

ANSWERS

EXERCISE 1.1

- (i), (iv), (v), (vi), (vii) and (viii) are sets.
- (i) $\in$ (ii) $\notin$ (iii) $\notin$ (vi) $\in$ (v) $\in$ (vi) $\notin$
- (i) $A = \{-3, -2, -1, 0, 1, 2, 3, 4, 5, 6\}$ (ii) $B = \{1, 2, 3, 4, 5\}$
 (iii) $C = \{17, 26, 35, 44, 53, 62, 71, 80\}$ (iv) $D = \{2, 3, 5\}$
 (v) $E = \{T, R, I, G, O, N, M, E, Y\}$ (vi) $F = \{B, E, T, R\}$
- (i) $\{x : x = 3n, n \in \mathbb{N} \text{ and } 1 \leq n \leq 4\}$ (ii) $\{x : x = 2^n, n \in \mathbb{N} \text{ and } 1 \leq n \leq 5\}$
 (iii) $\{x : x = 5^n, n \in \mathbb{N} \text{ and } 1 \leq n \leq 4\}$ (iv) $\{x : x \text{ is an even natural number}\}$
 (v) $\{x : x = n^2, n \in \mathbb{N} \text{ and } 1 \leq n \leq 10\}$
- (i) $A = \{1, 3, 5, \dots\}$ (ii) $B = \{0, 1, 2, 3, 4\}$
 (iii) $C = \{-2, -1, 0, 1, 2\}$ (iv) $D = \{L, O, Y, A\}$
 (v) $E = \{\text{February, April, June, September, November}\}$
 (vi) $F = \{b, c, d, f, g, h, j\}$
- (i) $\leftrightarrow$ (c) (ii) $\leftrightarrow$ (a) (iii) $\leftrightarrow$ (d) (iv) $\leftrightarrow$ (b)

EXERCISE 1.2

- (i), (iii), (iv)
- (i) Finite (ii) Infinite (iii) Finite (iv) Infinite (v) Finite
- (i) Infinite (ii) Finite (iii) Infinite (iv) Finite (v) Infinite
- (i) Yes (ii) No (iii) Yes (iv) No
- (i) No (ii) Yes
- $B = D, E = G$

EXERCISE 1.3

- (i) $\subset$ (ii) $\not\subset$ (iii) $\subset$ (iv) $\not\subset$ (v) $\not\subset$ (vi) $\subset$
 (vii) $\subset$
- (i) False (ii) True (iii) False (iv) True (v) False (vi) True
- (i) as $\{3, 4\} \in A$, (v) as $1 \in A$, (vii) as $\{1, 2, 5\} \subset A$,
 (viii) as $3 \notin A$, (ix) as $\phi \subset A$, (xi) as $\phi \subset A$,
- (i) $\phi, \{a\}$ (ii) $\phi, \{a\}, \{b\}, \{a, b\}$
 (iii) $\phi, \{1\}, \{2\}, \{3\}, \{1, 2\}, \{1, 3\}, \{2, 3\}, \{1, 2, 3\}$ (iv) ϕ
- (i) $(-4, 6]$ (ii) $(-12, -10)$ (iii) $[0, 7)$
 (iv) $[3, 4]$
- (i) $\{x : x \in \mathbb{R}, -3 < x < 0\}$ (ii) $\{x : x \in \mathbb{R}, 6 \leq x \leq 12\}$
 (iii) $\{x : x \in \mathbb{R}, 6 < x \leq 12\}$ (iv) $\{x \in \mathbb{R} : -23 \leq x < 5\}$ 8. (iii)

EXERCISE 1.4

1. (i) $X \cup Y = \{1, 2, 3, 5\}$ (ii) $A \cup B = \{a, b, c, e, i, o, u\}$
 (iii) $A \cup B = \{x : x = 1, 2, 4, 5 \text{ or a multiple of } 3\}$
 (iv) $A \cup B = \{x : 1 < x < 10, x \in \mathbb{N}\}$ (v) $A \cup B = \{1, 2, 3\}$
2. Yes, $A \cup B = \{a, b, c\}$ 3. B
4. (i) $\{1, 2, 3, 4, 5, 6\}$ (ii) $\{1, 2, 3, 4, 5, 6, 7, 8\}$ (iii) $\{3, 4, 5, 6, 7, 8\}$
 (iv) $\{3, 4, 5, 6, 7, 8, 9, 10\}$ (v) $\{1, 2, 3, 4, 5, 6, 7, 8\}$
 (vi) $\{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ (vii) $\{3, 4, 5, 6, 7, 8, 9, 10\}$
5. (i) $X \cap Y = \{1, 3\}$ (ii) $A \cap B = \{a\}$ (iii) $\{3\}$ (iv) ϕ (v) ϕ
6. (i) $\{7, 9, 11\}$ (ii) $\{11, 13\}$ (iii) ϕ (iv) $\{11\}$
 (v) ϕ (vi) $\{7, 9, 11\}$ (vii) ϕ
 (viii) $\{7, 9, 11\}$ (ix) $\{7, 9, 11\}$ (x) $\{7, 9, 11, 15\}$
7. (i) B (ii) C (iii) D (iv) ϕ
 (v) $\{2\}$ (vi) $\{x : x \text{ is an odd prime number}\}$ 8. (iii)
9. (i) $\{3, 6, 9, 15, 18, 21\}$ (ii) $\{3, 9, 15, 18, 21\}$ (iii) $\{3, 6, 9, 12, 18, 21\}$
 (iv) $\{4, 8, 16, 20\}$ (v) $\{2, 4, 8, 10, 14, 16\}$ (vi) $\{5, 10, 20\}$
 (vii) $\{20\}$ (viii) $\{4, 8, 12, 16\}$ (ix) $\{2, 6, 10, 14\}$
 (x) $\{5, 10, 15\}$ (xi) $\{2, 4, 6, 8, 12, 14, 16\}$ (xii) $\{5, 15, 20\}$
10. (i) $\{a, c\}$ (ii) $\{f, g\}$ (iii) $\{b, d\}$
11. Set of irrational numbers 12. (i) F (ii) F (iii) T (iv) T

