ANSWERS

EXERCISE 1.1

1. (i), (iv), (v), (vi), (vii) and (viii) are sets.

2. (i) $\in$ (ii) $\notin$ (iii) $\notin$ (vi) $\in$ (v) $\in$ (vi) $\notin$

3. (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}

4. (i) $\{ x : x = 3n, n \in N \text{ and } 1 \le n \le 4 \}$ (ii) $\{ x : x = 2^n, n \in N \text{ and } 1 \le n \le 5 \}$
(iii) $\{ x : x = 5^n, n \in N \text{ and } 1 \le n \le 4 \}$ (iv) $\{ x : x \text{ is an even natural number} \}$
(v) $\{ x : x = n^2, n \in N \text{ and } 1 \le n \le 10 \}$

5. (i) A = {1, 3, 5, . . . } (ii) B = {0, 1, 2, 3, 4 }
(iii) C = { –2, –1, 0, 1, 2 } (iv) D = { L, O, Y, A }
(v) E = { February, April, June, September, November }
(vi) F = {*b*, *c*, *d*, *f*, *g*, *h*, *j* }

6. (i) $\leftrightarrow$ (c) (ii) $\leftrightarrow$ (a) (iii) $\leftrightarrow$ (d) (iv) $\leftrightarrow$ (b)

EXERCISE 1.2

1. (i), (iii), (iv)

2. (i) Finite (ii) Infinite (iii) Finite (iv) Infinite (v) Finite

3. (i) Infinite (ii) Finite (iii) Infinite (iv) Finite (v) Infinite

4. (i) Yes (ii) No (iii) Yes (iv) No

5. (i) No (ii) Yes **6.** B= D, E = G

EXERCISE 1.3

1. (i) $\subset$ (ii) $\not\subset$ (iii) $\subset$ (iv) $\not\subset$ (v) $\not\subset$ (vi) $\subset$
(vii) $\subset$

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

3. (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 $\phi \subset A$,

4. (i) ϕ, { *a* } (ii) ϕ, { *a* }, { *b* }, { *a*, *b* }
(iii) ϕ, { 1 }, { 2 }, { 3 }, { 1, 2 }, { 1, 3 }, { 2, 3 }, { 1, 2, 3 } (iv) ϕ

5. (i) (– 4, 6] (ii) (– 12, –10) (iii) [0, 7)
(iv) [3, 4]

6. (i) $\{ x : x \in R, -3 < x < 0 \}$ (ii) $\{ x : x \in R, 6 \le x \le 12 \}$
(iii) $\{ x : x \in R, 6 < x \le 12 \}$ (iv) $\{ x \ R : -23 \le x < 5 \}$ **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) $A \cup B = \{x : x = 1, 2, 4, 5$ or a multiple of $3\}$

(iv) $A \cup B = \{x : 1 < x < 10, x \in N\}$ (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) $\{x : x$ 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) $\{x : x$ is an odd natural number$\}$

(ii) $\{x : x$ is an even natural number$\}$

(iii) $\{x : x \in \mathbf{N}$ and x is not a multiple of $3\}$

(iv) $\{ x : x$ is a positive composite number or $x = 1 \}$
(v) $\{ x : x$ is a positive integer which is not divisible by 3 or not divisible by 5$\}$
(vi) $\{ x : x \in \mathbf{N}$ and x is not a perfect square $\}$
(vii) $\{ x : x \in \mathbf{N}$ and x is not a perfect cube $\}$
(viii) $\{ x : x \in \mathbf{N}$ and $x \neq 3 \}$ (ix) $\{ x : x \in \mathbf{N}$ and $x \neq 2 \}$
(x) $\{ x : x \in \mathbf{N}$ and $x < 7 \}$ (xi) $\{ x : x \in \mathbf{N}$ 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, ..., 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 = {$(x, y) : y = x - 2$ 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 = **Z**
Range of R = **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 = **R**, Range = $(-\infty, 0]$
(ii) Domain of function = $\{x : -3 \le x \le 3\}$
Range of function = $\{x : 0 \le x \le 3\}$

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 = **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 = **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° 22′ 30″ (ii) –229° 5′ 27″ (iii) 300° (iv) 210°
3. 12π **4.** 12° 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. $\sin x = -\frac{\sqrt{3}}{2},\ \text{cosec}\, x = -\frac{2}{\sqrt{3}},\ \sec x = -2,\ \tan x = \sqrt{3},\ \cot x = \frac{1}{\sqrt{3}}$

2. $\text{cosec}\, x = \frac{5}{3},\ \cos x = -\frac{4}{5},\ \sec x = -\frac{5}{4},\ \tan x = -\frac{3}{4},\ \cot x = -\frac{4}{3}$

