

ANSWERS

Exercise 1.1

1. (i) $\begin{bmatrix} 2 & -4 \\ -6 & -3 \end{bmatrix}$

(ii) $\begin{bmatrix} 1 & 1 & -1 \\ -3 & 1 & 1 \\ 9 & -5 & -1 \end{bmatrix}$

(iii) $\frac{1}{3} \begin{bmatrix} 2 & -2 & 1 \\ 2 & 1 & -2 \\ 1 & +2 & 2 \end{bmatrix}$

2. (i) $\frac{1}{2} \begin{bmatrix} -3 & -4 \\ -1 & -2 \end{bmatrix}$

(ii) $\frac{1}{28} \begin{bmatrix} 6 & -1 & -1 \\ -1 & 6 & -1 \\ -1 & -1 & 6 \end{bmatrix}$

(iii) $\frac{1}{2} \begin{bmatrix} 1 & 1 & -1 \\ -3 & 1 & 1 \\ 9 & -5 & -1 \end{bmatrix}$

8. $\pm \begin{bmatrix} 6 & 2 & 1 \\ 5 & 2 & 2 \\ 6 & 2 & 3 \end{bmatrix}$

9. $\pm \frac{1}{6} \begin{bmatrix} 0 & -2 & 0 \\ 6 & 2 & -6 \\ -3 & 0 & 6 \end{bmatrix}$

10. $\begin{bmatrix} 2 & 0 & -2 \\ 0 & 2 & 0 \\ 2 & 0 & 2 \end{bmatrix}$

12. $\begin{bmatrix} 3 & 1 \\ 1 & -2 \end{bmatrix}$

13. $\begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$

15. HELP

Exercise 1.2

1. (i) 1 (ii) 2 (iii) 2 (iv) 3 (v) 3

2. (i) 2 (ii) 3 (iii) 3

3. (i) $\begin{bmatrix} -2 & 1 \\ -5 & 2 \end{bmatrix}$

(ii) $\begin{bmatrix} -2 & -3 & 1 \\ -3 & -3 & 1 \\ -2 & -4 & 1 \end{bmatrix}$

(iii) $\begin{bmatrix} -40 & 16 & 9 \\ 13 & -5 & -3 \\ 5 & -2 & -1 \end{bmatrix}$

Exercise 1.3

1. (i) $x = -11, y = 4$

(ii) $x = 2, y = -4$

(iii) $x = 2, y = 3, z = 4$

(iv) $x = 3, y = -2, z = 1$

2. $x = 2, y = 1, z = -1$

3. ₹ 18000, ₹ 600

4. 18 days, 36 days

5. ₹ 2000, ₹ 1000, ₹ 3000

Exercise 1.4

1. (i) $x = -2, y = 3$

(ii) $x = \frac{1}{2}, y = 3$

(iii) $x = 2, y = 3, z = 4$ (iv) $x = 1, y = 3, z = 3$

2. 84

3. 50% acid is 6 litres, 25% acid is 4 litres

4. Pump A : 15 minutes, Pump B : 30 minutes

5. ₹ 30/-, ₹ 10/-, ₹ 30/-, yes

Exercise 1.5

1. (i) $x = -1, y = 4, z = 4$

(ii) $x = 3, y = 1, z = 2$

2. $a = 2, b = 1, c = 6$

3. ₹ 30000, ₹ 15000, ₹ 20000

4. $a = 1, b = 3, c = -10$, yes

Exercise 1.6

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

(ii) $x = \frac{1}{10}(7 - 4t), y = \frac{1}{10}(5t - 1), z = t, t \in \mathbb{R}$



