Answers

Exercise 17.1

1. (i) $A=\{-2,-1,0,1,2\}$ (ii) $B=\{4,6,8,9,10\}$

(iii) $C=\{7,11,13\}$ (iv) $D=\{9,11,13,15\}$

(v) $E=\{-11,11\}$ (vi) $F=\{\ \}$ or $\varnothing$

2. (i) $A=\{x \mid x\in\mathbb{Q}\wedge 5<x<6\}$ (ii) $B=\{x \mid x \text{ is positive divisor of } 12\}$

(iii) $C=\{x \mid x\in\mathbb{Z}\wedge -40\le x\le 40\}$ (iv) $D=\{x \mid x\in\mathbb{E}\wedge -4\le x\le 4\}$

(v) $E=\{x \mid x \text{ is the square of first five natural numbers}\}$

(vi) $F=\{x \mid x \text{ is negative odd integer}\}$

3. (i) $A=\{x \mid x\in\mathbb{W}\wedge x<0\}$ (ii) A = set of boys students in girls college

(iii) $A=\{x \mid x\in\mathbb{N}\wedge 2x+1=2\}$ (iv) $A=\{x \mid x\in\mathbb{R}\wedge x^2=-1\}$

(v) A = set of women president of pakistan

4. i. Finite ii. Finite iii. Infinite iv. Finite v. Infinite

5. (i) Three proper subsets are: $\{a,i\},\{e,u\}$ and $\{i,o\}$

Improper subset is $\{a,e,i,o,u\}$, Equivalent set is $\{1,2,3,4,5\}$

(ii) Three proper subsets are: $\{-1,0\},\{+1,+2\}$ and $\{0,+2\}$

Improper subset is $\{-2,-1,0,1,2\}$, Equivalent set is $\{a,b,c,d,e\}$

6. $\{x \mid x\in\mathbb{N}\wedge x^2=16\}$ and $\{x \mid x\in\mathbb{Z}\wedge -1<x<1\}$

7. (i) $P(A)=\{\varnothing,\{5\},\{10\},\{15\},\{5,10\},\{5,15\},\{10,15\},\{5,10,15\}\}$

(ii) $P(B)=\{\varnothing,\{0\},\{1\},\{2\},\{3\},\{0,1\},\{0,2\},\{0,3\},\{1,2\},\{1,3\},\{2,3\},\{0,1,2\},\{0,2,3\},\{0,1,3\},\{1,2,3\},\{0,1,2,3\}\}$

8. i. Not possible ii. Singleton set iii. Null set

Exercise 17.2

1. i. Disjoint sets ii. Overlapping sets iii. Cells

iv. Exhaustive sets v. Cells

2. i. $\{1,2,3,4,5,6,8,10\}$ ii. $\{2,4,6\}$ iii. $\{1,3,5\}$

iv. $\{8,10\}$ v. $\{1,3,5,8,10\}$

3. i. $\{6,7,8,9,10\}$ ii. $\{2,4,6,8,10\}$

iii. $\{2,4,6,7,8,9,10\}$ iv. $\{6,8,10\}$

v. $\{6,8,10\}$ vi. $\{2,4,6,7,8,9,10\}$

vii. $\{2,4,7,9\}$ viii. $\{1,3,5,6,8,10\}$

ix. $\{1,3,5\}$ x. $\{6,8,10\}$

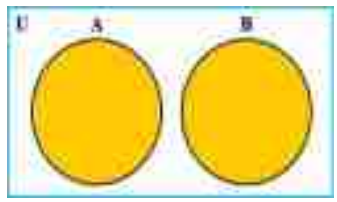
5. i. $\{6n \mid n \in \mathbb{N}\}$ ii. $\{2n \mid n \in \mathbb{N}\}$ iii. $\{12n \mid n \in \mathbb{N}\}$ iv. $\{4n \mid n \in \mathbb{N}\}$

6. i. A_3 ii. A_{11} iii. ϕ iv. $\{8\}$

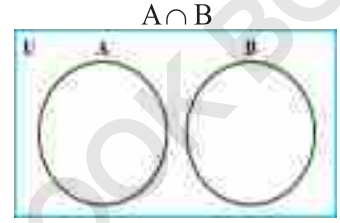
Exercise 17.4

(i)

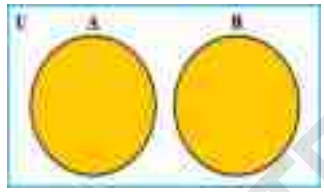
$A \cup B$



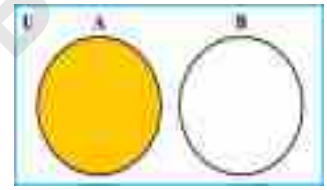
$A \cap B$



$A \Delta B$

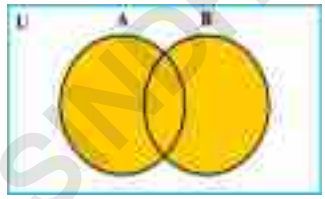


$A - B$

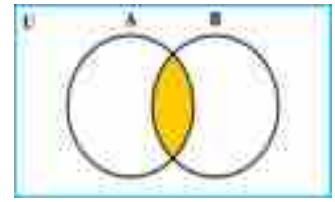


(ii)