EXERCISE 1.5

1. (i) $\{5, 6, 7, 8, 9\}$ (ii) $\{1, 3, 5, 7, 9\}$ (iii) $\{7, 8, 9\}$
 (iv) $\{5, 7, 9\}$ (v) $\{1, 2, 3, 4\}$ (vi) $\{1, 3, 4, 5, 6, 7, 9\}$
2. (i) $\{d, e, f, g, h\}$ (ii) $\{a, b, c, h\}$ (iii) $\{b, d, f, h\}$
 (iv) $\{b, c, d, e\}$
3. (i) $\{x : x \text{ is an odd natural number}\}$
 (ii) $\{x : x \text{ is an even natural number}\}$
 (iii) $\{x : x \in \mathbb{N} \text{ and } x \text{ is not a multiple of } 3\}$

- (iv) $\{x : x \text{ is a positive composite number or } x = 1\}$
 (v) $\{x : x \text{ is a positive integer which is not divisible by 3 or not divisible by 5}\}$
 (vi) $\{x : x \in \mathbf{N} \text{ and } x \text{ is not a perfect square}\}$
 (vii) $\{x : x \in \mathbf{N} \text{ and } x \text{ is not a perfect cube}\}$
 (viii) $\{x : x \in \mathbf{N} \text{ and } x \neq 3\}$ (ix) $\{x : x \in \mathbf{N} \text{ and } x \neq 2\}$
 (x) $\{x : x \in \mathbf{N} \text{ and } x < 7\}$ (xi) $\{x : x \in \mathbf{N} \text{ and } x \leq \frac{9}{2}\}$

6. A' is the set of all equilateral triangles.

7. (i) U (ii) A (iii) ϕ (iv) ϕ

Miscellaneous Exercise on Chapter 1

1. $A \subset B$, $A \subset C$, $B \subset C$, $D \subset A$, $D \subset B$, $D \subset C$
 2. (i) False (ii) False (iii) True (iv) False (v) False
 (vi) True
 10. We may take $A = \{1, 2\}$, $B = \{1, 3\}$, $C = \{2, 3\}$

EXERCISE 2.1

1. $x = 2$ and $y = 1$ 2. The number of elements in $A \times B$ is 9.
 3. $G \times H = \{(7, 5), (7, 4), (7, 2), (8, 5), (8, 4), (8, 2)\}$
 $H \times G = \{(5, 7), (5, 8), (4, 7), (4, 8), (2, 7), (2, 8)\}$
 4. (i) False
 $P \times Q = \{(m, n), (m, m), (n, n), (n, m)\}$
 (ii) True
 (iii) True
 5. $A \times A = \{(-1, -1), (-1, 1), (1, -1), (1, 1)\}$
 $A \times A \times A = \{(-1, -1, -1), (-1, -1, 1), (-1, 1, -1), (-1, 1, 1), (1, -1, -1), (1, -1, 1), (1, 1, -1), (1, 1, 1)\}$
 6. $A = \{a, b\}$, $B = \{x, y\}$
 8. $A \times B = \{(1, 3), (1, 4), (2, 3), (2, 4)\}$
 $A \times B$ will have $2^4 = 16$ subsets.
 9. $A = \{x, y, z\}$ and $B = \{1, 2\}$
 10. $A = \{-1, 0, 1\}$, remaining elements of
 $A \times A$ are $(-1, -1), (-1, 1), (0, -1), (0, 0), (1, -1), (1, 0), (1, 1)$

EXERCISE 2.2

1. $R = \{(1, 3), (2, 6), (3, 9), (4, 12)\}$
 Domain of $R = \{1, 2, 3, 4\}$
 Range of $R = \{3, 6, 9, 12\}$
 Co domain of $R = \{1, 2, \dots, 14\}$
2. $R = \{(1, 6), (2, 7), (3, 8)\}$
 Domain of $R = \{1, 2, 3\}$
 Range of $R = \{6, 7, 8\}$
3. $R = \{(1, 4), (1, 6), (2, 9), (3, 4), (3, 6), (5, 4), (5, 6)\}$
4. (i) $R = \{(x, y) : y = x - 2 \text{ for } x = 5, 6, 7\}$
 (ii) $R = \{(5, 3), (6, 4), (7, 5)\}$. Domain of $R = \{5, 6, 7\}$, Range of $R = \{3, 4, 5\}$
5. (i) $R = \{(1, 1), (1, 2), (1, 3), (1, 4), (1, 6), (2, 4), (2, 6), (2, 2), (4, 4), (6, 6), (3, 3), (3, 6)\}$
 (ii) Domain of $R = \{1, 2, 3, 4, 6\}$
 (iii) Range of $R = \{1, 2, 3, 4, 6\}$
6. Domain of $R = \{0, 1, 2, 3, 4, 5\}$
 Range of $R = \{5, 6, 7, 8, 9, 10\}$
7. $R = \{(2, 8), (3, 27), (5, 125), (7, 343)\}$
8. No. of relations from A into $B = 2^6$
9. Domain of $R = \mathbf{Z}$
 Range of $R = \mathbf{Z}$

EXERCISE 2.3

1. (i) yes, Domain = $\{2, 5, 8, 11, 14, 17\}$, Range = $\{1\}$
 (ii) yes, Domain = $\{2, 4, 6, 8, 10, 12, 14\}$, Range = $\{1, 2, 3, 4, 5, 6, 7\}$
 (iii) No.
2. (i) Domain = $\mathbf{R}$, Range = $(-\infty, 0]$
 (ii) Domain of function = $\{x : -3 \leq x \leq 3\}$
 Range of function = $\{x : 0 \leq x \leq 3\}$
3. (i) $f(0) = -5$ (ii) $f(7) = 9$ (iii) $f(-3) = -11$
4. (i) $t(0) = 32$ (ii) $t(28) = \frac{412}{5}$ (iii) $t(-10) = 14$ (iv) 100
5. (i) Range = $(-\infty, 2)$ (ii) Range = $[2, \infty)$ (iii) Range = $\mathbf{R}$

