

ANSWERS

1. SETS AND RELATIONS

Exercise 1.1

- 1) i) $A = \{M, A, R, I, G, E\}$
 ii) $B = \{0, 1, 2, 3, 4\}$
 iii) $C = \{2, 4, 6, 8, \dots\}$
- 2) i) $\{x/x \in W, x \notin N\}$
 ii) $\{x/-3 \leq x \leq 3, x \in Z\}$
 iii) $\{x/x = \frac{n}{n^2+1}, n \in N, n \leq 7\}$
- 3) i) $A \cup B \cup C = \{\frac{-5}{3}, -1, -\frac{1}{2}, \frac{3}{2}, 3\}$
 ii) $A \cap B \cap C = \{ \}$
- 6) i) 45 ii) 10 iii) 10 iv) 25
- 7) i) 132 ii) 63
- 8) i) 1750 ii) 250 iii) 1100
- 9) 42
- 10) i) 114 ii) 38 iii) 188
- 11) $P(A) = \{\{1\}, \{2\}, \{3\}, \{1,2\}, \{2,3\}, \{1,3\}, \{1,2,3\}, \{\phi\}\}$
- 12) i) $\{x/x \in R, -3 < x < 0\}$
 ii) $\{x/x \in R, 6 \leq x \leq 12\}$
 iii) $\{x/x \in R, 6 < x \leq 12\}$
 iv) $\{x/x \in R, -23 \leq x < 5\}$

Exercise 1.2

- 1) $x = 2, y = -2$
- 2) $x = 0, y = \frac{15}{2}$
- 3) i) $A \times B = \{(a,x), (a,y), (b,x), (b,y), (c,x), (c,y)\}$
 ii) $B \times A = \{(x,a), (x,b), (x,c), (y,a), (y,b), (y,c)\}$
 iii) $A \times A = \{(a,a), (a,b), (a,c), (b,a), (b,b), (b,c), (c,a), (c,b), (c,c)\}$
 iv) $B \times B = \{(x,x), (x,y), (y,x), (y,y)\}$
- 4) i) $P \times Q = \{(1,6), (2,6), (3,6), (1,4), (2,4), (3,4)\}$
 ii) $Q \times P = \{(6,1), (6,2), (6,3), (4,1), (4,2), (4,3)\}$
- 5) i) $A \times (B \cap C) = \{(1,5), (1,6), (2,5), (2,6), (3,5), (3,6), (4,5), (4,6)\}$
 ii) $\{(1,5), (1,6), (2,5), (2,6), (3,5), (3,6), (4,5), (4,6)\}$
 iii) $\{(1,4), (1,5), (1,6), (2,4), (2,5), (2,6), (3,4), (3,5), (3,6), (4,4), (4,5), (4,6)\}$
 iv) $\{(1,4), (1,5), (1,6), (2,4), (2,5), (2,6), (3,4), (3,5), (3,6), (4,4), (4,5), (4,6)\}$
- 6) $\{(0,10), (6,8), (8,6), (10,0)\}$
- 7) i) Domain = $\{1,2,3,4,5\}$; Range = $\{4\}$
 ii) Domain = $\{1,2,3,4,5,6,7,8,9,10,11\}$;
 Range = $\{11,10,9,8,7,6,5,4,3,2,1\}$
 iii) Domain = $\{2\}$; Range = $\{4,5,6,7\}$



9) i) $R_1 = \{(2,4), (3,9), (5,25), (7,49), (11,121), (13,169)\}$

Domain = $\{2,3,5,7,11,13\}$

Range = $\{4,9,25,49,121,169\}$

ii) $R_2 = \{(1,1), (2, \frac{1}{2}), (3, \frac{1}{3}), (4, \frac{1}{4}), (5, \frac{1}{5})\}$

Domain = $\{1,2,3,4,5\}$

Range = $\{1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}\}$

10) Range = $\{2,3,4,5\}$

11) i) $\{(1,3), (2,6), (3,9)\}$

ii) $\{(1,4), (1,6), (2,4), (2,6)\}$

iii) $\{(0,3), (1,2), (2,1), (3,0)\}$

MISCELLANEOUS EXERCISE - 1

- 1) i) $A = \{x/x = 10n, n \in \mathbb{N}, n \leq 5\}$
 ii) $B = \{x/x \text{ is vowel of English alphabets}\}$
 iii) $C = \{x/x \text{ represents day of a week}\}$

