1. (4) $k^{n-1}(adj\,I)$
2. (2) 2
3. (1) $\Delta \neq 0$
4. (2) $-\sqrt{3}$
5. $\cos^{-1}\left(-\frac{34}{63}\right)$
6. $x+9y+11z=0$
7. $\pm\frac{1}{3}(2\vec{i}-\vec{j}+2\vec{k})$ (4)
8. (2) $\cos\theta - i\sin\theta$
9. (3) $2+i$
10. (1) $\frac{2\pi}{n}$
11. (3) $x = \frac{-17}{4}$
12. (1) $(0, \pm 3)$
13. (2) ஒத்த இயக்குவரை (Corresponding directrix)

* 15. (1) $-\cot\theta$

* 14. (3) $\frac{2\pi}{3}$

16. (2) 0
17. (3) $x\to 0$ க்குத் தேறப்பெறாத வடிவத்தில் இல்லை
not in the indeterminate form as $x \to 0$
18. (2) $x = -\frac{9}{2}$
19. (1) $x \leq 1$
20. (2) 4.021

21. $\Delta = 0$, $\Delta_x \neq 0$
Inconsistant, no solution
ஒருங்கமைவு அற்றது, தீர்வு இல்லை

22. $(AB)^T = B^T A^T$

$$\begin{pmatrix} -2 & 4 & 5 \\ -6 & 12 & 15 \\ 12 & -24 & -30 \end{pmatrix}$$

23. $\vec{M} = \vec{r} \times \vec{F}$

$\vec{r} = \vec{OB} - \vec{OA} = 2\vec{i} + 3\vec{j} + \vec{k}$

$\vec{M} = \vec{i} + 2\vec{j} - 8\vec{k}$

24. $\sin\theta = \frac{\vec{b}\cdot\vec{n}}{|\vec{b}||\vec{n}|}$

$\theta = \sin^{-1}\left(\frac{3}{2\sqrt{91}}\right)$

25. $\frac{1}{1+2\omega} + \frac{1}{2+\omega} = -\omega \to (1)$

$\frac{1}{1+\omega} = -\omega \to (2)$

$(1) - (2) = -\omega + \omega = 0$

26. $\cos 13\theta + i\sin 13\theta$ (or)

$(\cos\theta + i\sin\theta)^{13}$

27. $C(0,0)$

$a = 5 \quad ae = 3, \quad e = \frac{3}{5}$

$a^2 = 25$

$b^2 = a^2(1-e^2)$

$b^2 = 16$

$\frac{x^2}{25} + \frac{y^2}{16} = 1$

(28) $f(x)$, $x=1$ புள்ளியில் வகையிடத்தக்கதாக இருக்காது, ஏனெனில் தொடர்ச்சியாக இருக்காது

$f(x)$, not differentiable at $x=1$ does not exist Rolle's theorem

(29) $f'(x) = 0$, $x = \frac{\pi}{4} \in [0, \frac{\pi}{3}]$

absolute maximum is $\sqrt{2}$

பெரும மதிப்பு $\sqrt{2}$

(30) $\frac{dy}{dx} = \frac{1}{2}(1-x)^{-\frac{1}{2}}(-1)$

$dy = -\frac{1}{2\sqrt{1-x}}\,dx = -0.01$

Part - III

(31) $(adj\ A) = 3A^T$

$$\begin{pmatrix} -3 & 6 & 6 \\ -6 & 3 & -6 \\ -6 & -6 & 3 \end{pmatrix} = \begin{pmatrix} -3 & 6 & 6 \\ -6 & 3 & -6 \\ -6 & -6 & 3 \end{pmatrix}$$

(32)

$$\alpha \begin{bmatrix} 1 & 2 & 4 & 3 \\ 0 & 1 & 2 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix} \qquad \rho(A) = 2$$

(33) $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

$\frac{1}{2}|\vec{a}\times\vec{b}| = \frac{1}{2}|\vec{b}\times\vec{c}| = \frac{1}{2}|\vec{c}\times\vec{a}|$