(iii) No solution

(iv) $x = \frac{1}{2}(s-t+2), y = s, z = t$ and $s, t \in \mathbb{R}$

2. (i) $k = 1$

(ii) $k \neq 1, k \neq -2$

(iii) $k = -2$

3. (i) $\lambda = 5$

(ii) $\lambda \neq 5, \mu \neq 9$

(iii) $\lambda = 5, \mu = 9$

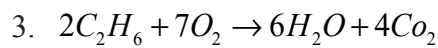
Exercise 1.7

1. (i) $x = -t, y = -2t, z = t, t \in \mathbb{R}$

(ii) Trivial solutions only

2. (i) $\lambda \neq 8$

(ii) $\lambda = 8$



Exercise 1.8

1	2	3	4	5	6	7	8	9	10
(2)	(3)	(2)	(3)	(4)	(2)	(4)	(4)	(2)	(1)
11	12	13	14	15	16	17	18	19	20
(2)	(4)	(1)	(2)	(4)	(3)	(2)	(1)	(4)	(4)
21	22	23	24	25					
(2)	(4)	(4)	(4)	(1)					

Exercise 2.1

1. $-1-i$

2. $1+i$

3. 0

4. 0

5. 1

6. $1-i$

Exercise 2.2

1. (i) $4+i$

(ii) $8-i$

(iii) $7+5i$

(iv) $1+17i$

(v) $15+8i$

(vi) $15+8i$

3. $x = -1, y = 1$

Exercise 2.3

3. $-z_1 = -2-5i$,

$$z_1^{-1} = \frac{1}{29}(2-5i)$$

$-z_2 = 3+4i$,

$$z_2^{-1} = \frac{1}{25}(-3+4i)$$

$-z_3 = -1-i$,

$$z_3^{-1} = \frac{1}{2}(1-i)$$

Exercise 2.4

1. (i) $7-5i$

(ii) $\frac{5}{4}(1-i)$

(iii) $\frac{2}{5} - \frac{14i}{5}$

2. (i) $\frac{x}{x^2+y^2}$

(ii) y

(iii) $-y-4$

3. $\frac{1}{25}(-1-2i), \frac{1}{5}(-11+2i)$

(4) $\frac{1}{2}(7-i)$

6. (i) 6

(ii) 3





Exercise 2.5

1. (i) $\frac{2}{5}$ (ii) $2\sqrt{2}$ (iii) 32 (iv) 50
4. $11+6i$
7. 10 9. (i) $\pm\left(\frac{3}{\sqrt{2}}+i\frac{1}{\sqrt{2}}\right)$ (ii) $\pm(\sqrt{2}-i2\sqrt{2})$ (iii) $\pm(2-3i)$

Exercise 2.6

3. (i) $y^2=3$ (ii) $x-y=0$ (iii) $x+y=0$ (iv) $x^2+y^2=1$
4. (i) $2+i, 3$ (ii) $-1+2i, 1$ (iii) $2-4i, \frac{8}{3}$
5. (i) $x^2+y^2-8x-240=0$ (ii) $6x+1=0$

Exercise 2.7

1. (i) $4\left(\cos\left(2k\pi+\frac{\pi}{3}\right)+i\sin\left(2k\pi+\frac{\pi}{3}\right)\right), k \in \mathbb{Z}$
(ii) $2\sqrt{3}\left(\cos\left(2k\pi-\frac{\pi}{6}\right)+i\sin\left(2k\pi-\frac{\pi}{6}\right)\right), k \in \mathbb{Z}$
(iii) $2\sqrt{2}\left(\cos\left(2k\pi-\frac{3\pi}{4}\right)+i\sin\left(2k\pi-\frac{3\pi}{4}\right)\right), k \in \mathbb{Z}$
(iv) $\sqrt{2}\left(\cos\left(2k\pi+\frac{5\pi}{12}\right)+i\sin\left(2k\pi+\frac{5\pi}{12}\right)\right), k \in \mathbb{Z}$
2. (i) $\frac{1}{\sqrt{2}}(1+i)$ (ii) $\frac{-i}{2}$

Exercise 2.8

3. 1 5. $3\operatorname{cis}\frac{\pi}{3}, -3, 3\operatorname{cis}\frac{5\pi}{3}$ 7. -1
9. (i) $2e^{\frac{i\pi}{12}}$ (ii) $2e^{\frac{i5\pi}{12}}$ (iii) $2e^{\frac{i5\pi}{4}}$

Exercise 2.9

1	2	3	4	5	6	7	8	9	10
(1)	(1)	(1)	(2)	(3)	(1)	(4)	(1)	(1)	(1)
11	12	13	14	15	16	17	18	19	20
(2)	(2)	(4)	(2)	(2)	(3)	(1)	(3)	(4)	(4)
21	22	23	24	25					
(2)	(3)	(4)	(1)	(1)					