Miscellaneous Exercise on Chapter 2

2. 2.1 3. Domain of function is set of real numbers except 6 and 2.
 4. Domain = $[1, \infty)$, Range = $[0, \infty)$
 5. Domain = $\mathbf{R}$, Range = non-negative real numbers
 6. Range = $[0, 1)$
 7. $(f + g)x = 3x - 2$ 8. $a = 2, b = -1$ 9. (i) No (ii) No (iii) No
 $(f - g)x = -x + 4$

$$\left(\frac{f}{g}\right)x = \frac{x+1}{2x-3}, \quad x \neq \frac{3}{2}$$

10. (i) Yes, (ii) No 11. No 12. Range of $f = \{3, 5, 11, 13\}$

EXERCISE 3.1

1. (i) $\frac{5\pi}{36}$ (ii) $-\frac{19\pi}{72}$ (iii) $\frac{4\pi}{3}$ (iv) $\frac{26\pi}{9}$
 2. (i) $39^\circ 22' 30''$ (ii) $-229^\circ 5' 27''$ (iii) 300° (iv) 210°
 3. 12π 4. $12^\circ 36'$ 5. $\frac{20\pi}{3}$ 6. $5 : 4$
 7. (i) $\frac{2}{15}$ (ii) $\frac{1}{5}$ (iii) $\frac{7}{25}$

EXERCISE 3.2

1. $\sin x = -\frac{\sqrt{3}}{2}$, $\operatorname{cosec} x = -\frac{2}{\sqrt{3}}$, $\sec x = -2$, $\tan x = \sqrt{3}$, $\cot x = \frac{1}{\sqrt{3}}$
 2. $\operatorname{cosec} x = \frac{5}{3}$, $\cos x = -\frac{4}{5}$, $\sec x = -\frac{5}{4}$, $\tan x = -\frac{3}{4}$, $\cot x = -\frac{4}{3}$
 3. $\sin x = -\frac{4}{5}$, $\operatorname{cosec} x = -\frac{5}{4}$, $\cos x = -\frac{3}{5}$, $\sec x = -\frac{5}{3}$, $\tan x = \frac{4}{3}$
 4. $\sin x = -\frac{12}{13}$, $\operatorname{cosec} x = -\frac{13}{12}$, $\cos x = \frac{5}{13}$, $\tan x = -\frac{12}{5}$, $\cot x = -\frac{5}{12}$

$$5. \sin x = \frac{5}{13}, \operatorname{cosec} x = \frac{13}{5}, \cos x = -\frac{12}{13}, \sec x = -\frac{13}{12}, \cot x = -\frac{12}{5}$$

$$6. \frac{1}{\sqrt{2}}$$

$$7. 2$$

$$8. \sqrt{3}$$

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

$$10. 1$$

EXERCISE 3.3

$$5. (i) \frac{\sqrt{3}+1}{2\sqrt{2}} \quad (ii) 2 - \sqrt{3}$$

Miscellaneous Exercise on Chapter 3

$$8. \frac{2\sqrt{5}}{5}, \frac{\sqrt{5}}{5}, \frac{1}{2}$$

$$9. \frac{\sqrt{6}}{3}, -\frac{\sqrt{3}}{3}, -\sqrt{2}$$

$$10. \frac{\sqrt{8+2\sqrt{15}}}{4}, \frac{\sqrt{8-2\sqrt{15}}}{4}, 4+\sqrt{15}$$

EXERCISE 4.1

$$1. 3 + i0$$

$$2. 0 + i0$$

$$3. 0 + i1$$

$$4. 14 + 28i$$

$$5. 2 - 7i$$

$$6. -\frac{19}{5} - \frac{21i}{10}$$

$$7. \frac{17}{3} + i\frac{5}{3}$$

$$8. -4 + i0$$

$$9. -\frac{242}{27} - 26i$$

$$10. -\frac{22}{3} - i\frac{107}{27}$$

$$11. \frac{4}{25} + i\frac{3}{25}$$

$$12. \frac{\sqrt{5}}{14} - i\frac{3}{14}$$

$$13. 0 + i1$$

$$14. 0 - i\frac{7\sqrt{2}}{2}$$

Miscellaneous Exercise on Chapter 4

1. $2 - 2i$ 3. $\frac{307+599i}{442}$
5. $\sqrt{2}$ 7. (i) $\frac{-2}{5}$, (ii) 0 8. $x = 3, y = -3$ 9. 2
11. 1 12. 0 14. 4

EXERCISE 5.1

1. (i) $\{1, 2, 3, 4\}$ (ii) $\{\dots - 3, -2, -1, 0, 1, 2, 3, 4, \dots\}$
2. (i) No Solution (ii) $\{\dots - 4, -3\}$
3. (i) $\{\dots - 2, -1, 0, 1\}$ (ii) $(-\infty, 2)$
4. (i) $\{-1, 0, 1, 2, 3, \dots\}$ (ii) $(-2, \infty)$
5. $(-4, \infty)$ 6. $(-\infty, -3)$ 7. $(-\infty, -3]$ 8. $(-\infty, 4]$
9. $(-\infty, 6)$ 10. $(-\infty, -6)$ 11. $(-\infty, 2]$ 12. $(-\infty, 120]$
13. $(4, \infty)$ 14. $(-\infty, 2]$ 15. $(4, \infty)$ 16. $(-\infty, 2]$
17. $(-\infty, 3)$,  18. $[-1, \infty)$, 
19. $(-1, \infty)$,  20. $\left[-\frac{2}{7}, \infty\right)$, 
21. 35 22. 82
23. $(5, 7), (7, 9)$ 24. $(6, 8), (8, 10), (10, 12)$
25. 9 cm 26. Greater than or equal to 8cm but less than or equal to 22cm

Miscellaneous Exercise on Chapter 5

1. $[2, 3]$

2. $(0, 1]$

3. $[-4, 2]$

4. $(-23, 2]$

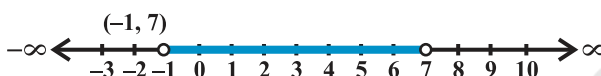
5. $\left(-\frac{80}{3}, -\frac{10}{3}\right]$

6. $\left[1, \frac{11}{3}\right]$

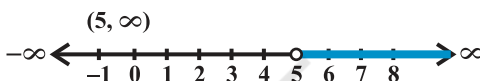
7. $(-5, 5)$



8. $(-1, 7)$



9. $(5, \infty)$



10. $[-7, 11]$



11. Between 20°C and 25°C

12. More than 320 litres but less than 1280 litres.

13. More than 562.5 litres but less than 900 litres.

14. $9.6 \leq \text{MA} \leq 16.8$

EXERCISE 6.1

1. (i) 125, (ii) 60.