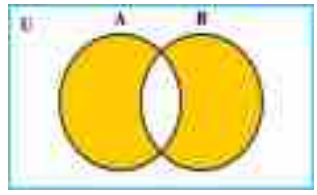
$A \cup B$



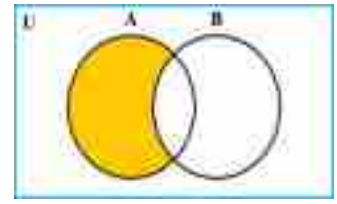
$A \cap B$



$A \Delta B$

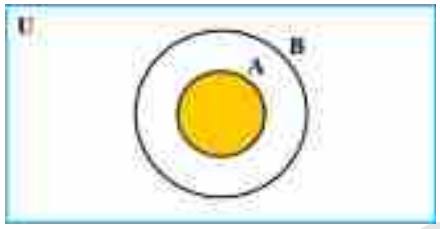


$A - B$



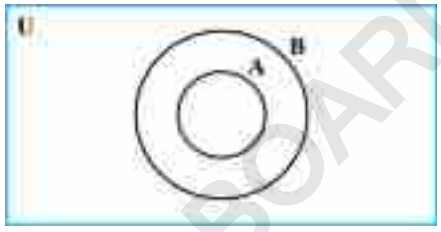
(iii) $A \cup B$

$A \cap B$



$A \Delta B$

$A - B$



Exercise 17.5

1. i. $x = 16$ and $y = 17$ ii. $x = 1$ and $y = 2$ iii. $x = 3$ and $y = 1$

2. $n(P \times Q) = 150$, $n(Q \times P) = 150$, $n(P \times P) = 100$ and n (Q x Q) = 225

3.

(i) $\{(1,2),(1,3),(2,2),(2,3)\}$

(ii) $\{(2,1),(2,3),(2,5),(3,1),(3,3),(3,5)\}$

(iii) $\{(1,1),(1,2),(1,3),(1,5)(2,1),(2,2),(2,3),(2,5)\}$

(iv) $\{(2,1),(2,2),(2,3),(2,5)(3,1),(3,2),(3,3),(3,5)\}$

(v) $\{(2,3)\}$

4.

(i) $R_1 = \{(5,2),(5,3)\}, R_2 = \{(5,1),(6,3)\}, R_3 = \{(6,2)\}$

(ii) $R_1 = \{(2,5)\}, R_2 = \{(3,5)\}, R_3 = \{(2,5),(3,5)\}, R_4 = \{(3,5),(1,5),(3,6)\}$

(iii) $R_1 = \varnothing, R_2 = \{(1,1),(1,2)\}, R_3 = \{(2,1),(2,3)\}, R_4 = \{(1,2),(2,2),(3,3)\},$
$R_5 = \{(1,1),(2,2),(3,3)\}$

(iv) $R_1 = \varnothing, R_2 = \{(5,5)\}, R_3 = \{(5,6)\}, R_4 = \{(6,5)\}, R_5 = \{(6,6)\},$
$R_6 = \{(5,5),(5,6)\}, R_7 = \{(5,5),(6,5)\}, R_8 = \{(5,5),(6,6)\},$
$R_9 = \{(5,6),(6,5)\}, R_{10} = \{(5,6),(6,6)\}, R_{11} = \{(6,5),(6,6)\},$
$R_{12} = \{(5,5),(5,6),(6,5)\}, R_{13} = \{(5,5),(6,5),(6,6)\},$
$R_{14} = \{(5,5),(5,6),(6,6)\}, R_{15} = \{(5,6),(6,5),(6,6)\},$
$R_{16} = \{(5,5),(5,6),(6,5),(6,6)\},$

5. Number of binary relation are 2^{12}.

6. (i) $R_1 = \{(0,2),(0,4),(1,2),(1,4),(2,2),(2,4),(3,2),(3,4)\}$

(ii) $R_2 = \{(1,8),(3,6)\}$ (iii) $R_3 = \{(3,2)\}$ (iv) $R_4 = \{(1,6),(3,2)\}$

7. i. Range $= \{1,3,5,7,9\}$ ii. Domain $= \{3,4,5,6\}$

8. i. Domain $= \{0,1,2,3\}$
Range $= \{2,5,8,11\}$

ii. Domain $= \{6,7,8,9,...\}$
Range $= \{0.1,2,3,4,...\}$

9. Dom f $= \{1,2,3,4\}$
Range f $= \{5,6,7,8\}$
Co-domain f $= N$
$f(2) = 6, f(4) = 8$

10. i. Not a function ii. Not a function
iii. Into function iv. Into function
v. Both one-one and onto

11. i. One-one function ii. One-one correspondence
iii. Neither one-one nor one-one correspondence

12. i. $f = \{(a,x),(b,y),(c,y)\}$ ii. $g = \{(p,a),(q,b),(r,c),(s,a)\}$
iii. $h = \{(a\ q)\ (b\ r)\ (c\ s)\}$ iv. $k = \{(x,a),(y,c),(z,b)\}$

REVIEW EXERCISE 17

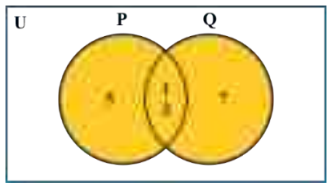
1. Multiple Choice Question MCQs.

i.	d	ii.	b	iii.	c	iv.	c	v.	d
vi.	c	vii.	b	viii.	c	ix.	a	x.	b
xi.	a	xii.	a	xiii.	d	xiv.	c	xv.	c
xvi.	b	xvii.	c	xviii.	d	xix.	c	xx.	b

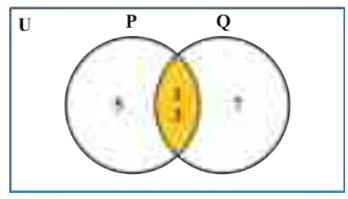
2. (a) $\{1,2,4,5,6\}$ (b) $\{2\}$ (c) $\{1,4,5,6\}$
(d) $\{1,5\}$ (e) $\{3,4,6\}$ (f) $\{1,3,5\}$

5.