EXERCISE 3.1

1. 8
2. (i) $x^3-6x^2+11x-6=0$ (ii) $x^3-3x-2=0$ (iii) $2x^3-7x^2+7x-2=0$
3. (i) $x^3+4x^2+12x+32=0$ (ii) $4x^3+3x^2+2x+1=0$ (iii) $x^3-2x^2+3x-4=0$





4. $2, 3, \frac{1}{3}$ 5. 10 6. $\frac{21}{19}, \frac{14}{19}, \frac{136}{19}$ and $6, 4, -1$ 7. $\sum \frac{1}{\alpha} = \frac{c}{d}, \sum \frac{\alpha}{\beta\gamma} = \frac{2ac-b^2}{ad}$
8. $2x^2 + 13x + 20 = 0$ 11. $x^3 - 18x^2 + 109x - 216 = 0$ 12. $x^3 + x - 12 = 0$

Exercise 3.2

1. When $k < 0$, the polynomial has real roots.
When $k = 0$ or $k = 8$, the roots are real and equal.
When $0 < k < 8$ the roots are imaginary.
When $k > 8$ the roots are real and distinct.

2. $x^2 - 4x + 7 = 0$ 3. $x^2 - 6x + 13 = 0$ 4. $x^4 - 16x^2 + 4$

Exercise 3.3

1. $-3, 3, \frac{1}{2}$ 2. $\frac{2}{3}, \frac{4}{3}, 2$ 3. $\frac{2}{3}, 2, 6$ 4. $k = 2, 2, \frac{1 \pm \sqrt{3}}{2}$
5. $1 - 2i, 1 + 2i, \sqrt{3}, -\sqrt{3}, \frac{1 + \sqrt{37}}{2}, \frac{1 - \sqrt{37}}{2}$ 6. (i) $1, \frac{1}{2}, 3$ (ii) $-1, \frac{1}{2}, \frac{3}{4}$ 7. $\pm 3, \pm \sqrt{5}$

Exercise 3.4

1. (i) $\{-2, 3, -7, 8\}$ (ii) $3, 3, 3 + \sqrt{17}, 3 - \sqrt{17}$ 2. $\left\{1, -2, \frac{-1 + 2\sqrt{5}}{2}, \frac{-1 - 2\sqrt{5}}{2}\right\}$

Exercise 3.5

1. (i) $\frac{\pi}{2} + 2\pi n$, no solution for $\sin x = 4$ (ii) $2, -\frac{1}{4}, \frac{2}{3}$
2. (i) $x = 1$ (ii) no rational roots 3. 4^n 4. $\frac{b^2}{4a}, \frac{9a^3}{b^2}$
5. (i) $2, 3, \frac{1}{2}, \frac{1}{3}$ (ii) $+1, -1, \frac{-3 + \sqrt{5}}{2}, \frac{-3 - \sqrt{5}}{2}$
6. $-2, 2, 3$ 7. $\frac{1}{3}, 3, \frac{1}{2}$ and 2

Exercise 3.6

1. It has at most four positive roots and at most two negative roots.
2. It has at most two positive roots and no negative roots.
4. It has one positive real root and one negative real root.
5. no positive real roots and no negative real roots.

Exercise 3.7

1	2	3	4	5	6	7	8	9	10
(4)	(1)	(3)	(2)	(2)	(4)	(1)	(3)	(1)	(2)

Exercise 4.1

- (i) $x = n\pi$, $n = 0, \pm 1, \pm 2, \dots, \pm 10$ (ii) $x = (4n-1)\frac{\pi}{2}$, $n = 0, \pm 1, \pm 2, \pm 3, 4$
- (i) $1, \frac{2\pi}{7}$ (ii) $1, 6\pi$ (iii) $4, \pi$ 4. (i) $\frac{\pi}{3}$ (ii) $-\frac{\pi}{4}$
- $x = 0$ 6. (i) $\{-1, 1\}$ (ii) $[0, 1]$ 7. $\frac{\pi}{3}$