2. 108

3. 5040

4. 336

5. 8

6. 20

EXERCISE 6.2

1. (i) 40320, (ii) 18

2. 30, No

3. 28

4. 64

5. (i) 30, (ii) 15120

EXERCISE 6.3

1. 504

2. 4536

3. 60

4. 120, 48

5. 56

6. 9

7. (i) 3, (ii) 4

8. 40320

9. (i) 360, (ii) 720, (iii) 240 10. 33810
 11. (i) 1814400, (ii) 2419200, (iii) 25401600

EXERCISE 6.4

1. 45 2. (i) 5, (ii) 6 3. 210 4. 40
 5. 2000 6. 778320 7. 3960 8. 200
 9. 35

Miscellaneous Exercise on Chapter 6

1. 3600 2. 1440 3. (i) 504, (ii) 588, (iii) 1632
 4. 907200 5. 120 6. 50400 7. 420
 8. ${}^4C_1 \times {}^{48}C_4$ 9. 2880 10. ${}^{22}C_7 + {}^{22}C_{10}$ 11. 151200

EXERCISE 7.1

1. $1 - 10x + 40x^2 - 80x^3 + 80x^4 - 32x^5$
 2. $\frac{32}{x^5} - \frac{40}{x^3} + \frac{20}{x} - 5x + \frac{5}{8}x^3 - \frac{x^5}{32}$
 3. $64x^6 - 576x^5 + 2160x^4 - 4320x^3 + 4860x^2 - 2916x + 729$
 4. $\frac{x^5}{243} + \frac{5x^3}{81} + \frac{10}{27}x + \frac{10}{9x} + \frac{5}{3x^3} + \frac{1}{x^5}$
 5. $x^6 + 6x^4 + 15x^2 + 20 + \frac{15}{x^2} + \frac{6}{x^4} + \frac{1}{x^6}$
 6. 884736 7. 11040808032 8. 104060401
 9. 9509900499 10. $(1.1)^{10000} > 1000$ 11. $8(a^3b + ab^3)$; $40\sqrt{6}$
 12. $2(x^6 + 15x^4 + 15x^2 + 1)$, 198

Miscellaneous Exercise on Chapter 7

2. $396\sqrt{6}$ 3. $2a^8 + 12a^6 - 10a^4 - 4a^2 + 2$
 4. 0.9510
 5. $\frac{16}{x} + \frac{8}{x^2} - \frac{32}{x^3} + \frac{16}{x^4} - 4x + \frac{x^2}{2} + \frac{x^3}{2} + \frac{x^4}{16} - 5$
 6. $27x^6 - 54ax^5 + 117a^2x^4 - 116a^3x^3 + 117a^4x^2 - 54a^5x + 27a^6$

EXERCISE 8.1

1. 3, 8, 15, 24, 35 2. $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{5}{6}$ 3. 2, 4, 8, 16 and 32
4. $-\frac{1}{6}, \frac{1}{6}, \frac{1}{2}, \frac{5}{6}$ and $\frac{7}{6}$ 5. 25, -125, 625, -3125, 15625
6. $\frac{3}{2}, \frac{9}{2}, \frac{21}{2}, 21$ and $\frac{75}{2}$ 7. 65, 93 8. $\frac{49}{128}$
9. 729 10. $\frac{360}{23}$
11. 3, 11, 35, 107, 323; $3 + 11 + 35 + 107 + 323 + \dots$
12. $-1, \frac{-1}{2}, \frac{-1}{6}, \frac{-1}{24}, \frac{-1}{120}; -1 + \left(\frac{-1}{2}\right) + \left(\frac{-1}{6}\right) + \left(\frac{-1}{24}\right) + \left(\frac{-1}{120}\right) + \dots$
13. 2, 2, 1, 0, -1; $2 + 2 + 1 + 0 + (-1) + \dots$ 14. $1, 2, \frac{3}{2}, \frac{5}{3}$ and $\frac{8}{5}$

EXERCISE 8.2

1. $\frac{5}{2^{20}}, \frac{5}{2^n}$ 2. 3072 4. -2187
5. (a) 13^{th} , (b) 12^{th} , (c) 9^{th} 6. ± 1 7. $\frac{1}{6} [1 - (0.1)^{20}]$
8. $\frac{\sqrt{7}}{2} (\sqrt{3} + 1) \left(3^{\frac{n}{2}} - 1 \right)$ 9. $\frac{[1 - (-a)^n]}{1 + a}$ 10. $\frac{x^3(1 - x^{2n})}{1 - x^2}$
11. $22 + \frac{3}{2} (3^{11} - 1)$ 12. $r = \frac{5}{2}$ or $\frac{2}{5}$; Terms are $\frac{2}{5}, 1, \frac{5}{2}$ or $\frac{5}{2}, 1, \frac{2}{5}$
13. 4 14. $\frac{16}{7}; 2; \frac{16}{7} (2^n - 1)$ 15. 2059 or 463

16. $\frac{-4}{3}, \frac{-8}{3}, \frac{-16}{3}, \dots$ or $4, -8, 16, -32, 64, \dots$ 18. $\frac{80}{81}(10^n - 1) - \frac{8}{9}n$
 19. 496 20. rR 21. $3, -6, 12, -24$ 26. 9 and 27
 27. $n = \frac{-1}{2}$ 30. 120, 480, 30 (2^n) 31. Rs 500 $(1.1)^{10}$
 32. $x^2 - 16x + 25 = 0$