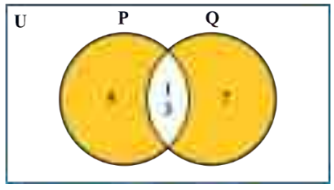
$P \cup Q$



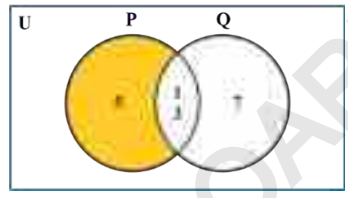
$P \cap Q$



$P \Delta Q$



$P - Q$



6. (a) $R_1 = \{(a,a),(a,c)\}, R_2 = \{(c,a),(c,c)\}$

(b) $R_1 = \{(b,b),(b,d)\}, R_2 = \{(d,b),(d,d)\}$

(c) $R_1 = \{(a,b)\}, R_2 = \{(a,d),(c,b)\}, R_3 = \{(c,b),(c,d)\}$

(d) $R_1 = \{(a,c),(b,d)\}, R_2 = \{(c,c),(d,c)\}$

7. (*a*) $f_1 = \{(1,6),(2,8),(5,6)\}$ (*b*) $f_2 = \{(1,6),(2,6),(5,6)\}$

Exercise 18.1

1. i. 5:2 ii. 3:5 iii. 2:9 iv. 1:10 v. 3:8 vi. 35:52

2. i. 5:3 ii. 3:5 iii. 3:8 iv. 5:8

3. 6:17 **4.** $a = 8$ **5.** The required number is 6.

6. $\frac{47}{81}$

7. i. $x = 45$ ii. $x = \frac{7}{6}$ iii. $x = 38$ iv. $x = a^2 - b^2$ v. $x = 4$

Exercise 18.2

1. (i) $y = \frac{10}{3}x$ (ii) $y = 20$ (iii) $x = \frac{9}{2}$

2. (i) $V = \frac{5}{8}T$ (ii) $V = \frac{75}{4}$ (iii) $T = 16$ **3.** $U = 6$ when $V = 216$
$V = 125$ when $U = 5$

4. $F = 375$ **5.** $y = 3$ when $x = 10$ **6.** $P = 81$ when $V = 4$

7. i. $F = \frac{32}{25}$ when $r = 5$ ii. $r = \frac{2}{\sqrt{3}}$ when $F = 24$

8. $x = \frac{1}{8}$ **9.** $d = \frac{1}{2}$ **10.** $y = \frac{18}{5}$

Exercise 18.3

1. (i) 18 (ii) $(a-b)^2$ (iii) $\frac{(x+y)^2}{x^2-xy+y^2}$ (iv) $a+b$

2. (i) 1 (ii) $(a-b)$ (iii) $2a^2$ (iv) a^2+ab+b^2

3. (i) 12 (ii) $10a^2b^2$ (iii) a^2-b^2 (iv) $a-b$

4. (i) 15 (ii) 12 (iii) 8 (iv) 31

Exercise 18.4

3. (i) $\{3,9\}$ (ii) $\{\ \}$ (iii) $\left\{\frac{101}{4}\right\}$ (iv) $\{\frac{8}{3}\}$

Exercise 18.5

1. $y = \frac{x^2z}{24}$, $y = 32$ **2.** $y = \frac{6xu^2}{5vt}$, $y = \frac{64}{5}$ **3.** $w = 360$

4. 3.21 sec **5.** 177.8 cubic units

Exercise 18.7

1. 3.068amp **2.** 0.01125 foot candles **3.** 900 pound **4.** 360000 rupees
5. Rs. 5600

REVIEW EXERCISE 18

1. Multiple Choice Question MCQs.

i.	d	ii.	b	iii.	b	iv.	b	v.	b
vi.	c	vii.	c	viii.	d	ix.	a	x.	d
xi.	a	xii.	c	xiii.	a	xiv.	a	xv.	c

2. (i) $20m : 1m$ (ii) $500g : 3g$

3. (i) $x = 4$ (ii) $x = 14$ **4.** $y = 48$ **5.** $y = \frac{25}{2}$

7. $x = \frac{7 \pm i\sqrt{15}}{2}$ **8.** $x = 10$ **9.** 3.33 Amp

Exercise 19.1

1. (i) Square matrix (ii) Column matrix
(iii) Row matrix
(iv) Scalar matrix (v) Diagonal matrix

2. i. 3×3 ii. 3×2 iii. 2×3 iv. 3×1 v. 1×1

3. (i) Symmetric matrix (ii) Skew symmetric matrix
(iii) Symmetric matrix (iv) Symmetric matrix

4. (i) $\begin{bmatrix} 3 & 2 \\ -1 & 3 \end{bmatrix}$ (ii) Not possible (iii) Not possible (iv) $\begin{bmatrix} 7 & -5 \\ 2 & 3 \end{bmatrix}$

(v) $\begin{bmatrix} 0 & -4 \\ 2 & -2 \end{bmatrix}$ (vi) $\begin{bmatrix} 1 & -2 \\ 0 & 1 \end{bmatrix}$ (vii) $\begin{bmatrix} 3 & -2 \\ 2 & -1 \end{bmatrix}$ (viii) $\begin{bmatrix} 2 & 4 & 2 \\ 0 & 2 & 5 \\ 3 & 3 & 3 \end{bmatrix}$

5. (i) $\begin{bmatrix} 3 & 2 & 4 \\ 0 & 5 & 1 \\ 6 & 4 & 0 \end{bmatrix}$ (ii) $\begin{bmatrix} -5 & -2 & -2 \\ 4 & -3 & -1 \\ 0 & 0 & -2 \end{bmatrix}$ (iii) $\begin{bmatrix} 5 & 4 & 9 \\ 2 & 11 & 2 \\ 15 & 10 & -1 \end{bmatrix}$