$ab\sin(\pi - C) = bc\sin(\pi - A) = ca\sin(\pi - B)$

$ab\sin C = bc\sin A = ca\sin B$

$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

(34) $x^2 - ax - bx + ab = 35$

$x^2 - 2x + 1 = 35$

$x^2 - 2x - 34 = 0$

$x^2 = 2 \pm \frac{\sqrt{4+140}}{2(1)}$

$x = 1 + \sqrt{35}$

(35) $3+i$, $3-i$

$S \cdot R = 6$, $P \cdot R = 10$

$x^4 - 8x^3 + 24x^2 - 32x + 20 = (x^2 - 6x + 10)(x^2 + px + 2)$

$10p - 12 = -32 \Rightarrow p = -2$

$x^2 - 2x + 2$

$x = 1 \pm i$

$(x \neq 3 \pm i)$, $(x = 1 \mp i)$

(36) $a^2 = \frac{275}{100}$ $a = \frac{\sqrt{11}}{2}$

$e = \sqrt{1 + \frac{b^2}{a^2}} = \sqrt{1 + \frac{275/44}{275/100}}$

$= \sqrt{1 + \frac{100}{44}} = \boxed{\frac{6}{\sqrt{11}} = e}$

$\boxed{C(0,0)}$

$F_1F_2(a, \pm ae) = \left(0, \pm \frac{\sqrt{11}}{2} \times \frac{6}{\sqrt{11}}\right)$

$\boxed{F_1F_2 = (0, \pm 3)}$

(37) $\tan\theta = \left|\frac{m_1 - m_2}{1 + m_1 m_2}\right|$

$\theta = \tan^{-1}(7)$

(38) $\frac{dy}{dx} = e^x = m_1 \rightarrow (1)$

$\frac{dy}{dx} = -e^{-x} = m_2 \rightarrow (2)$

$m_1 m_2 = -e^x \times e^{-x}$

$= -e^{x-x}$

$= -e^0 = -1$

(39) $$\frac{dw}{dt} = \frac{\partial w}{\partial x}\cdot\frac{dx}{dt} + \frac{\partial w}{\partial y}\cdot\frac{dy}{dt} + \frac{\partial w}{\partial z}\cdot\frac{dz}{dt}$$

$$= y(-\sin t) + x\cdot\cos t + 1\cdot 1$$

$$= -\sin^2 t + \cos^2 t + 1 = 2\cos^2 t$$

(40) $$\sin 2x \cdot \frac{\partial u}{\partial x} = \frac{2\tan x}{\tan x + \tan y + \tan z}$$

$$\Sigma \sin 2x \frac{\partial u}{\partial x} = \frac{2(\tan x + \tan y + \tan z)}{(\tan x + \tan y + \tan z)}$$

$$= 2$$

Section – IV

(41) (a)

$$a + 2b - c = 1$$
$$2a + 4b + c = 5$$
$$3a - 2b - 2c = 0$$

$\left\{ \frac{1}{x} = a,\ \frac{1}{y} = b,\ \frac{1}{z} = c \right.$

$\Delta = 24,\ \Delta a = 24,\ \Delta b = 12,\ \Delta c = 24$

$(1, \frac{1}{2}, 1) = (a, b, c)$

$(x, y, z) = (1, 2, 1)$

(42) (b) $\arg\left(\frac{x}{y}\right) = \arg(x) - \arg y$

$$\tan^{-1}\left(\frac{y}{x-2}\right) - \tan^{-1}\left(\frac{y-6}{x}\right)$$

$$\tan^{-1}\left[\frac{\left(\frac{y}{x-2} - \frac{y-6}{x}\right)}{\left(1 + \frac{y}{x-2}\cdot\frac{y-6}{x}\right)}\right] = \pi/2$$

$$1 + \frac{y}{x-2}\cdot\frac{y-6}{x} = 0$$

$$x^2 - 2x + y^2 - 6y = 0$$

(42) (a)

$$(\vec{a}\times\vec{b})\times(\vec{c}\times\vec{d}) = [\vec{a}\ \vec{b}\ \vec{d}]\vec{c} - [\vec{a}\ \vec{b}\ \vec{c}]\vec{d}$$

$$= -5\vec{i} - 3\vec{j} + 4\vec{k}$$

(b) $r = 1,\ \theta = -\frac{\pi}{3}$

$$= \text{cis}\left[-\frac{\pi}{4} + \frac{\pi}{4} + \frac{3\pi}{4} + \frac{5\pi}{4}\right]$$

