}.\vec{b}$ (ii) $\vec{a} \times \vec{b}$

8. $|\vec{a}| = \sqrt{26}\ |\vec{b}| = 7$ and $|\vec{a} \times \vec{b}| = 35$ find $\vec{a}.\vec{b} = ?$

9. *Prove that* $(\vec{a} - b) \times (\vec{a} + \vec{b}) = 2(\vec{a} \times \vec{b})$

10. *The projection of* $4\hat{\imath} + 4\hat{\jmath} - 6\hat{k}$ on $4\hat{\imath} - 7\hat{\jmath} + 4\hat{k}$ is

11. If $6\hat{\imath} + 3\hat{\jmath},\ 40\hat{\imath} - 8\hat{\jmath}, x\ \hat{\imath} - 52\hat{\jmath}$ ae colinear find x.

12. x $\hat{\imath} + 2\hat{\jmath} + z\hat{k} = 2\hat{\imath} + y\ \hat{\jmath} + \hat{k}$ find x, y, z

13. Evaluate $(3\vec{a} - 5\vec{b}).(2\vec{a} + 7\vec{b})$

14. If a is unit vector then $(\vec{x} - \vec{a})(\vec{x} + \vec{a}) = 8$ find $|\vec{x}| = ?$

15. Find length of projection of $\vec{a} = \hat{\imath} + a\hat{\jmath} + \hat{k}$ at $\vec{b} = 4\ i - 4\hat{\jmath} + 7\ \hat{k}$

16. If $|\vec{a} \times \vec{b}| = |\vec{a}.\vec{b}|$ then find angle b/w $\vec{a}$ and $\vec{b}$.

17. Prove that the point $2\ \hat{\imath} + j + \hat{k}, 6\hat{\imath} - j + 2\hat{k}$ and 14 I – 5 $\hat{\jmath}$ + 4 $k$ are collinear

18. If $3\hat{\imath} - 2\hat{\jmath} + 9\hat{k}$ and $\hat{\imath} - 2p\hat{\jmath} + 3\hat{k}$ are parallel then p = ?

19. If $\vec{a} = 2\hat{\imath} - 4\hat{\jmath} - 5\hat{k}$ and $\vec{b} = 2\hat{\imath} + 2\hat{\jmath} + 4\hat{k}$ find (i) Area of Δ ABC
    (ii) Area of parallelogram

20. Prove that $(a \times b)^2 + (\vec{a}.\vec{b})2 = a^2 - b^2$

21. If $\vec{a} + \vec{b} + \vec{c} = 0$ then prove that $\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}$

22. If $\vec{a} = \hat{\imath} + 2\hat{\jmath} + 3\hat{k},\ \vec{b} = 3\hat{\imath} + 2\hat{\jmath} + \hat{k}$ then cos $\theta$ = ?

23. Show that point $4\ i + 5\ j + \hat{k}, \hat{\jmath} - \hat{k}$ , $3\hat{\imath} + 9\hat{\jmath} + 4\hat{k}$ and $-4\hat{\imath} + 4\hat{\jmath} + 4\hat{k}$ are coplanar

24. If $3\hat{\imath} - 2\hat{\jmath} + 9\hat{k}$ are $\hat{\imath} - 2j + 3\hat{k}$ are collinear find p = ?

25. $\vec{a} = \hat{\imath} + \hat{\jmath} + 2\hat{k}, \vec{b} = 3\hat{\imath} + 2\hat{\jmath} - \hat{k}$ find $(a + 3\vec{b}).(2a - \vec{b}) = ?$

## ➢ *RELATION AND FUNCTION*

1. A = {1, 2, 3 } and $R$ = { (2, 2), (3, 3), (2,3), (3, 2), (2, 1)} What types of Relation.

2. Show that the relation R in the Set A = {1, 2, 3, 4, 5} given by R = {(a, b) : |a – b | is event{ is an equivalence Relation