(iv) $\begin{bmatrix} -1 & 0 & -2 \\ 6 & 8 & 7 \\ 5 & 12 & 10 \end{bmatrix}$ (v) $\begin{bmatrix} 9 & 8 & 1 \\ 13 & 6 & -3 \\ 4 & 4 & 2 \end{bmatrix}$ (vi) $\begin{bmatrix} 4 & 2 & -2 \\ 0 & 1 & 2 \\ -2 & 0 & 4 \end{bmatrix}$

8. $\begin{bmatrix} -8 & 3 \\ 27 & -36 \end{bmatrix}$ **9.** $a=-2, b=1, c=-1$ and $d=1$

10. $a=-1, b=2, c=3, d=2, x=3, y=3$ and $z=2$

11. $AB=\begin{bmatrix} 0 & 1 & 2 \\ 7 & 3 & -1 \end{bmatrix}, BC=\begin{bmatrix} -1 & -2 & 0 \\ -3 & -2 & 0 \end{bmatrix}$ **12.** $\begin{bmatrix} 11 & 8 & 0 \\ 11 & 11 & 2 \\ 8 & 13 & 6 \end{bmatrix}$

Exercise 19.2

1. i. 29 ii. 9 iii. 7 iv. 8 v. −59 vi. −105
vii. −84 viii. 184 ix. −42 x. 0 xi. $2x$

2. i. 1 ii. 3 iii. 3 iv. −1 v. 3 vi. −3

3. (i) $x = 3$ **4.** (i) Singular (ii) Non Singular

5. (i) $\begin{pmatrix} 7 & -6 \\ -4 & 1 \end{pmatrix}$ (ii) $\begin{pmatrix} -8 & 18 & -4 \\ -5 & 12 & -1 \\ 4 & -6 & 2 \end{pmatrix}$ (iii) $\begin{pmatrix} 12 & 12 & 12 \\ -18 & 0 & 0 \\ 6 & 6 & 12 \end{pmatrix}$

7. (i) $\begin{pmatrix} -1 & -2 \\ 2 & 3 \end{pmatrix}$ (ii) Does not exist (iii) $\begin{pmatrix} 3 & -1 & -1 \\ -4 & 2 & 1 \\ -1 & 0 & 1 \end{pmatrix}$

(iv) $\begin{pmatrix} -1 & -2 & -1 \\ -2 & -5 & -3 \\ 2 & 2 & 1 \end{pmatrix}$ (v) $\begin{pmatrix} 1 & -1 & -1 \\ -1.2 & 1.4 & 0.8 \\ -0.4 & 0.8 & 0.6 \end{pmatrix}$

8. (i) $\{(-5, 8)\}$ (ii) $\{(-\frac{3}{2}, \frac{9}{4})\}$

REVIEW EXERCISE 19

2. Multiple Choice Question MCQs.

i.	c	ii.	c	iii.	d	iv.	b	v.	d
vi.	a	vii.	c	viii.	b	ix.	a	x.	b

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

5. (i) $\begin{bmatrix} 3 & 13 & 17 \\ 3 & 4 & 4 \\ 5 & 3 & 11 \end{bmatrix}$ (ii) $\begin{bmatrix} -1 & 3 & 1 \\ 1 & -2 & -4 \\ -9 & -1 & 3 \end{bmatrix}$ (iii) $\begin{bmatrix} 73 & 47 & 76 \\ 5 & 13 & 20 \\ 46 & 9 & 16 \end{bmatrix}$

(iv) $\begin{bmatrix} -4 & 29 & 74 \\ -1 & 15 & 37 \\ 3 & 62 & 91 \end{bmatrix}$ (v) $\begin{bmatrix} 5 & 40 & 45 \\ 10 & 5 & 0 \\ -10 & 5 & 35 \end{bmatrix}$ (vi) $\begin{bmatrix} 14 & 35 & 56 \\ 7 & 21 & 28 \\ 49 & 14 & 28 \end{bmatrix}$

(vii) $\begin{bmatrix} -10 & 19 & 0 \\ 7 & -19 & -36 \\ -79 & -10 & 20 \end{bmatrix}$

6. 368

8. $\begin{bmatrix} \frac{-9}{47} & \frac{8}{47} & \frac{18}{47} \\ \frac{21}{94} & \frac{-3}{94} & \frac{5}{94} \\ \frac{7}{47} & \frac{-1}{47} & \frac{-14}{47} \end{bmatrix}$

9. $\{(1,5)\}$

Exercise 20.1

1.
(i) Roots are real, rational and unequal
(ii) Roots are real, rational and unequal
(iii) Roots are complex and conjugate of each other
(iv) Roots are real, rational and equal
(v) Roots are complex and conjugate of each other
(vi) Roots are complex and conjugate of each other
(vii) Roots are complex and conjugate of each other
(viii) Roots are imaginary and conjugate of each other

2. (i) (a) $k = \frac{9}{4}$ and (b) $k < \frac{9}{4}$ (ii) (a) $k = 4$ and (b) $k < 4$
(iii) (a) $k = \pm 2\sqrt{2}$ (b) $k > 2\sqrt{2}$ and $k < -2\sqrt{2}$ (iv) (a) $k = 3$ and (b) $k < 3, k \neq 1$
(v) (a) $k = \pm 4$ (b) $k > 4$ and $k < -4$
(vi) (a) $k = \pm 24$ (b) $k > 24$ and $k < -24$
(vii) (a) $k = 0$ (b) $k > 0$ and $k < 0, k \neq 2$
(viii) (a) $k = \pm 2$ (b) $k > 2$ and $k < -2$