- 2) i) $A \cup B = \{1,2,4,6,7,10,11\}$
 ii) $B \cap C = \{\} = \phi$
 iii) $A - B = \{1,10\}$
 iv) $B - C = \{2,4,6,7,11\}$
 v) $A \cup B \cup C = \{1,2,3,4,5,6,7,8,9,10,11,12\}$
 vi) $A \cap (B \cup C) = \{4,7\}$

3) 230

4) 12

5) i) $A \times B = \{(1,2), (1,4), (2,2), (2,4), (3,2), (3,4)\}$

$B \times A = \{(2,1), (2,2), (2,3), (4,1), (4,2), (4,3)\}$

$A \times A = \{(1,1), (1,2), (1,3), (2,1), (2,2), (2,3), (3,1), (3,2), (3,3)\}$

$B \times B = \{(2,2), (2,4), (4,2), (4,4)\}$

$(A \times B) \cap (B \times A) = \{(2,2)\}$

ii) $A \times A \times A = \{(-1,-1,-1), (-1,-1,1), (-1,1,-1), (1,-1,-1), (1,-1,1), (1,1,-1), (1,1,1), (-1,1,1)\}$

6) i) R_1 is a relation

ii) R_2 is a relation

iii) R_3 is a relation

iv) R_4 is not a relation

7) Domain = $\{1,2,3,4\}$

Range = $\{4\}$

2. FUNCTION

Exercise 2.1

- 1) a) It is a function
 b) It is not a function
 c) It is not a function
- 2) a) It is not a function
 b) It is a function
 c) It is not a function
 d) It is a function
- 3) a) 1 b) 19 c) $-\frac{1}{4}$ d) $x^2 - x - 1$
 e) $x^2 + 3x + 1$
- 4) a) $\frac{6}{5}$ b) $x = \pm 3$
 c) $x = \frac{1}{2}$ or $x = -\frac{2}{3}$
- 5) $x = 0$ or $x = \pm 3$
- 6) a) $f(3) = 22$ b) $f(2) = 7$ c) $f(0) = 3$



- 7) a) $f(-4) = -18$ b) $f(-3) = -14$
 c) $f(1) = 5$ d) $f(5) = 25$
- 8) a) $9x + 4$ b) 0
 c) 238 d) $\frac{3x+5}{6x-1}$ domain = $R - \{\frac{1}{6}\}$
- 9) a) $50x^2 - 40x + 11$ b) $10x^2 + 13$
 c) $8x^4 + 24x^2 + 21$ d) $25x - 12$

MISCELLANEOUS EXERCISE - 2

- 1) i) Yes, Domain = $\{2,4,6,8,10,12,14\}$
 Range = $\{1,2,3,4,5,6,7\}$
 ii) Not a function
 iii) Yes, Domain = $\{1,3,5\}$,
 Range = $\{1,2\}$
- 2) $f^{-1}(x) = \frac{5(x-2)}{3}$
- 3) $f(-1) = 1$
 $f(-2) = -3$
 $f(0) = \text{does not exist}$
- 4) 2
- 5) $3x^2 - 11x + 15$
- 6) $a = 4$, $f(4) = 16$
- 7) $a = 3$, $b = -2$

3. COMPLEX NUMBERS

Exercise 3.1

- 1) i) $3 - i$ ii) $3 + i$
 iii) $-\sqrt{5} + \sqrt{7}i$ iv) $\sqrt{5}i$
 v) $-5i$ vi) $\sqrt{5} + i$
 vii) $\sqrt{2} - \sqrt{3}i$

- 2) i) $a = -4$, $b = -3$ ii) $a = \frac{-7}{2}$, $b = \frac{1}{2}$
 iii) $a = \frac{3}{10}$, $b = \frac{-1}{10}$ iv) $a = \frac{-8}{29}$, $b = 0$
 v) $a = \frac{11}{19}$, $b = \frac{2\sqrt{3}}{19}$
 vi) $a = 13$, $b = 0$
 vii) $a = \frac{23}{13}$, $b = \frac{15}{13}$

- 4) i) $-i$ ii) 1 iii) i
 iv) 1 v) $-i$ vi) -1
 vii) 0
- 6) i) $2i$ ii) 0
- 7) 1
- 8) i) $x = 1$, $y = 2$
 ii) $x = -2$, $y = 2$
- 9) i) 7
 ii) 2