Exercise 4.2

- (i) $x = (2n+1)\frac{\pi}{2}$, $n = 0, \pm 1, \pm 2, \pm 3, \pm 4, \pm 5$ (ii) $x = (2n+1)\pi$, $n = 0, \pm 1, \pm 2, -3$
- $-\frac{\pi}{6} \notin [0, \pi]$ 3. True 4. $\frac{\pi}{3}$
- (i) $\frac{5\pi}{6}$ (ii) $-\frac{\pi}{6}$ (iii) $\frac{24\pi}{119}$ 6. (i) $[-5, 5]$ (ii) $[-1, 1]$
- $0 < x < \frac{1}{3}$ 8. (i) 0 (ii) $-\frac{7\pi}{12}$

Exercise 4.3

- (i) $[-3, 3]$ (ii) $\mathbb{R}$ 2. (i) $\frac{\pi}{4}$ (ii) $\frac{\pi}{6}$
- (i) $\frac{7\pi}{4}$ (ii) 1947 (iii) -0.2021 4. (i) ∞ (ii) $-\frac{2\sqrt{5}}{25}$ (iii) $\frac{24}{25}$

Exercise 4.4

- (i) $\frac{\pi}{6}$ (ii) $\frac{\pi}{6}$ (iii) $-\frac{\pi}{4}$ 2. (i) $-\frac{\pi}{3}$ (ii) $\cot^{-1}(2) - \frac{\pi}{6}$ (iii) $-\frac{5\pi}{6}$

Exercise 4.5

- (i) $-\frac{\pi}{2}$ (ii) $-\frac{\pi}{4}$ (iii) $5-2\pi$
- (i) $\sqrt{2x-x^2}$ (ii) $\frac{1}{\sqrt{9x^2-6x+2}}$ (iii) $\frac{2x+1}{\sqrt{3-4x-4x^2}}$
- (i) $\frac{\pi}{6}$ (ii) 0 (iii) $\frac{17}{6}$ 8. $\frac{\pi}{4}$
- (i) $x = 13$ (ii) $x = \frac{a-b}{1+ab}$ (iii) $x = n\pi$, $x = n\pi + \frac{\pi}{4}$
- (iv) $x = \sqrt{3}$
- Three



Exercise 4.6

1	2	3	4	5	6	7	8	9	10
(3)	(2)	(3)	(1)	(2)	(1)	(3)	(1)	(4)	(4)
11	12	13	14	15	16	17	18	19	20
(3)	(2)	(2)	(1)	(3)	(3)	(2)	(2)	(4)	(4)

Exercise 5.1

1. $x^2 + y^2 \pm 10y = 0$
2. $(x-2)^2 + (y+1)^2 = 50$
3. $x^2 + y^2 + 4x + 4y + 4 = 0$ or $x^2 + y^2 + 20x + 20y + 100 = 0$
4. $x^2 + y^2 - 4x - 6y - 12 = 0$
5. $x^2 + y^2 - 5x + 3y - 22 = 0$
6. $x^2 + y^2 = 1$
7. $x^2 + y^2 - 6x - 4y + 4 = 0$
8. ± 12
9. $x - 5y + 8 = 0, x + 5y - 12 = 0$
10. out side, inside, outside
11. (i) $(0, -2), 0$ (ii) $(-3, 2), 3$ (iii) $\left(\frac{1}{2}, -1\right), \frac{\sqrt{17}}{2}$ (iv) $\left(\frac{3}{2}, -1\right), \frac{3}{2}$
12. $p = q = 3, (1, 0), 5$

Exercise 5.2

1. (i) $y^2 = 16x$ (ii) $3x^2 = -4y$ (iii) $(y+2)^2 = 12(x-1)$ (iv) $y^2 = 16x$
2. (i) $\frac{x^2}{36} + \frac{y^2}{27} = 1$ (ii) $\frac{x^2}{9} + \frac{y^2}{25} = 1$ (iii) $\frac{16x^2}{625} + \frac{y^2}{25} = 1$ (iii) $\frac{x^2}{8} + \frac{y^2}{16} = 1$
3. (i) $\frac{9x^2}{16} - \frac{9y^2}{20} = 1$ (ii) $\frac{(x-2)^2}{12} - \frac{(y-1)^2}{24} = 1$ (iii) $\frac{x^2}{16} - \frac{9y^2}{64} = 1$
- 4.