Miscellaneous Exercise on Chapter 8

1. 4 2. 160; 6 3. ± 3 4. 8, 16, 32
 5. 4 11. (i) $\frac{50}{81}(10^n - 1) - \frac{5n}{9}$, (ii) $\frac{2n}{3} - \frac{2}{27}(1 - 10^{-n})$
 12. 1680
 13. Rs 16680 14. Rs 39100 15. Rs 43690 16. Rs 17000; 20,000
 17. Rs 5120 18. 25 days

EXERCISE 9.1

1. $\frac{121}{2}$ square unit.
 2. $(0, a), (0, -a)$ and $(-\sqrt{3}a, 0)$ or $(0, a), (0, -a)$, and $(\sqrt{3}a, 0)$
 3. (i) $|y_2 - y_1|$, (ii) $|x_2 - x_1|$ 4. $\left(\frac{15}{2}, 0\right)$ 5. $-\frac{1}{2}$
 7. $-\sqrt{3}$ 9. 135°
 10. 1 and 2, or $\frac{1}{2}$ and 1, or -1 and -2 , or $-\frac{1}{2}$ and -1

EXERCISE 9.2

1. $y = 0$ and $x = 0$ 2. $x - 2y + 10 = 0$ 3. $y = mx$
 4. $(\sqrt{3} + 1)x - (\sqrt{3} - 1)y = 4(\sqrt{3} - 1)$ 5. $2x + y + 6 = 0$
 6. $x - \sqrt{3}y + 2\sqrt{3} = 0$ 7. $5x + 3y + 2 = 0$

4. $\left| \cos \frac{\phi - \theta}{2} \right|$ 5. $x = -\frac{5}{22}$ 6. $2x - 3y + 18 = 0$
 7. k^2 square units 8. 5 10. $3x - y = 7, x + 3y = 9$
 11. $13x + 13y = 6$ 13. $1 : 2$ 14. $\frac{23\sqrt{5}}{18}$ units
 15. The line is parallel to x - axis or parallel to y -axis
 16. $x = 1, y = 1$. or $x = -4, y = 3$ 17. $(-1, -4)$.
 18. $\frac{1 \pm 5\sqrt{2}}{7}$ 20. $18x + 12y + 11 = 0$
 21. $\left(\frac{13}{5}, 0\right)$ 23. $119x + 102y = 125$

EXERCISE 10.1

1. $x^2 + y^2 - 4y = 0$ 2. $x^2 + y^2 + 4x - 6y - 3 = 0$
 3. $36x^2 + 36y^2 - 36x - 18y + 11 = 0$ 4. $x^2 + y^2 - 2x - 2y = 0$
 5. $x^2 + y^2 + 2ax + 2by + 2b^2 = 0$ 6. $c(-5, 3), r = 6$
 7. $c(2, 4), r = \sqrt{65}$ 8. $c(4, -5), r = \sqrt{53}$ 9. $c\left(\frac{1}{4}, 0\right); r = \frac{1}{4}$
 10. $x^2 + y^2 - 6x - 8y + 15 = 0$ 11. $x^2 + y^2 - 7x + 5y - 14 = 0$
 12. $x^2 + y^2 + 4x - 21 = 0$ & $x^2 + y^2 - 12x + 11 = 0$
 13. $x^2 + y^2 - ax - by = 0$ 14. $x^2 + y^2 - 4x - 4y = 5$
 15. Inside the circle; since the distance of the point to the centre of the circle is less than the radius of the circle.

EXERCISE 10.2

1. $F(3, 0)$, axis - x - axis, directrix $x = -3$, length of the Latus rectum = 12
 2. $F\left(0, \frac{3}{2}\right)$, axis - y - axis, directrix $y = -\frac{3}{2}$, length of the Latus rectum = 6
 3. $F(-2, 0)$, axis - x - axis, directrix $x = 2$, length of the Latus rectum = 8

4. F (0, -4), axis - y - axis, directrix $y = 4$, length of the Latus rectum = 16
5. F ($\frac{5}{2}$, 0) axis - x - axis, directrix $x = -\frac{5}{2}$, length of the Latus rectum = 10
6. F (0, $\frac{-9}{4}$), axis - y - axis, directrix $y = \frac{9}{4}$, length of the Latus rectum = 9
7. $y^2 = 24x$ 8. $x^2 = -12y$ 9. $y^2 = 12x$
10. $y^2 = -8x$ 11. $2y^2 = 9x$ 12. $2x^2 = 25y$

EXERCISE 10.3

1. F ($\pm\sqrt{20}$, 0); V (± 6 , 0); Major axis = 12; Minor axis = 8, $e = \frac{\sqrt{20}}{6}$,
Latus rectum = $\frac{16}{3}$
2. F (0, $\pm\sqrt{21}$); V (0, ± 5); Major axis = 10; Minor axis = 4, $e = \frac{\sqrt{21}}{5}$,
Latus rectum = $\frac{8}{5}$
3. F ($\pm\sqrt{7}$, 0); V (± 4 , 0); Major axis = 8; Minor axis = 6, $e = \frac{\sqrt{7}}{4}$,
Latus rectum = $\frac{9}{2}$
4. F (0, $\pm\sqrt{75}$); V (0, ± 10); Major axis = 20; Minor axis = 10, $e = \frac{\sqrt{3}}{2}$,
Latus rectum = 5
5. F ($\pm\sqrt{13}$, 0); V (± 7 , 0); Major axis = 14; Minor axis = 12, $e = \frac{\sqrt{13}}{7}$,
Latus rectum = $\frac{72}{7}$
6. F (0, $\pm 10\sqrt{3}$); V (0, ± 20); Major axis = 40; Minor axis = 20, $e = \frac{\sqrt{3}}{2}$,
Latus rectum = 10

7. $F(0, \pm 4\sqrt{2})$; $V(0, \pm 6)$; Major axis = 12; Minor axis = 4, $e = \frac{2\sqrt{2}}{3}$;