Exercise 3.2

- 1) i) $\pm(1 - 3i)$ ii) $\pm(4 + 3i)$
 iii) $\pm(2 + \sqrt{3}i)$ iv) $\pm(\sqrt{5} + \sqrt{2}i)$
 v) $\pm(\sqrt{3} - i)$
- 2) i) $\frac{-1 \pm \sqrt{7}i}{8}$ ii) $\frac{\sqrt{3} \pm \sqrt{5}i}{4}$
 iii) $\frac{7 \pm \sqrt{11}i}{6}$ iv) $2 \pm 3i$
- 3) i) $x = 2i$ or $x = -5i$
 ii) $x = \frac{1}{2}i$ or $x = -2i$
 iii) $x = -2i$ iv) $x = -2i$



- 4) i) $x = 3 - i$ or $x = -1 + 2i$
 ii) $x = 3\sqrt{2}$ or $x = 2i$
 iii) $x = 3 - 4i$ or $x = 2 + 3i$
 iv) $x = 1 - i$ or $x = \frac{4}{5} - \frac{2}{5}i$

Exercise 3.3

- 1) i) 7 ii) 65 iii) w^2
 2) i) -1 ii) 0 iii) -1
 iv) 0 v) 1

MISCELLANEOUS EXERCISE - 3

- 1) -1
 2) $-3\sqrt{2}$
 3) i) $3 + 8i$ ii) $-4 + 0i$
 iii) $14 - 5i$ iv) $\frac{15}{2} - 10i$
 v) $-30 + 10i$ vi) $\frac{1}{2} + \frac{7}{2}i$
 vii) $\frac{-35}{26} - \frac{45}{26}i$ viii) $\frac{1}{4} + i\frac{\sqrt{15}}{4}$
 ix) $-i$ x) $\frac{8}{5} + \frac{56}{25}i$
 4) i) $x = 2, y = 1$ ii) 3, 2
 iii) 17, 19 iv) $\frac{28}{61}, \frac{3}{61}$
 v) 4, -2
 5) i) 1 ii) -2 iii) -3
 6) i) $\pm(3 + 5i)$ ii) $\pm(4 - i)$
 iii) $\pm(\sqrt{3} + i)$ iv) $\pm(3 + 3i)$
 v) $\pm(2 - i)$ vi) $\pm\sqrt{2}(2 + i)$

4. SEQUENCES AND SERIES

Exercise 4.1

- 1) i) $t_n = 2(3^{n-1})$ ii) $t_n = (-5)^{n-1}$
 iii) $t_n = (5)^{3/2-n}$ iv) it is not a G.P.
 v) it is not a G.P.
 2) i) $t_7 = \frac{1}{81}$ ii) $t_3 = \frac{7}{2187}$
 iii) $t_6 = -1701$ iv) $r = 3$
 3) $t_{10} = 5^{10}$
 4) $x = \pm \frac{4}{9}$
 5) G.P. with $a = \frac{4}{25}, r = \frac{5}{2}$
 6) 3, 6, 12 and 12, 6, 3
 7) $\frac{1}{27}, \frac{1}{3}, 3, 27$ or $27, 3, \frac{1}{3}, \frac{1}{27}$
 8) 1, 2, 4, 8, 16 or 1, -2, 4, -8, 16

Exercise 4.2

- 1) i) $S_n = 3(2^n - 1)$
 ii) $S_n = \frac{p^{2-n}(q^n - p^n)}{q - p}$
 2) i) $S_6 = \frac{266}{243}$
 ii) $a = 3$
 3) i) $n = 5$
 ii) $r = \frac{3}{5}$
 4) i) 635
 ii) $S_{10} = 2046$
 5) i) $\frac{1}{3} \left\{ \frac{10}{9} (10^n - 1) - n \right\}$



$$\text{ii) } \frac{8}{9} \left\{ \frac{10}{9} (10^n - 1) - n \right\}$$

$$6 \quad \text{i) } \frac{4}{9} \left\{ n - \frac{1}{9} [1 - (0.1)^n] \right\}$$

$$\text{ii) } \frac{7}{9} \left\{ n - \frac{1}{9} [1 - (0.1)^n] \right\}$$

$$7 \quad \text{i) } t_n = \frac{5}{9} [1 - (0.1)^n]$$

$$\text{ii) } t_n = \frac{2}{9} \{1 - (0.1)^n\}$$

$$8) \quad t_n = \frac{4}{3} (3^n)$$

Exercise 4.3

- 1) i) Sum to infinity = 1
ii) Sum to infinity = 6
iii) $\frac{-9}{4}$
iv) Sum to infinity does not exist.