	Vertex	Focus	Equation of directrix	Length of latus rectum
i.	(0,0)	(4,0)	$x = -4$	16
ii.	(0,0)	(0,6)	$y = -6$	24
iii.	(0,0)	(-2,0)	$x = 2$	8
iv.	(1,-2)	(1,4)	$y = 0$	8
v.	(1,2)	(3,2)	$x = -1$	8





5.

	Type of conic	Centre	Vertices	Foci	Directrices
i.	Ellipse	$(0,0)$	$(\pm 5,0)$	$(\pm 4,0)$	$x = \pm \frac{25}{4}$
ii.	Ellipse	$(0,0)$	$(0, \pm \sqrt{10})$	$(0, \pm \sqrt{7})$	$y = \pm \frac{10}{\sqrt{7}}$
iii.	Hyperbola	$(0,0)$	$(\pm 5,0)$	$(\pm 13,0)$	$x = \pm \frac{25}{13}$
iv.	Hyperbola	$(0,0)$	$(0, \pm 4)$	$(0, \pm 5)$	$y = \pm \frac{16}{5}$

8.

	Type of Conic	Centre	Vertices	Foci	Directrices
i.	Ellipse	$(3,4)$	$(3,21), (3,-13)$	$(3,12), (3,-4)$	$y = \frac{321}{8},$ $y = \frac{-257}{8}$
ii.	Ellipse	$(-1,2)$	$(-11,2), (9,2)$	$(-7,2), (5,2)$	$x = \frac{47}{3},$ $x = \frac{-53}{3}$
iii.	Hyperbola	$(-3,4)$	$(-18,4), (12,4)$	$(-20,4), (14,4)$	$x = \frac{176}{17},$ $x = \frac{-276}{17}$
iv.	Hyperbola	$(-1,2)$	$(-1,7), (-1,-3)$	$(-1, 2 + \sqrt{41})$ $(-1, 2 - \sqrt{41})$	$y = \frac{25}{\sqrt{41}} + 2,$ $y = \frac{-25}{\sqrt{41}} + 2$
v.	Ellipse	$(4,-2)$	$(4, -2 + 3\sqrt{2}),$ $(4, -2 - 3\sqrt{2})$	$(4, -2 + \sqrt{6}),$ $(4, -2 - \sqrt{6})$	$y = -2 + 3\sqrt{6},$ $y = -2 - 3\sqrt{6}$
vi.	Hyperbola	$(2,-3)$	$(3,-3), (1,-3)$	$(2 + \sqrt{10} - 3),$ $(2 - \sqrt{10} - 3)$	$x = \frac{1}{\sqrt{10}} + 2,$ $x = \frac{-1}{\sqrt{10}} + 2$





Exercise 5.3

1. hyperbola 2. circle 3. ellipse 4. circle 5. hyperbola 6. parabola

Exercise 5.4

1. $x - y - 3 = 0, x - 9y + 13 = 0$ 2. $10x - 3y + 32 = 0, 10x + 3y - 32 = 0$
3. $(-3, 1)$ 4. $x - y + 4 = 0$
5. $x - 2y + 8 = 0$ 6. $4x - 3y - 6 = 0, 3x + 4y - 12 = 0$

Exercise 5.5

1. 8.4 m 2. 9.6 m 3. 3 m
4. $y^2 = 4.8x, 1.3m$ 5. $3.52m, 5.08m$ 6. $45.41m, 74.45m$
7. $\frac{2\sqrt{2}}{3}$ 8. $3\sqrt{3}m$ 9. $\tan^{-1}\left(\frac{4}{3}\right)$ 10. $\frac{x^2}{9} - \frac{y^2}{16} = 1$

