

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) $\frac{1}{2} \begin{bmatrix} 1 & 1 & -1 \\ -3 & 1 & 1 \\ 9 & -5 & -1 \end{bmatrix}$ 4. $A^{-1} = \frac{1}{7} \begin{bmatrix} 2 & 3 \\ -1 & -5 \end{bmatrix}$
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) $x = \frac{1}{10}(7 - 5t), y = \frac{1}{10}(5t - 1), z = t, t \in \mathbb{R}$



(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) $\lambda = 5$ and $\mu \neq 9$

(ii) $\lambda \neq 5$ and $\mu \in \mathbb{R}$

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

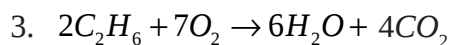
Exercise 1.7

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
 3. $11+6i$
 8. 10 10. (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. $3\text{cis}\frac{\pi}{3}, -3, 3\text{cis}\frac{5\pi}{3}$ 7. -1
 9. (i) $2\sqrt{2}e^{\frac{i\pi}{12}}$ (ii) $2\sqrt{2}e^{\frac{i5\pi}{12}}$ (iii) $2\sqrt{2}e^{\frac{i5\pi}{4}}$

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. 60
 2. (i) $x^3-6x^2+11x-6=0$ (ii) $x^3-3x+2=0$ (iii) $x^3-4x^2-4x+16=0$
 3. (i) $x^3+4x^2+12x+32=0$ (ii) $4x^3+3x^2+2x+1=0$ (ii) $x^3-2x^2+3x-4=0$



4. $2, 3, \frac{1}{3}$ 5. 10 6. $6, 4, -1$ 7. $\sum \frac{\alpha}{\beta\gamma} = \frac{2ac - b^2}{ad}$
8. $2x^2 - 3x - 20 = 0$ 11. $x^3 + x - 12 = 0$

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) $n\pi + (-1)^n \frac{\pi}{2}, n \in \mathbb{Z}$, 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. $2, 3$ 7. $\frac{1}{3}, 3, -\frac{1}{2}$ and -2

Exercise 3.6

1. It has at most four positive roots and at most three 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)	(1)	(3)	(4)	(1)	(3)	(1)	(2)



Exercise 4.1

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

Exercise 4.2

1. (i) $x = (2n+1)\frac{\pi}{2}$, $n = 0, \pm 1, \pm 2, \pm 3, \pm 4, \pm 5, -6$ (ii) $x = (2n+1)\pi$, $n = 0, \pm 1, \pm 2, -3$
2. $-\frac{\pi}{6} \notin [0, \pi]$ 3. True 4. $\frac{\pi}{3}$
5. (i) $\frac{5\pi}{6}$ (ii) $-\frac{\pi}{6}$ (iii) $\frac{24\pi}{119}$ 6. (i) $[-5, 5]$ (ii) $[-1, 1]$
7. $0 < x < \frac{1}{3}$ 8. (i) 0 (ii) $\frac{17\pi}{12}$

Exercise 4.3

1. (i) $[-3, 3]$ (ii) $\mathbb{R}$ 2. (i) $\frac{\pi}{4}$ (ii) $-\frac{\pi}{6}$
3. (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

1. (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

1. (i) $-\frac{\pi}{2}$ (ii) $-\frac{\pi}{4}$ (iii) $5 - 2\pi$
2. (i) $\sqrt{2x - x^2}$ (ii) $\frac{1}{\sqrt{9x^2 - 6x + 2}}$ (iii) $\frac{2x+1}{\sqrt{3-4x-4x^2}}$
3. (i) $\frac{\pi}{6}$ (ii) 0 (iii) $\frac{17}{6}$ 8. $\frac{\pi}{4}$
9. (i) $x = 13$ (ii) $x = \frac{a-b}{1+ab}$ (iii) $x = 2n\pi$, $x = n\pi + \frac{\pi}{4}$, $n \in \mathbb{Z}$
- (iv) $x = \sqrt{3}$
10. 3

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

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

Exercise 5.2

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

	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	$(-3,4)$	$(-18,4), (12,4)$	$(-20,4), (14,4)$	$x = \frac{174}{17},$ $x = \frac{-276}{17}$
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. $4x - 3y - 6 = 0, 3x + 4y - 42 = 0$

Exercise 5.5

1. 8.4 m 2. 26.6 m 3. 3 m
 4. $y^2 = 4.8x, 1.3m$ 5. 3.52m, 5.08m 6. 90.82m, 148.91m
 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. $\left(\vec{r} - (4\hat{i} + 3\hat{j} - 7\hat{k})\right) \times (2\hat{i} - 6\hat{j} + 7\hat{k}) = \vec{0}, \frac{x-4}{2} = \frac{y-3}{-6} = \frac{z+7}{7}$
 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. $\left(\frac{32}{3}, 0, \frac{47}{3}\right), (0, 16, -11)$



4. $\left(\frac{2}{7}, \frac{3}{7}, \frac{6}{7}\right), \vec{r} = (5\hat{i} + 6\hat{j} + 7\hat{k}) + t(2\hat{i} + 3\hat{j} + 6\hat{k})$ 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° (ii) $\frac{\pi}{6}$ (iii) $\frac{\pi}{2}$ 6. $\frac{\pi}{2}$ 7. $a=18, b=\frac{2}{3}$ 8. 1

Exercise 6.5

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

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

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

4. (6, 2, 1)

5. 2 units

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

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

Exercise 6.6

1. $\vec{r} \cdot \left(\frac{3\hat{i} - 4\hat{j} + 5\hat{k}}{5\sqrt{2}}\right) = 7$ 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-intercept = 2, y-intercept = 3, z-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. $\vec{r} = (2\hat{i} + 2\hat{j} + \hat{k}) + s(-\hat{i} - 4\hat{j} + 2\hat{k}) + t(3\hat{i} - 4\hat{j} + 5\hat{k}), s, t \in \mathbb{R};$

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

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

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

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

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

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. $(2, 2, 0), \sin^{-1}\left(\frac{2}{3\sqrt{6}}\right)$

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

Exercise 6.10

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