Latus rectum = $\frac{4}{3}$

8. $F(0, \pm\sqrt{15})$; $V(0, \pm 4)$; Major axis = 8; Minor axis = 2, $e = \frac{\sqrt{15}}{4}$;

Latus rectum = $\frac{1}{2}$

9. $F(\pm\sqrt{5}, 0)$; $V(\pm 3, 0)$; Major axis = 6; Minor axis = 4, $e = \frac{\sqrt{5}}{3}$;

Latus rectum = $\frac{8}{3}$

10. $\frac{x^2}{25} + \frac{y^2}{9} = 1$

11. $\frac{x^2}{144} + \frac{y^2}{169} = 1$

12. $\frac{x^2}{36} + \frac{y^2}{20} = 1$

13. $\frac{x^2}{9} + \frac{y^2}{4} = 1$

14. $\frac{x^2}{1} + \frac{y^2}{5} = 1$

15. $\frac{x^2}{169} + \frac{y^2}{144} = 1$

16. $\frac{x^2}{64} + \frac{y^2}{100} = 1$

17. $\frac{x^2}{16} + \frac{y^2}{7} = 1$

18. $\frac{x^2}{25} + \frac{y^2}{9} = 1$

19. $\frac{x^2}{10} + \frac{y^2}{40} = 1$

20. $x^2 + 4y^2 = 52$ or $\frac{x^2}{52} + \frac{y^2}{13} = 1$

EXERCISE 10.4

1. Foci $(\pm 5, 0)$, Vertices $(\pm 4, 0)$; $e = \frac{5}{4}$; Latus rectum = $\frac{9}{2}$

2. Foci $(0, \pm 6)$, Vertices $(0, \pm 3)$; $e = 2$; Latus rectum = 18

3. Foci $(0, \pm\sqrt{13})$, Vertices $(0, \pm 2)$; $e = \frac{\sqrt{13}}{2}$; Latus rectum = 9

4. Foci $(\pm 10, 0)$, Vertices $(\pm 6, 0)$; $e = \frac{5}{3}$; Latus rectum = $\frac{64}{3}$

5. Foci $(0, \pm \frac{2\sqrt{14}}{\sqrt{5}})$, Vertices $(0, \pm \frac{6}{\sqrt{5}})$; $e = \frac{\sqrt{14}}{3}$; Latus rectum $= \frac{4\sqrt{5}}{3}$
6. Foci $(0, \pm \sqrt{65})$, Vertices $(0, \pm 4)$; $e = \frac{\sqrt{65}}{4}$; Latus rectum $= \frac{49}{2}$
7. $\frac{x^2}{4} - \frac{y^2}{5} = 1$ 8. $\frac{y^2}{25} - \frac{x^2}{39} = 1$ 9. $\frac{y^2}{9} - \frac{x^2}{16} = 1$
10. $\frac{x^2}{16} - \frac{y^2}{9} = 1$ 11. $\frac{y^2}{25} - \frac{x^2}{144} = 1$ 12. $\frac{x^2}{25} - \frac{y^2}{20} = 1$
13. $\frac{x^2}{4} - \frac{y^2}{12} = 1$ 14. $\frac{x^2}{49} - \frac{9y^2}{343} = 1$ 15. $\frac{y^2}{5} - \frac{x^2}{5} = 1$

Miscellaneous Exercise on Chapter 10

1. Focus is at the mid-point of the given diameter.
2. 2.23 m (approx.) 3. 9.11 m (approx.) 4. 1.56m (approx.)
5. $\frac{x^2}{81} + \frac{y^2}{9} = 1$ 6. 18 sq units 7. $\frac{x^2}{25} + \frac{y^2}{9} = 1$
8. $8\sqrt{3}a$

EXERCISE 11.1

1. y and z - coordinates are zero 2. y - coordinate is zero
3. I, IV, VIII, V, VI, II, III, VII
4. (i) XY - plane (ii) $(x, y, 0)$ (iii) Eight

EXERCISE 11.2

1. (i) $2\sqrt{5}$ (ii) $\sqrt{43}$ (iii) $2\sqrt{26}$ (iv) $2\sqrt{5}$
4. $x - 2z = 0$ 5. $9x^2 + 25y^2 + 25z^2 - 225 = 0$

Miscellaneous Exercise on Chapter 11

1. $(1, -2, 8)$ 2. $7, \sqrt{34}, 7$ 3. $a = -2, b = -\frac{16}{3}, c = 2$
4. $x^2 + y^2 + z^2 - 2x - 7y + 2z = \frac{k^2 - 109}{2}$

EXERCISE 12.1

1. 6 2. $\left(\pi - \frac{22}{7}\right)$ 3. π 4. $\frac{19}{2}$
5. $-\frac{1}{2}$ 6. 5 7. $\frac{11}{4}$ 8. $\frac{108}{7}$
9. b 10. 2 11. 1 12. $-\frac{1}{4}$
13. $\frac{a}{b}$ 14. $\frac{a}{b}$ 15. $\frac{1}{\pi}$ 16. $\frac{1}{\pi}$
17. 4 18. $\frac{a+1}{b}$ 19. 0 20. 1
21. 0 22. 2 23. 3, 6
24. Limit does not exist at $x = 1$
25. Limit does not exist at $x = 0$ 26. Limit does not exist at $x = 0$
27. 0 28. $a=0, b=4$
29. $\lim_{x \rightarrow a_1} f(x) = 0$ and $\lim_{x \rightarrow a} f(x) = (a - a_1)(a - a_2) \dots (a - a_n)$
30. $\lim_{x \rightarrow a} f(x)$ exists for all $a \neq 0$. 31. 2
32. For $\lim_{x \rightarrow 0} f(x)$ to exist, we need $m = n$; $\lim_{x \rightarrow 1} f(x)$ exists for any integral value of m and n .