Exercise 5.6

1	2	3	4	5	6	7	8	9	10	11	12	13
(1)	(3)	(4)	(3)	(3)	(1)	(1)	(3)	(2)	(2)	(1)	(4)	(3)
14	15	16	17	18	19	20	21	22	23	24	25	---
(3)	(1)	(4)	(4)	(1)	(1)	(2)	(2)	(3)	(3)	(3)	(2)	---

Exercise 6.1

11. 80 units 12. 69 units
13. $\sqrt{179}, \frac{3}{\sqrt{179}}, \frac{-11}{\sqrt{179}}, \frac{-7}{\sqrt{179}}$ 14. $-96\hat{i} + 115\hat{j} + 15\hat{k}$

Exercise 6.2

1. 24 2. 720 cubic units 3. -5
4. ± 12 5. $\frac{2\sqrt{3}}{5}$ 6. coplanar 7. 2

Exercise 6.3

1. (i) $-2\hat{i} + 14\hat{j} - 22\hat{k}$ (ii) $22\hat{i} + 14\hat{j} + 2\hat{k}$ 5. -74
7. $l = 0, m = 10, n = -3$ 8. $\theta = \frac{\pi}{3}$

Exercise 6.4

1. $\vec{r} - (4\hat{i} + 3\hat{j} - 7\hat{k}) \times (2\hat{i} - 6\hat{j} + 7\hat{k}) = \vec{0}, \frac{x-4}{2} = \frac{y-3}{-6} = \frac{z+7}{7}$
2. $\vec{r} = (-2\hat{i} + 3\hat{j} + 4\hat{k}) + t(-4\hat{i} + 5\hat{j} - 6\hat{k}), \frac{x+2}{-4} = \frac{y-3}{5} = \frac{z-4}{-6}$
3. $\left(\frac{32}{0}, 0, \frac{47}{3}\right), (0, 16, -11)$



$$4. \left(\frac{2}{7}, \frac{3}{7}, \frac{6}{7} \right), \vec{r} = (5\hat{i} + 6\hat{j} + 7\hat{k}) + t(2\hat{i} + 3\hat{j} + 6\hat{k}) \text{ or}$$

$$\vec{r} = (7\hat{i} + 9\hat{j} + 13\hat{k}) + t(2\hat{i} + 3\hat{j} + 6\hat{k}),$$

$$\frac{x-5}{2} = \frac{y-6}{3} = \frac{z-7}{6} \text{ or } \frac{x-7}{2} = \frac{y-9}{3} = \frac{z-13}{6}$$

$$5. (i) 0^\circ \quad (ii) \cos^{-1}\left(\frac{3}{2\sqrt{3}}\right) \quad (iii) \frac{\pi}{2} \quad 6. \frac{\pi}{2} \quad 7. a=18, b=\frac{2}{3} \quad 8. 1$$

Exercise 6.5

$$1. \vec{r} = (5\hat{i} + 2\hat{j} + 8\hat{k}) + t(2\hat{i} + \hat{j} - 2\hat{k}), t \in \mathbb{R}, \frac{x-5}{2} = \frac{y-2}{1} = \frac{z}{-2}$$

$$2. \frac{7}{\sqrt{5}} \text{ units}$$

$$3. \frac{9}{2}$$

$$4. (6, 2, 1)$$

$$5. 2 \text{ units}$$

$$6. \frac{\sqrt{83}}{\sqrt{6}} \text{ units}$$

$$7. (1, 6, 0), \frac{x-5}{-4} = \frac{y-4}{2} = \frac{z-2}{-2}$$

Exercise 6.6

$$1. \vec{r} \cdot \left(\frac{3\hat{i} - 4\hat{j} + 5\hat{k}}{5\sqrt{2}} \right) = 7 \quad 2. \frac{12}{13}, \frac{3}{13}, \frac{-4}{13}; \vec{r} \cdot \left(\frac{12\hat{i} + 3\hat{j} - 4\hat{k}}{13} \right) = 5; 5$$