$$2) \quad \text{i) } 0.\overline{32} = \frac{32}{99}$$

$$\text{ii) } 3.\overline{5} = \frac{32}{9}$$

$$\text{iii) } 4.\overline{18} = \frac{46}{11}$$

$$\text{iv) } 0.3\overline{45} = \frac{342}{990} = \frac{19}{55}$$

$$\text{v) } 3.4\overline{56} = \frac{3422}{990} = \frac{1711}{495}$$

$$3) \quad a = 4$$

$$4) \quad r = \frac{6}{11}$$

$$5) \quad \frac{15}{4}, \frac{15}{16}, \frac{15}{64}, \dots$$

Exercise 4.4

- 1) i) Given series is a H.P.
ii) Given series is a H.P.
iii) Given series is a H.P.

$$2) \quad \text{i) } \frac{1}{3n-1}, \frac{1}{23}$$

$$\text{ii) } \frac{1}{2n+2}, \frac{1}{18}$$

$$\text{iii) } \frac{1}{5n}, \frac{1}{40}$$

$$3) \quad A=5$$

$$4) \quad H = \frac{24}{5}$$

$$5) \quad G=60$$

$$6) \quad \frac{1}{9} \text{ and } \frac{1}{11}$$

$$7) \quad -3 \text{ and } 9$$

$$8) \quad 4 \text{ and } 9$$

$$9) \quad 14 \text{ and } 56$$

Exercise 4.5

$$1) \quad \frac{n(4n^2 + 9n - 1)}{6}$$

$$2) \quad \frac{n(2n^2 + n + 1)}{2}$$

$$3) \quad \frac{n(n+3)}{4}$$

$$4) \quad \frac{n(n+1)(n+2)}{12}$$

$$5) \quad \frac{n(16n^2 + 48n + 41)}{3}$$

- 6) $\frac{2n(n+1)(2n+1)}{3}$
 7) 2485
 8) $n(6n^3 + 8n^2 + 3n - 2)$
 9) $n = 48$

MISCELLANEOUS EXERCISE - 4

- 1) $t_{10} = 3072$.
 2) $r = \frac{3}{4}$
 3) $a = \frac{49}{5}, r = \frac{5}{7}$
 4) 5, 10, 20 or 20, 10, 5
 5) $\frac{1}{27}, \frac{1}{3}, 3, 27$ or $27, 3, \frac{1}{3}, \frac{1}{27}$
 6) $\frac{1}{3}, 1, 3, 9, 27$, or $27, 9, 3, 1, \frac{1}{3}$
 7) The sequence is a G.P. $r = 7$
 8) $\frac{2}{9} \left[\frac{10}{9} (10^n - 1) - n \right]$
 9) $t_n = \frac{2}{3} [1 - (0.1)^n]$
 10) $\frac{n(10n^2 + 27n - 1)}{6}$
 11) $\frac{n(n+1)(3n^2 - 17n + 26)}{12}$
 12) $\frac{n(n+1)(n+2)}{18}$
 13) $\frac{n(n+1)(2n+1)}{24}$
 14) $2n(n+1)(n+2)$
 15) 2364
 16) 1275

- 17) $r = \pm 15$
 18) $k = 2$
 19) 1

5. STRAIGHT LINE

Exercise 5.1

1. $2x - 4y + 5 = 0$
 2. $9x - y + 6 = 0$
 3. $3x^2 + 3y^2 + 4x - 24y + 32 = 0$
 4. $x^2 + y^2 - 11x - 11y + 53 = 0$
 5. $3x + 4y - 41 = 0$
 6. $x^2 + y^2 - 4x - 11y + 33 = 0$
 7. (a) $(-1, 0)$ (b) $(0, 2)$
 8. (a) $(6, 7)$ (b) $(4, 6)$
 9. $(-3, 11)$
 10. (a) $3X - Y + 6 = 0$
 (b) $X^2 + Y^2 + X + 4Y - 5 = 0$
 (c) $XY = 0$