3. R = {(a, b) : a, b ∈ z and a – b is divisible by 5{ is an equivalence R.

4. A = {1, 2, 3} R = {(1, 1) (2, 2) (3, 3) (1, 2), (2, 1) (2, 3) (3, 2) (1, 3) (3, 1)}

**Prove that**

(i) Reflexive (ii) Symmetric (iii) Transitive

## ➢ *FUNCTION BINARY COPERATION INVERSE*

1. F : N → N be a f$^n$ defined as f(x) = 9x + 3 snow that f is one-one f$^n$.
2. F : R → R and f(x) = 2x show that it is on to f$^n$.
3. F : R → R be a f$^n$ defined as by f(x) = $4x^3 - 7$ show that It is bijective f$^n$.
4. f(x) = 3x – 4 and f(x) = 10x + 7 is define F : R → R then find $F^{-1}$ (x)
5. F : R → R such that f(x) = 4x + 3 find $f^{-1}$ (x)
6. F : R → R such that f(x) = 2x + 3 find $f^{-1}$(x)
7. If a * b = $a^2$ $b^2$ then (1*2) *6 = ?
8. If x * y = 1 + 12x + xy ∀ $x, y \in \theta$ find (2 * 3)
9. f(x) = $8x^3$ and g(x) = $x^{1/3}$ find gof
10. If f(x) = $\frac{x+3}{2}$ and g(x) = 2x – 3 find fog and gof
11. If f(x) = $\frac{3x+4}{5x-7}$ find gof(x) and fog(x)
12. f(x) = $(3 - x^3)^{1/3}$ find fof
13. * defined on N such that a * b = LCM 20 * 16 then show that * is commutative.

## ➢ *INCREASING & DECREASING*

1. Discuss increasing and decreasing Natur of f(x) = $2x^3 - 15x^2 + 36x + 4$
2. Discuss increasing and decreasing natur of f(x) = 4 $x^3$ – 6 $x^2$ – 72 x + 30

## ➢ *MAXIMA AND MINIMA*

1. Find Maximum and minimum value of f(x) = $2x^3$ – 15 $x^2$ + 36x + 1 on the [1, 5]
   Ans :- (56, 24)
2. f(x) = 12 $x^{4/3}$ – 6 $x^{1/3}$, x ∈ $[-1, 1]$ Ans :- 18, $-9/4$
3. Find two numbers whose sum is 24 abd whose product is large possible.
4. Find two positive number x & y such that x + y = 60 and $xy^3$ is maximum

## ➢ ROLLES THEOREM

1. If $f(x) = x^2 + 4$ in $[-1, 1]$ then find C by Rolles theorem
2. Verify Rolles theorem for the function $f(x) = 2x^3 + x^2 - 4x + 2$ in $\left[-\frac{1}{2}, \sqrt{2}\right]$
3. Verify Rolles theorem $f(x) = \sin x + \cos x$ in $[0, \frac{\pi}{2}]$

## ➢ MEAN VALUE THEOREM M.U.T.

1. Verify M.U.T if $f(x) = (x - 1)(x - 2)(x - 3)$ in $[0, 4]$
2. Find the value of C By M.U.T.
   (a) $F(x) = 2x^2 - 10x + 29$ in $[2, 7]$
   (b) $f(x) = x^3 - 3x^2 + 2x$ in $\left[0, \frac{1}{2}\right]$

## ➢ TANGENT AND NORMAL

1. Find the slope o tangent to the curve $y = x^3 - x$ at $x = 2$
2. Find the slope of tangent to the curve $y = x^3 + x + 1$ at x – co-ordinate is 2.
3. Find the slope of the Normal to the curve $y = 2x^2 + 3 \sin x$ at $x = 0$ is
4. Find the point at which the tangent to the curve $y = \sqrt{4x - 3} - 1$ has Its slope 2/3.
5. Find the slope of normal at point (1, 1) of the curve. $y = x^2 + 3x - 4$

## ➢ APPROXIMATION

1. Find Approximate value sing differeniation if
   (a) $\sqrt{36.6}$ (b) $\sqrt{49.5}$ (c) $(401)^{\frac{1}{2}}$ (d) $\left(\frac{17}{81}\right)^{\frac{1}{4}}$
2. Find the approximate value of f (3.02) where $f(x) = 3x^2 + 5x + 3$
3. the approximate change n the volme of a cube of side x m cubesed by increasing the side by 3% is

## ➢ RATE OF CHANGE OF QUANTITIES

1. Find the rate of change of the area of a circle with respect to Its r. when (i) r = 5 cm (ii) r = 3 cm
2. The radius of 21 circle is increasing at the rate of 0.7 cm/s What is the rate of increasing of Its circumference.
3. A ballon which always remains spherical has a variable radius. Find the rate at which its volume is increasing with the radius when the later is 10 cm.