$$3. \vec{r} \cdot (\hat{i} + 3\hat{j} + 5\hat{k}) = 35; x + 3y + 5z = 35$$

$$4. \vec{r} \cdot (\hat{i} + \hat{j} + \hat{k}) = 2; x + y + z = 2$$

$$5. x\text{-intercept} = 2, y\text{-intercept} = 3, z\text{-intercept} = -4$$

$$6. \frac{x}{u} + \frac{y}{v} + \frac{z}{w} = 3$$

Exercise 6.7

$$1. \vec{r} \cdot (\hat{i} - 2\hat{j} + 4\hat{k}) = 20; x - 2y + 4z - 20 = 0$$

$$2. \vec{r} \cdot (3\hat{i} + 4\hat{j} - 5\hat{k}) = 9; 3x + 4y - 5z - 9 = 0$$

$$3. \vec{r} \cdot (2\hat{i} + 2\hat{j} + \hat{k}) + s(-\hat{i} - 4\hat{j} + 2\hat{k}) + t(3\hat{i} - 4\hat{j} + 5\hat{k}), s, t \in \mathbb{R};$$

$$12x - 11y - 16z + 14 = 0$$

$$4. \vec{r} \cdot (\hat{i} + 10\hat{j} + 7\hat{k}) = 9; x + 10y + 7z - 9 = 0$$

$$5. \vec{r} \cdot (\hat{i} - \hat{j} + 3\hat{k}) + s(2\hat{i} - \hat{j} + 4\hat{k}) + t(\hat{i} + 2\hat{j} + \hat{k}), s, t \in \mathbb{R}; 9x - 2y - 5z + 4 = 0$$

$$6. \vec{r} \cdot (3\hat{i} + 6\hat{j} - 2\hat{k}) + s(-4\hat{i} - 8\hat{j} + 8\hat{k}) + t(3\hat{i} - 2\hat{j}), s, t \in \mathbb{R}; \vec{r} \cdot (2\hat{i} + 3\hat{j} + 4\hat{k}) = 16;$$

$$2x + 3y + 4z - 16 = 0$$

$$7. \vec{r} \cdot (3\hat{i} + 5\hat{j} - 7\hat{k}) = 6; 3x + 5y - 7z - 6 = 0$$

Exercise 6.8

$$1. \vec{r} \cdot (17\hat{i} - 47\hat{j} - 24\hat{k}) = 172$$

$$2. x + 2y - z - 4 = 0$$

$$3. m = \pm\sqrt{2}$$

$$4. -2, 2, y + z + 1 = 0, y - z + 1 = 0$$



Exercise 6.9

1. $15x - 47y + 28z - 7 = 0$

2. $5x - 11y + z - 17 = 0$

3. $\sin^{-1}\left(\frac{8}{21}\right)$

4. $\cos^{-1}\left(\frac{2}{3\sqrt{6}}\right)$

5. $2x - 3y + 5z - 11 = 0; \frac{4}{\sqrt{38}}$

6. $\frac{1}{\sqrt{3}}$ units

7. $(2, 2, 0)$

8. $(3, -1, -1); \sqrt{14}$ units.

Exercise 6.10

1	2	3	4	5	6	7	8	9	10
(4)	(3)	(1)	(2)	(3)	(3)	(1)	(1)	(1)	(2)
11	12	13	14	15	16	17	18	19	20
(3)	(1)	(2)	(4)	(4)	(2)	(3)	(4)	(2)	(1)
21	22	23	24	25					
(2)	(3)	(4)	(3)	(1)					



GLOSSARY

CHAPTER 1

APPLICATIONS OF MATRICES AND DETERMINANTS

Adjoint matrix	சேர்ப்பு அணி
Inverse matrix	நேர்மாறு அணி
Rank	தரம்
Elementary transformation	சாதாரண உருமாற்றங்கள்
Echelon form	ஏறுபடி வடிவம்
Trivial solution	வெளிப்படைத் தீர்வு
Non-trivial solution	வெளிப்படையற்ற தீர்வு
Augmented matrix	விரிவுபடுத்தப்பட்ட அணி
Consistent	முரண்பாடற்ற
Pivot	சுழற்சித்தான உறுப்பு

Upper bound	மேல் எல்லை
Lower bound	கீழ் எல்லை
Polar form	துருவ வடிவம்
Exponential form	அடுக்குக்குறி வடிவம்
Trigonometric form	முக்கோணவியல் வடிவம்
Absolute value	எண்ணளவு
Modulus	மட்டு மதிப்பு
Argument or amplitude	வீச்சு
Principal argument	முதன்மை வீச்சு
Euler's form	ஆய்லர் வடிவம்