3. (i) $m = 3, -2$ (ii) $m = \pm 24$

6. $p = 2$ and $q = \frac{-5}{3}$

Exercise 20.2

1. (i) $4, 4\omega$ and $4\omega^2$ (ii) $-5, -5\omega$ and $-5\omega^2$ (iii) $6, 6\omega$ and $6\omega^2$
(iv) $-b, -b\omega, -b\omega^2$

2. (i) ω (ii) 4 (iii) 729 (iv) -16

Exercise 20.3

1. (i) S.O.R $= 1$ and P.O.R $= -1$ (ii) S.O.R $= \frac{3}{2}$ and P.O.R $= -2$
(iii) S.O.R $= a$ and P.O.R $= \frac{-3a^2}{4}$ (iv) S.O.R $= \frac{5k}{7}$ and P.O.R $= k$

2. (i) $m = \frac{2}{3}$ (ii) $m = \frac{1}{8}$

3. (i) $p = \pm 5$ (ii) $p = 0, 1$

4. (i) $m = 3$ (ii) $m = 13$

5. (i) $k=-4$ (ii) $k=-\frac{10}{7}$

6. (i) $p=\frac{3}{2}$ (ii) $p=1$

Exercise 20.4

1. (i) $(\alpha+\beta)^2-4\alpha\beta$ (ii) $(\alpha+\beta)^3-3\alpha\beta(\alpha+\beta)$

(iii) $\frac{(\alpha+\beta)^3-3\alpha\beta(\alpha+\beta)}{\alpha\beta}$ (iv) $\alpha\beta\left[(\alpha+\beta)^2-2\alpha\beta\right]$

(v) $\frac{(\alpha+\beta)^3-3\alpha\beta(\alpha+\beta)}{(\alpha\beta)^3}$ (vi) $\frac{(\alpha+\beta)^2-4\alpha\beta}{(\alpha\beta)^2}$

2. (i) $\frac{9}{49}$ (ii) $-\frac{99}{98}$ (iii) $\frac{3a+4}{7a^2+3a+2}$ **3.** $-\sqrt{\frac{q}{p}}$

4. $\alpha+\beta$ represents a straight line and $\alpha\beta$ represents a hyperbola.

Exercise 20.5

1. (i) $x^2+5x+6=0$ (ii) $x^2+x+1=0$

(iii) $x^2-4x+5=0$ (iv) $x^2-8=0$

2. (i) $3x^2-9x+8=0$ (ii) $36x^2-33x+1=0$

(iii) $x^2-3x+6=0$ (iv) $2x^2-x+1=0$

(v) $2x^2-7x+3=0$ (vi) $x^2+3x+6=0$

3. $rx^2-qx+p=0$ **4.** $x^2-2px+4q=0$

5. $px^2-(4p-q)x+(4p-2q+r)=0$

6. (i) $3b^2=16ac$ (ii) $b^3+ac(a+c)=3abc$

(iii) $b=0$ (iv) $a=c$

Exercise 20.6

1. (i) Remaining two roots are -1 and $\frac{1}{2}$ (ii) Remaining two roots are -1 and 2

(iii) Remaining two roots are 6 and -4

2. (i) Remaining two roots are $\frac{1}{3}$ and $\frac{1}{2}$ (ii) Remaining two roots are $\sqrt{5}i$ and $-\sqrt{5}i$

(iii) Remaining two roots are -1 and 2

3. $m=\frac{7}{3}$ and remaining two roots are $\frac{3}{2}$ and -1

4. $a=2$ and remaining two roots are 6 and -1

5. $a=49$ and $b=36$ and remaining two roots are 7 and -3

Exercise 20.7

1. $\left\{(1,-1),\left(\frac{7}{5},-\frac{1}{5}\right)\right\}$

2. $\left\{(2,0),\left(\frac{8}{5},\frac{4}{5}\right)\right\}$

3. $\left\{(4,3),\left(\frac{25}{8},-\frac{25}{6}\right)\right\}$

4. $\{(-3,0),(1,2)\}$

5. $\{(\pm 3,\pm 4),(0,5),(-5,0)\}$

6. $\left\{(\pm 2\sqrt{2},\pm 2\sqrt{2}),\left(\frac{\pm 4\sqrt{5}}{5},\frac{\pm 8\sqrt{5}}{5}\right)\right\}$

7. $\{(1,2),(2,1),(-1,-2),(-2,-1)\}$

8. $\left\{\left(2,\frac{1}{2}\right),\left(-2,-\frac{1}{2}\right)\right\}$

9. $\left\{\left(\frac{4}{5},20\right),\left(\frac{1}{5},5\right)\right\}$

10. 7 and 5 or 5 and 7

11. length = $9m$ and width = $4m$

12. 6 and 8

13. 9cm and 12cm when hypotenuse is 15cm.

14. 13cm, 13cm and 10cm

15. 30 and 25

REVIEW EXERCISE 20

1. Multiple Choice Question MCQs.

i.	d	ii.	c	iii.	c	iv.	c	v.	c
vi.	b	vii.	a	viii.	b	ix.	c	x.	c

2. (i) Real, rational and unequal (ii) Real, rational and equal
(iii) Complex, unequal and conjugate of each others (iv) Complex, unequal and conjugate of each other

3. (i) $k=\pm 4$ (ii) $k<4$ or $k>-4$
(iii) $k>4$ or $k<-4$ (iv) $k=\pm 4$ or ± 5 and other values also which make it perfect square.