## ➢ DIFFERENTIAL EQUATION

**Find order and degree**

1. $\left(\frac{d^2y}{dx^2}\right)^2 + 2\left(\frac{dy}{dx}\right)^3 + 9y = \sin x$
2. $y^{111} + 2y^{11} + y^1 = 0$
3. $\left(\frac{d^2y}{dx^2}\right)^2 + \cos\{\frac{dy}{dx}\ \{= 0$
4. $8x^2\frac{d^2y}{dx^2} + 7\,(\frac{dy}{dx})^2 + 9 = 0$
5. $(y^{111})^2 + (y^{11})^3 + (y^1) + y^5 = 0$
6. Solve $x\frac{dy}{dx} - y = 2x^2$
7. Solve $(tan^{-1}y - x)\frac{dy}{dx} = (1 + y^2)dx$
8. solve $(x^3 + y^3)dy - x^2ydx = 0$
9. $\frac{dy}{dx} + y.\cot x = 2x + x^2\cot x$
10. Solve $\frac{dy}{dx} = e^{x+y}$
11. $\frac{dy}{dx} + \frac{y}{x} = \frac{y^2}{x^2}$
12. $\frac{dy}{dx} = \frac{x}{y}$ solve
13. Solve $\frac{dy}{dx} - \frac{2y}{x} = y^4$
14. Solve y dx – (x + $2y^2$) dy = 0
15. Solve $(x - y)dy - (x + y)dx = 0$

## ➢ B * AREA BOUNDED BY CURUE *

1. Find the area bounded by parabola $y^2 = x$ and the line x + y = 2 above the x-axis
2. Fnd the are of smaller part of the circle $x^2 + y^2 = a^2$ by the line x = a/2
3. Find the area bounded by curie $x^2 = 4y$ and line x = 4y – 2
4. Find the area of the circle $4x^2 + 4y^2 = 9$ which is interior to the parabola $x^2 = 4y$
5. Find the area of the region bounded by the elipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$

## ➢ C * CONTINUITY AND DIFFERENTIABILITITY *

1. Is f(x) = $\{x^3 - 3$ , $x \leq 2$ continous at x = 2 Find the value of k.
2. Find the vaue of 'a' and 'b' such that the f$^n$ defined by f(x) = $\begin{Bmatrix} 5 & if & x \leq 2 \\ ax + b & if & 2 < x < 10 \\ 21 & if & x \geq 10 \end{Bmatrix}$ is continous
3. f(x) $\begin{Bmatrix} x^2 + 3x + a & when\ x \leq 1 \\ bx + 2 & when\ x > 1 \end{Bmatrix}$ is differentiable find a & b

## ➢ PROBABILITY

1. If and B are two events such that P(A) = $\frac{1}{3}$ P(B) = $\frac{1}{7}$ and P(A $\cap$ B) = $\frac{1}{5}$ then$P\left(\frac{A}{B}\right)$ and $P\left(\frac{B}{A}\right)$

2. $P(A) = \frac{3}{8}$ $P(B) = \frac{5}{8}$ $P(A \cup B) = \frac{3}{4}$ then $P\left(\frac{B}{A}\right) = ?$

3. $P(A) = \frac{3}{8}$ $P(B) = \frac{1}{3}$ $P(A \cap B) = \frac{1}{4}$ find $P(\bar{A} \cap \bar{B}) = ?$

4. $P(A) = \frac{3}{8}$ $P(B) = \frac{1}{2}$ $P(A \cap B) = \frac{1}{4}$ find $P(\bar{A}/\bar{B}) = ?$

5. $P(A \cup B) = \frac{3}{4}, P(A \cap B) = \frac{1}{4}$ and $P(\bar{A}) = \frac{2}{3}$ find $P(\bar{A} \cap B) = ?$

6. If A and B are two events such that $P(A) = \frac{1}{4}$ $P(B) = \frac{1}{3}$ and $P(A \cup B) = \frac{1}{2}$ then prove that A and B are independent event

7. A pair of dice is rolled. Find the probability of obtaining an even prime on each dice.

8. A speaksibe truth is 75% cases and B is 50% of the cases. In What percentage of case are they lively to contraidict each in statily the same fact.

9. Find :-

| X | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| P(X) | a | 3a | 5a | 7a | 9a | 11a | 13a | 15a | 17a |

(i) $P(x \leq 3)$ (ii) $P(x \geq 5)$ (iii) $P(2 \leq x \leq 7)$ (iv) $a = ?$

10. Find

| X | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| P(X) | 0 | K | 2k | 2k | 3k | $K^2$ | $2k^2$ | $7k^2 + k$ |

(i) k (ii) $P(x < 6)$ (iii) $P(x \geq 2)$

11. $P(A) = \frac{1}{2}$ $P(B) = 0$ then $P\left(\frac{A}{B}\right)$ is

12. If $P\left(\frac{A}{B}\right) = P\left(\frac{B}{A}\right)$ then

13. $P(A) = \frac{1}{2}$ $P(A \cap B) = \frac{3}{5}$, $P(B) = P$ find P

(i) Mutualy excusive (ii) independent

14. In a box containing 100 bulbs, 10 are detective the probability of out of a sample of 5 bubs, none is defective.

## ➢ 3-d & PLANE

1. Find the direction cosine of x-axis, y-axis and z-axis.

2. $l^2 + m^2 + n^2 = ?$ Or, $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = ?$ Or $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = ?$