$$= \text{cis}\, 2\pi$$

$$= 1$$

(43) (a) $\alpha = 1+i$

$\beta = 1-i$

$$(y+\alpha)^n = \frac{1}{\sin^n\theta}(\cos n\theta + i\sin n\theta)$$

$$(y+\beta)^n = \frac{1}{\sin^n}(\cos n\theta - i\sin n\theta)$$

$$\alpha - \beta = 2i$$

$$= \frac{\sin n\theta}{\sin^n\theta}.$$

(b) $a = 3 \quad X = x - 3,\ Y = y + 1$

Axis $x - 3 = 0$

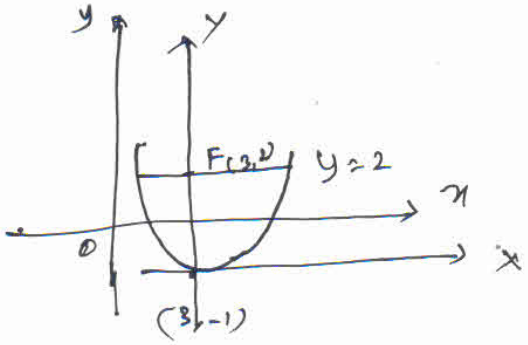
Vertex $V(3, -1)$

Focus $F(3, 2)$

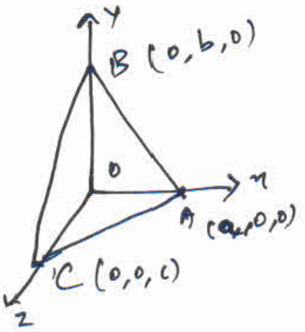
Directrix $y + 4 = 0$

L.R $-y - 2 = 0$

L.L.R $4a = 12$



(44) (a) 3 points

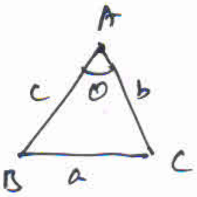


$$\begin{vmatrix} x-a & y-0 & z-0 \\ -a & b-0 & 0 \\ -a & 0 & c-0 \end{vmatrix} = 0$$

$bcx + cay + abz = abc$

$$\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$$

(b)



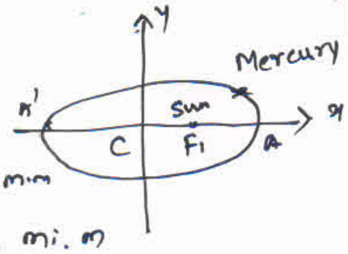
$\Delta = \frac{1}{2} bc \sin\theta$

$$\frac{d\Delta}{dt} = \frac{1}{2} bc \cos \frac{d\theta}{dt}$$

$$= \frac{1}{2} \times 5 \times 4 \times \cos\frac{\pi}{3} \times 0.06$$

$$= 0.3 \; m^2/sec$$

(45) (a)



2. $F_1A = 28.584$ mi.m

$F_1A' = 43.416$ mi.m

(b) $\frac{\partial u}{\partial x} = \cos xy \cdot y$

$\frac{\partial u}{\partial y} = \cos xy \cdot x$

$$\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial}{\partial x}(x \cos xy)$$

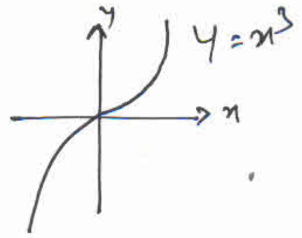
$$= -xy \sin xy + \cos xy \rightarrow ①$$

$$\frac{\partial^2 u}{\partial y \partial x} = \frac{\partial}{\partial y}(\cos xy \cdot y)$$

$$= -xy \sin xy + \cos xy \rightarrow ②$$

① = ②

46 (a)



(b) $y' = -2xe^{-x^2}$

$y'' = 2e^{-x^2}(2x^2 - 1)$

$x = -\frac{1}{\sqrt{2}}, \; x = \frac{1}{\sqrt{2}}$

வளைவு மாற்றப் புள்ளிகள் $\left(\frac{1}{\sqrt{2}}, e^{-\frac{1}{2}}\right)$
point of inflection

$-\infty < x < \frac{-1}{\sqrt{2}}$ மேல்நோக்கி குழிவு
concave upward

$-\frac{1}{\sqrt{2}} < x < \frac{1}{\sqrt{2}}$ கீழ்நோக்கி குழிவு
concave downward

$\frac{1}{\sqrt{2}} < x < \infty$ மேல்நோக்கி குழிவு
concave upward.

(47) (a)

$(1.02)^{\frac{1}{3}} \simeq 1.0066$

$(1.02)^{1/4} \simeq 1.005$

$\simeq 1.0066 + 1.005 = 2.0116$

(b)

$$\sim \begin{bmatrix} 1 & 1 & 1 & 6 \\ 0 & 1 & 2 & 4 \\ 0 & 0 & \lambda-3 & \mu-10 \end{bmatrix}$$

(i) $\lambda - 3 = 0, \; \mu \neq 10$ $(\rho(A) \neq \rho(A,B))$

(ii) $\lambda - 3 \neq 0$ $(\rho(A) = \rho(A,B) = 3$

(iii) $\lambda - 3 = 0, \; \mu - 10 = 0$

$\rho(A) = \rho(A,B) < 3.$

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(i) $\rho(A) \neq \rho(A;B)$

no solution

(ii) $\rho(A) = \rho(A,B) = 3$

single solution

(iii) $\rho(A) = \rho(A,B) < 2$

many solution

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