EXERCISE 12.2

1. 20 2. 1 3. 99
4. (i) $3x^2$ (ii) $2x - 3$ (iii) $\frac{-2}{x^3}$ (iv) $\frac{-2}{(x-1)^2}$
6. $nx^{n-1} + a(n-1)x^{n-2} + a^2(n-2)x^{n-3} + \dots + a^{n-1}$
7. (i) $2x - a - b$ (ii) $4ax(ax^2 + b)$ (iii) $\frac{a-b}{(x-b)^2}$

$$8. \frac{nx^n - anx^{n-1} - x^n + a^n}{(x-a)^2}$$

$$9. \text{ (i) } 2 \quad \text{(ii) } 20x^3 - 15x^2 + 6x - 4 \quad \text{(iii) } \frac{-3}{x^4}(5+2x) \quad \text{(iv) } 15x^4 + \frac{24}{x^5}$$

$$\text{(v) } \frac{-12}{x^5} + \frac{36}{x^{10}} \quad \text{(vi) } \frac{-2}{(x+1)^2} - \frac{x(3x-2)}{(3x-1)^2} \quad 10. -\sin x$$

$$11. \begin{array}{ll} \text{(i) } \cos 2x & \text{(ii) } \sec x \tan x \\ \text{(iii) } 5\sec x \tan x - 4\sin x & \text{(iv) } -\operatorname{cosec} x \cot x \\ \text{(v) } -3\operatorname{cosec}^2 x - 5 \operatorname{cosec} x \cot x & \text{(vi) } 5\cos x + 6\sin x \\ \text{(vii) } 2\sec^2 x - 7\sec x \tan x & \end{array}$$

Miscellaneous Exercise on Chapter 12

$$1. \text{ (i) } -1 \quad \text{(ii) } \frac{1}{x^2} \quad \text{(iii) } \cos(x+1) \quad \text{(iv) } -\sin\left(x - \frac{\pi}{8}\right) \quad 2. 1$$

$$3. \frac{-qr}{x^2} + ps \quad 4. 2c(ax+b)(cx+d) + a(cx+d)^2$$

$$5. \frac{ad-bc}{(cx+d)^2} \quad 6. \frac{-2}{(x-1)^2}, x \neq 0, 1 \quad 7. \frac{-(2ax+b)}{(ax^2+bx+c)^2}$$

$$8. \frac{-apx^2 - 2bpx + ar - bq}{(px^2 + qx + r)^2} \quad 9. \frac{apx^2 + 2bpx + bq - ar}{(ax+b)^2} \quad 10. \frac{-4a}{x^5} + \frac{2b}{x^3} - \sin x$$

$$11. \frac{2}{\sqrt{x}} \quad 12. na(ax+b)^{n-1}$$

$$13. (ax+b)^{n-1}(cx+d)^{m-1} [mc(ax+b) + na(cx+d)] \quad 14. \cos(x+a)$$

$$15. -\operatorname{cosec}^3 x - \operatorname{cosec} x \cot^2 x \quad 16. \frac{-1}{1+\sin x}$$

$$17. \frac{-2}{(\sin x - \cos x)^2} \quad 18. \frac{2\sec x \tan x}{(\sec x + 1)^2} \quad 19. n \sin^{n-1} x \cos x$$

$$20. \frac{bc \cos x + ad \sin x + bd}{(c + d \cos x)^2}$$

$$21. \frac{\cos a}{\cos^2 x}$$

$$22. x^3 (5x \cos x + 3x \sin x + 20 \sin x - 12 \cos x)$$

$$23. -x^2 \sin x - \sin x + 2x \cos x$$

$$24. -q \sin x (ax^2 + \sin x) + (p + q \cos x)(2ax + \cos x)$$

$$25. -\tan^2 x (x + \cos x) + (x - \tan x)(1 - \sin x)$$

$$26. \frac{35 + 15x \cos x + 28 \cos x + 28x \sin x - 15 \sin x}{(3x + 7 \cos x)^2}$$

$$27. \frac{x \cos \frac{\pi}{4} (2 \sin x - x \cos x)}{\sin^2 x}$$

$$28. \frac{1 + \tan x - x \sec^2 x}{(1 + \tan x)^2}$$

$$29. (x + \sec x)(1 - \sec^2 x) + (x - \tan x) \cdot (1 + \sec x \tan x)$$

$$30. \frac{\sin x - n x \cos x}{\sin^{n+1} x}$$

EXERCISE 13.1

$$1. 3$$

$$2. 8.4$$

$$3. 2.33$$

$$4. 7$$

$$5. 6.32$$

$$6. 16$$

$$7. 3.23$$

$$8. 5.1$$

$$9. 157.92$$

$$10. 11.28$$

$$11. 10.34$$

$$12. 7.35$$

EXERCISE 13.2

$$1. 9, 9.25$$

$$2. \frac{n+1}{2}, \frac{n^2-1}{12}$$

$$3. 16.5, 74.25$$

$$4. 19, 43.4$$

$$5. 100, 29.09$$

$$6. 64, 1.69$$

$$7. 107, 2276$$

$$8. 27, 132$$

$$9. 93, 105.58, 10.27$$

$$10. 5.55, 43.5$$

Miscellaneous Exercise on Chapter 13

1. 4, 8 2. 6, 8 3. 24, 12
 5. (i) 10.1, 1.99 (ii) 10.2, 1.98
 6. 20, 3.036

EXERCISE 14.1

1. No.
 2. (i) $\{1, 2, 3, 4, 5, 6\}$ (ii) ϕ (iii) $\{3, 6\}$ (iv) $\{1, 2, 3\}$ (v) $\{6\}$
 (vi) $\{3, 4, 5, 6\}$, $A \cup B = \{1, 2, 3, 4, 5, 6\}$, $A \cap B = \phi$, $B \cup C = \{3, 6\}$, $E \cap F = \{6\}$,
 $D \cap E = \phi$,
 $A - C = \{1, 2, 4, 5\}$, $D - E = \{1, 2, 3\}$, $E \cap F' = \phi$, $F' = \{1, 2\}$
 3. $A = \{(3, 6), (4, 5), (5, 4), (6, 3), (4, 6), (5, 5), (6, 4), (5, 6), (6, 5), (6, 6)\}$
 $B = \{(1, 2), (2, 2), (3, 2), (4, 2), (5, 2), (6, 2), (2, 1), (2, 3), (2, 4), (2, 5), (2, 6)\}$
 $C = \{(3, 6), (6, 3), (5, 4), (4, 5), (6, 6)\}$
 A and B, B and C are mutually exclusive.
 4. (i) A and B; A and C; B and C; C and D (ii) A and C (iii) B and D
 5. (i) “Getting at least two heads”, and “getting at least two tails”
 (ii) “Getting no heads”, “getting exactly one head” and “getting at least two heads”
 (iii) “Getting at most two tails”, and “getting exactly two tails”
 (iv) “Getting exactly one head” and “getting exactly two heads”
 (v) “Getting exactly one tail”, “getting exactly two tails”, and getting exactly three tails”