3. $\sin x = -\frac{4}{5},\ \text{cosec}\, x = -\frac{5}{4},\ \cos x = -\frac{3}{5},\ \sec x = -\frac{5}{3},\ \tan x = \frac{4}{3}$

4. $\sin x = -\frac{12}{13},\ \text{cosec}\, x = -\frac{13}{12},\ \cos x = \frac{5}{13},\ \tan x = -\frac{12}{5},\ \cot x = -\frac{5}{12}$

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) $\frac{\sqrt{3}+1}{2\sqrt{2}}$ (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.** $0 + i\,0$ **3.** $0 + i\,1$ **4.** $14 + 28\,i$

5. $2 - 7\,i$ **6.** $-\frac{19}{5} - \frac{21i}{10}$ **7.** $\frac{17}{3} + i\frac{5}{3}$ **8.** $-4 + i\,0$

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

2. (i) No Solution (ii) $\{\ldots -4, -3\}$

3. (i) $\{\ldots -2, -1, 0, 1\}$ (ii) $(-\infty, 2)$

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

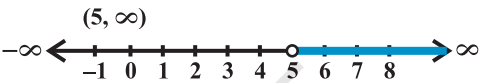
1. [2, 3] **2.** (0, 1] **3.** [– 4, 2]

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, ∞)



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. $9.6 \leq MA \leq 16.8$

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. ${}^{4}C_{1} \times {}^{48}C_{4}$ **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; $3 + 11 + 35 + 107 + 323 + \ldots$

12. $-1, \frac{-1}{2}, \frac{-1}{6}, \frac{-1}{24}, \frac{-1}{120}; -1+\left(\frac{-1}{2}\right)+\left(\frac{-1}{6}\right)+\left(\frac{-1}{24}\right)+\left(\frac{-1}{120}\right)+\ldots$

13. 2, 2, 1, 0, –1; $2 + 2 + 1 + 0 + (-1) + \ldots$ **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.** $\frac{1}{6}\left[1-(0.1)^{20}\right]$

8. $\frac{\sqrt{7}}{2}\left(\sqrt{3}+1\right)\left(3^{\frac{n}{2}}-1\right)$ **9.** $\frac{\left[1-(-a)^n\right]}{1+a}$ **10.** $\frac{x^3\left(1-x^{2n}\right)}{1-x^2}$

11. $22+\frac{3}{2}\left(3^{11}-1\right)$ **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.** $\frac{16}{7}; 2; \frac{16}{7}\left(2^n-1\right)$ **15.** 2059 or 463

16. $\frac{-4}{3}, \frac{-8}{3}, \frac{-16}{3}, \ldots$ or $4, -8, 16, -32, 64, \ldots$ **18.** $\frac{80}{81}\left(10^n - 1\right) - \frac{8}{9}n$

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) $\frac{50}{81}\left(10^n - 1\right) - \frac{5n}{9}$, (ii) $\frac{2n}{3} - \frac{2}{27}\left(1 - 10^{-n}\right)$

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 $\left(-\sqrt{3}a, 0\right)$ or $(0, a)$, $(0, -a)$, and $\left(\sqrt{3}a, 0\right)$

3. (i) $\left|y_2 - y_1\right|$, (ii) $\left|x_2 - x_1\right|$ **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. $\left(\sqrt{3}+1\right)x - \left(\sqrt{3}-1\right)y = 4\left(\sqrt{3}-1\right)$ **5.** $2x + y + 6 = 0$

6. $x - \sqrt{3}y + 2\sqrt{3} = 0$ **7.** $5x + 3y + 2 = 0$

8. $3x - 4y + 8 = 0$ **9.** $5x - y + 20 = 0$

10. $(1 + n)x + 3(1 + n)y = n + 11$ **11.** $x + y = 5$

12. $x + 2y - 6 = 0,\ 2x + y - 6 = 0$

13. $\sqrt{3}x + y - 2 = 0$ and $\sqrt{3}x + y + 2 = 0$ **14.** $2x - 9y + 85 = 0$

15. $L = \frac{.192}{90}(C - 20) + 124.942$ **16.** 1340 litres. **18.** $2kx + hy = 3kh$.

EXERCISE 9.3

1. (i) $y = -\frac{1}{7}x + 0, -\frac{1}{7}, 0$; (ii) $y = -2x + \frac{5}{3}, -2, \frac{5}{3}$; (iii) $y = 0x + 0,\ 0,\ 0$

2. (i) $\frac{x}{4} + \frac{y}{6} = 1, 4, 6$; (ii) $\frac{x}{\frac{3}{2}} + \frac{y}{-2} = 1, \frac{3}{2}, -2$;

(iii) $y = -\frac{2}{3}$, intercept with y-axis $= -\frac{2}{3}$ and no intercept with x-axis.