Exercise 5.2

1. a) Slope of the line AB = 2
 b) Slope of the line CD = $\frac{4}{7}$
 c) Its slope is not defined.
 d) Slope of the line is 0.
 2. $-\frac{3}{2}$
 3. $\frac{1}{\sqrt{3}}$
 4. 1
 5. -1.
 7. 1
 8. $k = 1$



Exercise 5.3

- a) $y = 5$ b) $x = -5$ c) $y = -1$ and $y = 7$
- a) $y = 3$ b) $x = 4$
- a) $x = 2$ b) $y = -3$
- $4x - y - 8 = 0$
- $m = 1, c = -1$
- a) $2x + y - 4 = 0$
b) $2x - 5y + 14 = 0$
c) $2x + 4y - 13 = 0$.
- a) X- intercept 3, Y-intercept 2
b) X- intercept $\frac{2}{3}$, Y-intercept $\frac{3}{2}$
c) X- intercept -6 , Y-intercept 4
- $x + y - 7 = 0$
- a) $5x + y - 15 = 0$
b) $3x + 4y - 14 = 0$
c) $2x - 3y - 1 = 0$

Exercise 5.4

- a) slope $-\frac{2}{3}$, X-intercept 3, Y-intercept 2
b) slope $-\frac{1}{2}$, both the intercepts 0
- a) $2x - y - 4 = 0$, b) $0x + 1y - 4 = 0$
c) $2x + y - 4 = 0$ d) $2x - 3y + 0 = 0$
- $P = \pm 24$
- $(1, -1)$
- $x + 3y = 3$
- 4 units
- $\frac{25}{\sqrt{117}}$ units

- $8x + 13y - 24 = 0$
- $2x + y + 13 = 0, x - 9y + 73 = 0,$
 $11x - 4y - 52 = 0, \left(\frac{-1}{19}, \frac{-10}{19}\right)$

MISCELLANEOUS EXERCISE - 5

- a) $-\frac{7}{2}$ b) $-\frac{1}{4}$ c) -1 d) 4
- a) $\frac{1}{\sqrt{3}}$ b) $\frac{4}{3}$ c) $-\frac{1}{2}$
- a) 22 b) $\frac{5}{3}$ c) 1
- $y = -2x - \frac{8}{3}$, slope $= -2$.
- 1
- 1
- No, point does not satisfy the equation.
- (d) $2x - y = 0$.
- a) $y + 3 = 0$ b) $x + 2 = 0$
c) $y = 5$ d) $x = 3$
- a) $y = 3$ b) $y = 4$
c) $x = 2$
- a) $5x - y + 7 = 0$ b) $13x - y = 25$
c) $x = 7$ d) $x = 0$
e) $3x - 2y = 0$
- $4x - 3y + 12 = 0$
- a) $5x - y - 25 = 0$ b) $\sqrt{3}x - y + 4 = 0$
- a) BC : $3x + y = 9$, CA : $x = 1$,
AB : $x + y = 5$
b) Median AD : $x - y + 3 = 0$,
Median BE : $2x + y = 7$,
Median CF : $5x + y = 11$
c) $x - 3y + 12 = 0, y = 5, x - y + 2 = 0$,
d) $x - 3y + 11 = 0, y = 3, x - y + 5 = 0$



6. DETERMINANTS

Exercise 6.1

- 1) i) 49 ii) -358
 iii) $-27+9i$ iv) -20
 v) -10 vi) 46
 vii) $abc + 2fgh - af^2 - bg^2 - ch^2$
 viii) 0
- 2) i) $x = 2$ ii) $x = \frac{14}{5}$
 iii) $x = 1$ or $x = 2$ or $x = 3$
- 3) i) $x = 2$ or $x = -4$ ii) $x = -1$ or $x = 2$
- 4) $x = -2$
- 5) $x = 11$ and $y = 52$

Exercise 6.2

- 1) i) 0 ii) 0 iii) 0
- 2) $4abc$
- 3) $x = -\frac{7}{3}$
- 4) $x = 0$, or $x = 12$
- 5) $10 \begin{vmatrix} 1 & 2 & 1 \\ 3 & 1 & 7 \\ 3 & 2 & 6 \end{vmatrix}$
- 6) i) 0 ii) 0
- 7) (i) $\begin{vmatrix} c_1 & a_1 & b_1 \\ c_2 & a_2 & b_2 \\ c_3 & a_3 & b_3 \end{vmatrix}$
 (ii) $\begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix}$