CHAPTER 2

COMPLEX NUMBER

Complex numbers	கலப்பு எண்கள்
Imaginary unit	கற்பனை அலகு
Rectangular form	செவ்வக வடிவம்
Argand Plane	ஆர்கன்ட் தளம்
Conjugate of a complex number	ஒரு கலப்பெண்ணின் இணைக் கலப்பெண்

CHAPTER 3

THEORY OF EQUATION

Complex conjugate root theorem	இணைக்கலப்பெண் மூலத் தேற்றம்
Leading coefficient	முதன்மைக் கெழு
Leading term	முதன்மை உறுப்பு
Monic polynomial	ஒற்றை முதன்மை உறுப்பு பல்லுறுப்புக் கோவை
Non-polynomial equation	பல்லுறுப்புக் கோவையற்ற சமன்பாடு



Non real complex number	மெய்யற்ற கலப்பெண்
Quartic polynomial	நாற்படி பல்லுறுப்புக் கோவை
Radical solution	அடிப்படைத்தீர்வு
Rational root Theorem	விகிதமுறு மூலத்தேற்றம்
Reciprocal equation	தலைகீழ் சமன்பாடு
Reciprocal polynomial	தலைகீழ் பல்லுறுப்புக் கோவை
Simple root	எளிய மூலம்
Zero polynomial	பூஜ்ஜிய பல்லுறுப்புக் கோவை

CHAPTER 4

INVERSE TRIGONOMETRIC FUNCTION

Inverse trigonometric functions	நேர்மாறு முக்கோணவியல் சார்புகள்
Principal value	முதன்மை மதிப்பு
Amplitude	வீச்சு
Period	காலம்
Principal domain	முதன்மை சார்பகம்
Periodic function	காலமுறைச் சார்பு

Reciprocal inverse identities	நேர்மாறு தலைகீழி முற்றொருமைகள்
Reflection identities	மிரதிபலிப்பு முற்றொருமைகள்
Cofunction inverse identities	நேர்மாறு துணைச் சார்பு முற்றொருமைகள்

CHAPTER 5

ANALYTICAL GEOMETRY II AND FUNCTIONS

Circle	வட்டம்
Parabola	பரவளையம்
Ellipse	நீள்வட்டம்
Hyperbola	அதிபரவளையம்
Algebraic techniques	இயற்கணித நுட்பங்கள்
Geometrical problems	வடிவியல் கணக்குகள்
Astronomy	வானியல்
Conics	கூம்பு வளைவுகள்
Focus	குவியம்
Directrix	இயக்குவரை
Eccentricity	மையத்தொலைத் தகவு



Focal chord	குவி நாண்
Vertex	முனை
Latus rectum	செவ்வகலம்
Major axis	நெட்டச்சு
Minor axis	குற்றச்சு
Transverse axis	துணையச்சு
Conjugate axis	குறுக்கச்சு
Auxiliary circle	துணை வட்டம்
Incircle	உள் வட்டம்
Asymptotes	தொலைத் தொடுகோடுகள்
Degenerate forms	சிதைந்த வடிவங்கள்
Double napped cone	இரட்டைக் கூம்பு
Parametric equation	துணையலகுச் சமன்பாடுகள்
Director circle	இயக்கு வட்டம்
Elliptic orbit	நீள்வட்ட சுற்றுப்பாதை
Reflective property	பிரதிபலிப்பு பண்புகள்

CHAPTER 6

VECTOR ALGEBRA AND ITS APPLICATIONS

Box product	பெட்டிப் பெருக்கல்
Line of intersection	வெட்டுக்கோடு
Moment	திருப்புத்திறன்
Normal	செங்குத்து
Parallelepiped	இணைகரத்திண்மம்
Parameter	துணையலகு
Plane	தளம்
Rotaional force	சுழல் விசை
Skew lines	ஒரு தள அமையாக் கோடுகள்
Torque	முறுக்குத்திறன்
Triple product	முப்பெருக்கல்





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