3. 5 units

4. $(-2, 0)$ and $(8, 0)$ **5.** (i) $\frac{65}{17}$ units, (ii) $\frac{1}{\sqrt{2}}\left|\frac{p + r}{l}\right|$ units.

6. $3x - 4y + 18 = 0$ **7.** $y + 7x = 21$ **8.** $30°$ and $150°$

9. $\frac{22}{9}$

11. $\left(\sqrt{3} + 2\right)x + \left(2\sqrt{3} - 1\right)y = 8\sqrt{3} + 1$ or $\left(\sqrt{3} - 2\right)x + \left(1 + 2\sqrt{3}\right)y = -1 + 8\sqrt{3}$

12. $2x + y = 5$ **13.** $\left(\frac{68}{25}, -\frac{49}{25}\right)$ **14.** $m = \frac{1}{2}, c = \frac{5}{2}$

16. $y - x = 1,\ \sqrt{2}$

Miscellaneous Exercise on Chapter 9

1. (a) 3, (b) ± 2, (c) 6 or 1

2. $2x - 3y = 6, -3x + 2y = 6$ **3.** $\left(0, -\frac{8}{3}\right), \left(0, \frac{32}{3}\right)$

4. $\left|\text{Cos}\ \frac{\phi-\theta}{2}\right|$ **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. $\frac{1\pm5\sqrt{2}}{7}$ **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 $(\pm 6, 0)$; Major axis = 12; Minor axis = 8, $e = \frac{\sqrt{20}}{6}$,

Latus rectum = $\frac{16}{3}$

2. F $(0, \pm\sqrt{21})$; V $(0, \pm 5)$; Major axis = 10; Minor axis = 4, $e = \frac{\sqrt{21}}{5}$;

Latus rectum = $\frac{8}{5}$

3. F $(\pm\sqrt{7}, 0)$; V $(\pm 4, 0)$; Major axis = 8; Minor axis = 6, $e = \frac{\sqrt{7}}{4}$;

Latus rectum = $\frac{9}{2}$

4. F $(0, \pm\sqrt{75})$; V $(0, \pm 10)$; Major axis = 20; Minor axis = 10, $e = \frac{\sqrt{3}}{2}$;

Latus rectum = 5

5. F $(\pm\sqrt{13}, 0)$; V $(\pm 7, 0)$; Major axis = 14; Minor axis = 12, $e = \frac{\sqrt{13}}{7}$;

Latus rectum = $\frac{72}{7}$

6. F $(0, \pm 10\sqrt{3})$; V $(0, \pm 20)$; 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 $\left(0, \pm\sqrt{15}\right)$; 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 ± 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. $\lim\limits_{x \to a_1} f(x) = 0$ and $\lim\limits_{x \to a} f(x) = (a - a_1)(a - a_2) \ldots (a - a_x)$

30. $\lim\limits_{x \to a} f(x)$ exists for all $a \neq 0$. **31.** 2

32. For $\lim\limits_{x \to 0} f(x)$ to exists, we need $m = n$; $\lim\limits_{x \to 1} f(x)$ 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. $nx^{n-1} + a(n-1)x^{n-2} + a^2(n-2)x^{n-3} + \ldots + a^{n-1}$

7. (i) $2x - a - b$ (ii) $4ax\left(ax^2 + b\right)$ (iii) $\frac{a-b}{(x-b)^2}$

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

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

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

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

Miscellaneous Exercise on Chapter 12

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

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

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

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

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

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

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

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

20. $\dfrac{bc\cos x + ad\sin x + bd}{(c + d\cos x)^2}$ **21.** $\dfrac{\cos a}{\cos^2 x}$

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

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

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

27. $\dfrac{x\cos\dfrac{\pi}{4}(2\sin x - x\cos x)}{\sin^2 x}$ **28.** $\dfrac{1 + \tan x - x\sec^2 x}{(1 + \tan x)^2}$

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

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

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.** $\dfrac{n+1}{2}, \dfrac{n^2-1}{12}$ **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 (Winning Rs 4.00) $= \frac{1}{16}$, P(Winning Rs 1.50) $= \frac{1}{4}$, P (Losing Re. 1.00) $= \frac{3}{8}$

P (Losing Rs 3.50) $= \frac{1}{4}$, P (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∩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.** $\frac{1}{5040}$