4. $9, 9\omega, 9\omega^2$

5. (i) S.O.R = 7 and P.O.R = 29 (ii) S.O.R = p and P.O.R = q
(iii) S.O.R = $\frac{7}{5}$ and P.O.R = $\frac{8}{5}$ (iv) S.O.R = $\frac{11}{9}$ and P.O.R = $-\frac{28}{9}$

7. $x^2-2x-2=0$

8. $16x^2-10x+1=0$

9. (i) {(2,3),(3,2)} (ii) {(1,6),(-1,-6),(6,1),(-6,-1)}

Exercise 21.1

1. $\frac{2}{x-3}-\frac{2}{x+3}$

2. $\frac{5}{x+1}-\frac{1}{x-3}$

3. $\frac{3}{x}+\frac{2}{x-2}-\frac{4}{x-1}$

4. $\frac{7}{x+4}-\frac{3}{x+1}-\frac{2}{2x-1}$

5. $1+\frac{2}{x+3}+\frac{6}{x-2}$

6. $1-\frac{2}{x-3}+\frac{3}{x+1}$

7. $3x-2+\frac{1}{x-2}-\frac{5}{x+2}$

Exercise 21.2

1. $\frac{4}{x+1}-\frac{7}{(x+1)^2}$
2. $\frac{1}{x^2}+\frac{2}{x}-\frac{1}{x+3}$
3. $\frac{5}{x-2}-\frac{10}{(x-2)^2}+\frac{4}{(x-2)^3}$
4. $\frac{2}{x-5}-\frac{3}{x+2}+\frac{4}{(x+2)^2}$
5. $\frac{1}{x-1}+\frac{1}{(x-1)^2}+\frac{3}{(x-1)^3}$

Exercise 21.3

1. $\frac{2x+3}{x^2+7}-\frac{1}{x-2}$
2. $\frac{x+5}{x^2+10}-\frac{1}{x+1}$
3. $\frac{1}{x}+\frac{3}{x^2}+\frac{2-5x}{x^2+5}$
4. $\frac{1}{x+1}+\frac{2x-2}{x^2-x+3}$
5. $\frac{1}{x+1}-\frac{1}{x^2+3}$

Exercise 21.4

1. $\frac{1}{4(1-x)}+\frac{(x+1)}{4(x^2+1)}-\frac{(x+1)}{2(x^2+1)^2}$
2. $\frac{1}{9x}+\frac{2}{9x^2}-\frac{(x+2)}{9(x^2+3)}-\frac{(x-1)}{3(x^2+3)^2}$
3. $\frac{1}{4(1+x)}+\frac{(1-x)}{4(x^2+1)}+\frac{x-1}{2(x^2+1)^2}$
4. $\frac{7}{9(x+1)}+\frac{7(1-x)}{9(x^2+2)}+\frac{7(1-x)}{3(x^2+2)^2}$
5. $\frac{1}{x-2}-\frac{x+2}{3+x^2}-\frac{7(x+2)}{8(3+x^2)^2}$

REVIEW EXERCISE 21

1. Multiple Choice Question (MCQs.)

i. d ii. b iii. d iv. b v. a

3. (i) $\frac{13}{3(x-1)}+\frac{2}{3(x+2)}$ (ii) $\frac{-7}{10x}+\frac{33}{14(x+2)}+\frac{257}{35(x-5)}$

(iii) $\frac{11}{5(x-2)}-\frac{6x+2}{x^2+1}$ (iv) $1+\frac{16}{x+1}-\frac{10x+8}{x^2+x+1}$

(v) $\frac{4}{5(x-3)}+\frac{-4x-7}{5(x^2+1)}$ (vi) $\frac{11}{9(x-1)}-\frac{11}{9(x-2)}+\frac{10}{3(x-1)^2}$

Exercise 22.3

1. (a). A.M. = 11.889, H.M. = 11.194, Median = 12, Mode = 12.
   (b). A.M. = 0, G.M. = 0, Median = 0, Non-modal.
   (c). A.M. = 13.044, G.M. = 12.837, H.M. = 11.727, Median = 12.3.
   (d). A.M. = 56.5, G.M. = 56.339, H.M. = 56.180, Median = 56, Mode = 52.
   (e). Mode = AB^+. (f). Non-modal,
   (g). A.M. = B+, Median = B+, Mode = B+.
2. A.M. = 172.1, G.M. = 169.551, H.M. = 166.615, Median = 184.5, Mode = 190.
3. A.M. = Like dogs, Median = Like dogs, Mode = Love dogs.
4. COVID.

5. A.M.=7.149, G.M.=7.106, H.M.=7.061, Median=7, Q_1= 6.5, Q_3 = 7.5, Mode = 7.
6. A.M.=32.5, G.M.=32.303, H.M.=32.102, Median=32, Q_1=30, Q_3 = 34, Mode = 32.
7. A.M. = Rs. 9640.
8. A.M. = 36.464, G.M. = 36.087, H.M. = 35.700, Median = 36.643, Mode = 36.929.
9. A.M.=11.9179, G.M.=11.9039, H.M.=11.8897, Median=11.9708, Mode = 12.117.

Exercise 22.4

1. (c). –6, (d). 458.125.
2. X is asymmetric. Y is symmetric.
3. $(A.M.)_W$ = 330, $(G.M.)_W$ = 310.902, $(H.M.)_W$ = 295.806.
4. $(A.M.)_W$ = 23.852Kg, $(G.M.)_W$ = 23.850Kg, $(H.M.)_W$ = 23.848Kg.

Exercise 22.5

1. Range = 7, Var. = 4.490, S.D. = 2.119, M.D. = 1.673.
2. Batsman-A: Range = 185, M.D. = 45.111, Var. = 3699.222, S.D. = 60.821.
   Batsman-B: Range = 72, M.D. = 21.111, Var. = 601.555, S.D. = 24.527
   Batsman-B is more consistent scorer than Batsman-A.
3. Relative S.D. (Income) = 0.488, Relative S.D. (Expenditure) = 0.4945.
   Variation in income is smaller than that is expenditure.
4. Team-A: Relative S.D. = 1.012, Relative M.D. = 0.528 (approximately).
   Team-B: Relative S.D. = 0.866, Relative M.D. = 0.5 (approximately).
   Team-B is more consistent than Team-A.
5. Range = 2.1, Var. = 0.196, S.D. = 0.443, M.D. = 0.343 (approximately).