 **Note** There may be other events also as answer to the above question.

6. $A = \{(2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6), (4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6), (6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)\}$
 $B = \{(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6), (5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6)\}$
 $C = \{(1, 1), (1, 2), (1, 3), (1, 4), (2, 1), (2, 2), (2, 3), (3, 1), (3, 2), (4, 1)\}$
 (i) $A' = \{(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6), (5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6)\} = B$
 (ii) $B' = \{(2, 1), (2, 2), (2, 3), (2, 4), (2, 5), (2, 6), (4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6), (6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)\} = A$
 (iii) $A \cup B = \{(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (3, 1), (3, 2), (3, 3), (3, 4), (3, 5), (3, 6), (5, 1), (5, 2), (5, 3), (5, 4), (5, 5), (5, 6), (2, 1), (2, 2), (2, 3), (2, 5), (2, 6), (4, 1), (4, 2), (4, 3), (4, 4), (4, 5), (4, 6), (6, 1), (6, 2), (6, 3), (6, 4), (6, 5), (6, 6)\} = S$

- (iv) $A \cap B = \phi$
 (v) $A - C = \{(2,4), (2,5), (2,6), (4,2), (4,3), (4,4), (4,5), (4,6), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6)\}$
 (vi) $B \cup C = \{(1,1), (1,2), (1,3), (1,4), (1,5), (1,6), (2,1), (2,2), (2,3), (3,1), (3,2), (3,3), (3,4), (3,5), (3,6), (4,1), (5,1), (5,2), (5,3), (5,4), (5,5), (5,6)\}$
 (vii) $B \cap C = \{(1,1), (1,2), (1,3), (1,4), (3,1), (3,2)\}$
 (viii) $A \cap B' \cap C' = \{(2,4), (2,5), (2,6), (4,2), (4,3), (4,4), (4,5), (4,6), (6,1), (6,2), (6,3), (6,4), (6,5), (6,6)\}$

7. (i) True (ii) True (iii) True (iv) False (v) False (vi) False

EXERCISE 14.2

1. (a) Yes (b) Yes (c) No (d) No (e) No 2. $\frac{3}{4}$
 3. (i) $\frac{1}{2}$ (ii) $\frac{2}{3}$ (iii) $\frac{1}{6}$ (iv) 0 (v) $\frac{5}{6}$ 4. (a) 52 (b) $\frac{1}{52}$ (c) (i) $\frac{1}{13}$ (ii) $\frac{1}{2}$
 5. (i) $\frac{1}{12}$ (ii) $\frac{1}{12}$ 6. $\frac{3}{5}$
 7. Rs 4.00 gain, Rs 1.50 gain, Re 1.00 loss, Rs 3.50 loss, Rs 6.00 loss.
 $P(\text{Winning Rs 4.00}) = \frac{1}{16}$, $P(\text{Winning Rs 1.50}) = \frac{1}{4}$, $P(\text{Losing Re. 1.00}) = \frac{3}{8}$
 $P(\text{Losing Rs 3.50}) = \frac{1}{4}$, $P(\text{Losing Rs 6.00}) = \frac{1}{16}$
 8. (i) $\frac{1}{8}$ (ii) $\frac{3}{8}$ (iii) $\frac{1}{2}$ (iv) $\frac{7}{8}$ (v) $\frac{1}{8}$ (vi) $\frac{1}{8}$ (vii) $\frac{3}{8}$ (viii) $\frac{1}{8}$ (ix) $\frac{7}{8}$
 9. $\frac{9}{11}$ 10. (i) $\frac{6}{13}$ (ii) $\frac{7}{13}$ 11. $\frac{1}{38760}$
 12. (i) No, because $P(A \cap B)$ must be less than or equal to $P(A)$ and $P(B)$, (ii) Yes
 13. (i) $\frac{7}{15}$ (ii) 0.5 (iii) 0.15 14. $\frac{4}{5}$
 15. (i) $\frac{5}{8}$ (ii) $\frac{3}{8}$ 16. No 17. (i) 0.58 (ii) 0.52 (iii) 0.74

18. 0.6

19. 0.55

20. 0.65

21. (i) $\frac{19}{30}$ (ii) $\frac{11}{30}$ (iii) $\frac{2}{15}$

Miscellaneous Exercise on Chapter 14

1. (i) $\frac{{}^{20}C_5}{{}^{60}C_5}$ (ii) $1 - \frac{{}^{30}C_5}{{}^{60}C_5}$ 2. $\frac{{}^{13}C_3 \cdot {}^{13}C_1}{{}^{52}C_4}$

3. (i) $\frac{1}{2}$ (ii) $\frac{1}{2}$ (iii) $\frac{5}{6}$ 4. (a) $\frac{999}{1000}$ (b) $\frac{{}^{9990}C_2}{{}^{10000}C_2}$ (c) $\frac{{}^{9990}C_{10}}{{}^{10000}C_{10}}$

5. (a) $\frac{17}{33}$ (b) $\frac{16}{33}$ 6. $\frac{2}{3}$

7. (i) 0.88 (ii) 0.12 (iii) 0.19 (iv) 0.34 8. $\frac{4}{5}$

9. (i) $\frac{33}{83}$ (ii) $\frac{3}{8}$ 10. $\frac{1}{5040}$