3. Find the shortest distance b/w lines

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

4. The direction ratio of normal to the plane 7x + 4y – 2z + 5 = 0 are
5. The direction cosine of noral to the plane 2x – 3y – 6z – 3 =0 are
6. Find the distance of plane 2x – 3y + 6z +7 = 0 from the point $(2, -3, -1)$
7. Find the eq$^n$ of the line passing through $(2, -1, 3)$ and direction ratio (3, -1, 2)
8. Find the direction ratio of the line $(x_1, y_1, z_1)$ and $(x_2, y_2, z_2)$
9. If the lines $\frac{x-1}{-3} = \frac{y-2}{2k} = \frac{z-3}{2}$ and $\frac{x-1}{3k} = \frac{y-1}{1} = \frac{z-6}{-5}$ are perpendicular find the value of k.
10. Find the eq$^n$ of the plane parallel to 2x + 5y – 6z + 3 = 0 and passes (1, 1, 1)
11. Find the eq$^n$ of the plane passing through the point (0, 7, −7).
12. The cartesian eq$^n$ of the line is $\frac{x+2}{2} = \frac{y-5}{4} = \frac{z+6}{2}$
13. Show that $\frac{x-5}{7} = \frac{y+2}{-5} = \frac{z}{1}$ and $\frac{x}{1} = \frac{-y}{2} = \frac{z}{3}$ are ⊥ each other
14. Find the vector and cortesian eq$^n$ of the line that passes through the point (3, $-2, -5$) & $(3, -2, 6)$
15. Find the value of P so that the line $\frac{1-x}{3} = \frac{7y-14}{2P} = \frac{z-3}{2}$ and $\frac{7-7x}{3P} = \frac{y-5}{1} = \frac{6-z}{5}$ are right angle

## ➢ *MIXED PROBLEM*

1. y = cos (log x) then $\frac{dy}{dx}$ = ?
2. (i) $\vec{a} \times \vec{b}$ = ? (ii) $\hat{\imath} \times \hat{\jmath}$ = ?
   (ii) $\vec{a} \perp \vec{b}$ then $\vec{a}.\vec{b}$ = ? (iv) $\hat{k}.\hat{k}$ = ?
3. The I.F of diff. equation $\frac{dy}{dx} + Py = q$ is
4. the order and degree of diff. eq$^n$ $\left(\frac{d^2y}{dx^2}\right)^2 - x\left(\frac{dy}{dx}\right)^3 = y^3$ is
5. $\tan^{-1}\left(\sqrt{3}\right) - cot^{-1}(-\sqrt{3})$
6. Prove that $tan^{-1}x + tan^{-1}\left(\frac{2x}{1-x^2}\right) = tan^{-1}\left\{\frac{3x-x^3}{1-3x^2}\right\}$
7. $\cos\left[tan^{-1}\{\sin(cos^{-1}x)\}\right] = \sqrt{\frac{1+x^2}{2+x^2}}$
8. Show that $\tan\left\{\frac{1}{2}\ sin^{-1}\frac{3}{4}\right\} = \frac{4-\sqrt{7}}{3}$

9. $\int \frac{x \cdot sin^{-1}x}{1-x^2}\, dx$

10. Write the vector eq$^{n}$ line $\frac{x-5}{3} = \frac{y+y}{7} = \frac{6-z}{2}$

11. $l^2 + m^2 + n^2 = ?$

12. $\sin^2 \alpha + \sin^2 \beta + \sin^2 \gamma = ?$

13. $\cos^2\alpha + cos^2\beta + cos^2\gamma = ?$

14. Find the value of $\lambda$ lines are $\perp$ each other $\frac{x-5}{3\lambda+2} = \frac{2-y}{5} = \frac{1-z}{-1}$ and $\frac{x}{1} = \frac{2y+1}{4\,\lambda} = \frac{1-z}{-3}$

15. $f(x) = x^2 + 4$ find $f^{-1}(x)$

16. If $y = e^x$ {sin x + cos x{ then prove that $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = 0$

17. F : R $\rightarrow$ R be a f$^{n}$ and $f(x) = 4x^3 + 7$ is bijective f$^{n}$.

18. h(A) = 2 n(B) = 2 then $n(A \times B) = ?$

19. F : N $\rightarrow$ N as f(n) = $\begin{cases} \frac{n+1}{2} & when\ n\ is\ odd \\ \frac{n}{2} & when\ n\ is\ even \end{cases}$ $\forall\ x(n)$ show that bijective

20. Prove that $\begin{vmatrix} a & b & c \\ a-b & b-c & c-a \\ b+c & c+a & a+b \end{vmatrix} = a^3 + b^3 + c^3 - 3abc$