REVIEW EXERCISE 22

1. Tick the correct option.

i. (c) ii. (c) iii. (b) iv. (a) v. (a) vi. (a) vii. (b) viii. (c) ix. (c) x. (d).

Exercise 23.1

2. (i) $x = 25$ (ii) $x = 12$ (iii) $x = 2$ (iv) $x = 15$
3. $\sqrt{34}$ 4. 12 5. 10 6. 6
7. $a = 2\sqrt{15}$ units, $b = 2\sqrt{21}$ units, $h = \sqrt{35}$ units 8. $10\sqrt{34}m$ 9. $4\sqrt{3}$ 10. 12
11. 30 12. length = 12cm and breadth = 5cm

REVIEW EXERCISE 23

1. Multiple Choice Questions (MCQs.)

i. (c) ii. (a) iii. (b) iv. (b) v. (a)
vi. (d) vii. (c)

3. $2\sqrt{119}m$ 4. (i) $\sqrt{13}$ (ii) $\sqrt{51}$ (iii) $\sqrt{63}$
2. 24

Exercise 24.1

1. $m\overline{CE} = 10cm$ 2. $x = 1$

Exercise 24.2

1. $x = 1$; equilateral triangle 2. $x = 2$ and $y = 4$ 3. $A_2 = 7cm^2$ 4. $x = 11$

REVIEW EXERCISE 24

1. Multiple Choice Question MCQs.

i.	d	ii.	d	iii.	c	iv.	b	v.	a	vi.	b
vii.	c	viii.	c	ix.	d	x.	b	xi.	a	xii.	b

Exercise 25.1

1. No, because right bisectors between all pair of three collinear points will never intersect at the same point.
2. Yes, it is possible only when the quadrilateral formed by joining the four points is cyclic, i.e. the sum of the opposite angles of the quadrilateral is 180°. But, in general, for any four non-collinear points, it is not possible to draw a circle passing through them.
3. Hint. See Examples 1-2.
4. Hint. See Examples 1-2.
5. The desired location of mosque is at the centre of circle joining the villages A, B and C, as shown in the figure. The equal distance the villagers will travel to reach mosque is 5 km.

Exercise 25.2

1. Hint. Diameters are chords passing through the centre . See theorems 25.2- 25.3.
2. Refer theorems 25.2 and 25.3.
3. $C = 10\pi\ cm$ and $A = 25\pi\ cm$.
4. See Examples 1-2 for details and figure. (a) $2\sqrt{65}cm$ (b) $6\sqrt{3}cm$.
5. See Example 1-2 for details and figure. $r = \sqrt{34}cm$.

Exercise 25.3

1. Refer theorems 25.4 and 25.5.
2. Refer theorems 25.4 and 25.5.
3. (a). $\sqrt{95}cm$ (b). $\sqrt{39}cm$ (c). $2\sqrt{15}cm$ (d). $2\sqrt{77}cm$
4. (a). 7cm (b). 27.594 cm
5. (a). $2\sqrt{5}$ (b). 6 (c). 5 (d). 10.8 (e). $2\sqrt{51}$ (f). 6

REVIEW EXERCISE 25

1. Tick the correct option.

i. (b) ii. (c) iii. (c) iv. (b) v. (b) vi. (a) vii. (a) viii. (b) ix. (a)

Exercise 26.1

1. Hint. See proof in Example 1.
2. Hint. See proof in Example 1.
3. $\frac{5\sqrt{3}}{2}\ cm$ and $5\sqrt{3}cm$.d = 6cm, C = 18.8495cm (approximately) and A = 28.2743cm^2.
4. 24cm.
5. $\sqrt{109}cm$.

Exercise 26.2

1. Hint. Refer theorem 26.3 and corollaries.
2. Hint. The statement to prove is a converse of theorem and proof in Example-1.
3. Refer theorem 26.3.
4. (a). 6, (b). $2\sqrt{66}$, (c). 7, (d). 11, (e). $\frac{55}{7}$, (f). 14.22 (approximately), (g). 4.3, (h). 18.8714 (approximately).
5. (a). 6, (b). 4, (c). 6, (d). 1.1547 (approximately), (e). 5, (f). 13.

Exercise 26.3

1. Hint. The statement to prove is a converse of theorem 26.4 Case (A).
2. Hint. The statement to prove is a converse of theorem in Example 1.
3. 6cm and 37.7cm (approximately).
4. (a). 70^0 (b). 50^0
5. Hint. Refer theorem 26.4 Case (A).
6. 4cm
7. 8.5cm

REVIEW EXERCISE 26

1. Tick the correct option.

i. (b) ii. (c) iii. (b) iv. (c) v. (b) vi. (b) vii. (a) viii. (d) ix. (a) x. (b) xi. (d)

Exercise 27.1

3. $x = 20$ and $y = 10$ **4.** 114° and 92° **5.** 30° and 65° **6.** 120°

REVIEW EXERCISE 27

1. Multiple Choice Question MCQs.

i. b ii. c iii. c iv. b v. b vi. c vii. a viii. d ix. a

Exercise 28.1

1. 60° **2.** 70° **3.** 120°

Exercise 28.2

1. 18° **2.** $x < 46°$ **3.** $x > 13°$

REVIEW EXERCISE 28

1. Multiple Choice Question MCQs.

i.	(a)	ii.	(b)	iii.	(d)	iv.	(d)	v.	(b)
vi.	(a)	vii.	(b)	viii.	(c)	ix.	(b)	x.	(c)

REVIEW EXERCISE 29

1. Multiple Choice Question MCQs.

i.	(b)	ii.	(d)	iii.	(a)	iv.	(c)	v.	(c)
vi.	(b)	vii.	(a)	viii.	(b)	ix.	(d)	x.	(d)
xi.	(c)	xii.	(a)	xiii.	(b)	xiv.	(c)	xv.	(d)
xvi.	(b)	xvii.	(d)	xviii.	(c)	xix.	(a)	xx.	(d)

Exercise 30.1

1.

(i)	32.25°	(ii)	10.5°	(iii)	8.258° approx.
(iv)	45.36°	(v)	25.5°	(vi)	18.11°

2.

(i)	32°15′	(ii)	47°21′36″	(iii)	57°19′30″
(iv)	$-(67°34'48'')$	(v)	22°30′	(vi)	225°36′

3. (i) $45°$ (ii) $60°$ (iii) $-135°$
(iv) $171.887°$ approx. (v) $54.71°$ approx. (vi) $257.83°$ approx.

4. (i) $\frac{\pi}{6}$ radian (ii) $\frac{\pi}{4}$ radian (iii) $\frac{\pi}{3}$ radian
(iv) $\frac{\pi}{8}$ radian (v) $\frac{-5\pi}{4}$ radian (vi) 1.06 radian approx.

Exercise 30.2

1. (i) 4 radians (ii) 15.1 radians (iii) 2.09 radians approx. (iv) 1.8 radians

2. (i) $l = 2.12$ cm (ii) $l = 10.2$ cm (iii) $l = 3.14$ cm (iv) $l = 15.84$ cm

3. (i) $r = 1.91$ m (ii) $r = 0.5$ m (iii) $r = 16$ cm (iv) $r = 4.9$ cm

4. (i) $l = 0.52$ unit (ii) $l = 0.79$ unit (iii) $l = 1.05$ unit (iv) $l = 1.57$ unit

5. (i) $l = 2.62$ cm (ii) area of circular sector $= 6.55$ cm^2
6. distance travelled by the point, say $l = 2.2$ m
7. area of circular sector $= 6.28$ cm^2
8. $\theta = 800$ radian **9.** $\theta = 0.5$ radian
10. $l = 17.6$ cm and area of sector $= 105.6$ cm^2

Exercise 30.3

1. (i) $415°$ and $-305°$ (ii) $\frac{13\pi}{6}$ and $-\frac{11\pi}{6}$
(iii) $315°$ and $-405°$ (iv) $\frac{5\pi}{4}$ and $-\frac{11\pi}{4}$

2. (i) Q_4 (ii) Q_1 (iii) Q_3
(iv) Q_1 (v) Q_3 (vi) Q_2

3. (i), (ii), (iii), (iv), (v) are of negative sign (vi) Positive sign

4. (i) Lies in Q_2 (ii) Lies in Q_3 (iii) Lies in Q_3
(iv) Lies in Q_3 (v) Lies in Q_2 (vi) Lies in Q_1 or Q_3

5. (i) $\sec\theta = -\frac{5}{3}, \sin\theta = \frac{4}{5}, \operatorname{cosec}\theta = \frac{5}{4}, \tan\theta = -\frac{4}{3}$ and $\cot\theta = -\frac{3}{4}$

6. (i) $\operatorname{cosec}\theta = \frac{2}{\sqrt{3}}, \cos\theta = -\frac{1}{2}, \sec\theta = -2, \tan\theta = -\sqrt{3}$ and $\cot\theta = -\frac{1}{\sqrt{3}}$

(ii) $\sec\theta = \frac{3}{2}, \sin\theta = \frac{-\sqrt{5}}{3}, \operatorname{cosec}\theta = -\frac{3}{\sqrt{5}}, \tan\theta = \frac{-\sqrt{5}}{2}$ and $\cot\theta = \frac{-2}{\sqrt{5}}$

(iii) $\cot\theta = -2, \sin\theta = \frac{1}{\sqrt{5}}, \operatorname{cosec}\theta = \sqrt{5}, \cos\theta = \frac{-2}{\sqrt{5}}$ and $\sec\theta = \frac{-\sqrt{5}}{2}$

(iv) $\sin\theta = \cos\theta = \frac{1}{\sqrt{2}}$, and $\tan\theta = \cot\theta = 1$

(v) $\sec\theta = 2, \sin\theta = \frac{\sqrt{3}}{2}, \operatorname{cosec}\theta = \frac{2}{\sqrt{3}}, \tan\theta = \sqrt{3}$ and $\cot\theta = \frac{1}{\sqrt{3}}$

7. (i) 2 (ii) $\frac{1}{\sqrt{3}}$ (iii) $\sqrt{2}-1$

(iv) $\frac{\sqrt{3}+1}{4}$ (v) $2-\sqrt{3}$ (vi) 4

Exercise 30.5

1. $x = 304.85m$ **2.** $L = 4\sqrt{3} \approx 6.93m$ **3.** $\theta = 60°$

4. $x = 286.865m$ **5.** $\theta = 24°$

REVIEW EXERCISE 30

1. Multiple Choice Question MCQs.

i.	b	ii.	a	iii.	c	iv.	b	v.	b
vi.	a	vii.	b	viii.	c	ix.	b	x.	b

3. $\frac{2821\pi}{7200}$ **4.** 120 degree **5.** 120 degree

6. $54°40'12''$ **7.** $\frac{28}{\pi}cm$ **8.** 1 radian

10. 6 cm^2