Exercise 6.3

- 1) i) $x = \frac{5}{3}, y = 1, z = \frac{-4}{3}$
 ii) $x = \frac{1499}{447}, y = \frac{520}{447}, z = \frac{332}{447}$
 iii) $x = 4, y = 7, z = 6$
 iv) $x = \frac{3}{5}, y = \frac{-3}{5}, z = \frac{-1}{2}$
 v) $x=1, y=-2, z=2$
- 2) Rs. 1750, Rs. 1500, Rs. 1750
- 3) Consistent
- 4) i) $k = 16$ ii) $k = \frac{22}{5}$
- 5) i) 13 sq. unit ii) $\frac{35}{2}$ sq. unit
 iii) 25 sq. unit
- 6) $k = 3; k = \frac{-7}{3}$
- 7) $\frac{35}{2}$ sq. unit
- 8) $A(\triangle PQR) = 0$
- 9) 3, 5, 7 are the three required numbers

MISCELLANEOUS EXERCISE - 6

- 1) i) -113 ii) -76
- 2) i) $x = \frac{-1}{3}$ or $x = 2$ ii) $x = \frac{2}{3}$
- 3) 0
- 4) i) 0 ii) LHS = RHS
 iii) LHS = RHS iv) 0
- 5) i) $x = 1, y = 2, z = 1$
 ii) $x = \frac{3}{5}, y = \frac{-3}{5}, z = \frac{-1}{2}$



iii) $x = \frac{9}{2}, y = -\frac{3}{2}, z = \frac{1}{2}$

6) i) $k = 5$ ii) $k = \frac{14}{5}$ or $k = 2$

7) i) 4 sq. unit

ii) $\frac{25}{2}$ sq. unit iii) $\frac{13}{2}$ sq. unit

8) i) $k = 0; k = 8$ ii) $k = 34; k = 1$

II. 1. $\frac{2}{3\sqrt{3}}$ 2. -8

III. 1. $\frac{7}{2}$ 2. 1 3. 24 4. -24

IV. 1. 2 2. $\frac{-1}{3}$

Exercise 7.4

I. 1. $\frac{1}{\log 4} \log\left(\frac{9}{5}\right)$ 2. $\log\left(\frac{15}{2}\right)$ 3. 1

II. 1. $(\log 3)^2$ 2. $e^{\frac{2}{3}}$ 3. $\frac{-2}{3}$

III. 1. $\frac{1}{4} \log\left(\frac{a^3}{b^2}\right)$ 2. $\frac{(\log 2)^2}{\log 3}$

3. $(\log 3)(\log 5)$ 4. $\frac{1}{6}$

IV. 1. $(\log 5)^2$ 2. $(\log 7 - \log 5)^2$

7. LIMITS

Exercise 7.1

I. 1. 1 2. $\frac{-3}{16}$ 3. $\frac{3}{125}$ 4. $\pm \frac{2}{\sqrt{3}}$

II. 1. $\frac{2}{3(\sqrt[3]{7})}$ 2. 4 3. 4

III. 1. $\frac{-1}{6}$ 2. 24 3. $\frac{3}{2}(a+2)^{1/2}$
4. $\frac{15}{2}$

Exercise 7.2

I. 1. $\frac{-1}{4}$ 2. $\frac{-1}{2}$ 3. $\frac{-1}{2}$ 4. $\frac{-1}{2}$

II. 1. $\frac{4}{3}$ 2. 0 3. 0

III. 1. 44 2. 3 3. -3 4. 8

Exercise 7.3

I. 1. $\frac{1}{2\sqrt{6}}$ 2. -1 3. $\sqrt{2}$

MISCELLANEOUS EXERCISE - 7

I. 1) $n = 5$

II. 1) $\frac{5}{3}(a+2)^{2/3}$ 2) n 3) 1

4) $\frac{3}{7}$ 5) 1 6) $-\frac{1}{3}$ 7) $\log 5$

8) $e^{\frac{1}{5}}$ 9) 9 10) $\frac{5}{3}$

11) $\log(abc)$ 12) 1 13) 1

14) $2(\log a)^2$ 15) $(\log 5)^2$ 16) $\frac{2 \log a}{\log b}$

17) 100 18) $\frac{-1}{2}$ 19) 3



8. CONTINUITY

Exercise 8.1

- 1) i) Continuous at $x = -2$
ii) Continuous on $\mathbb{R}$ except at $x = 3$
- 2) i) Discontinuous at $x = 2$
ii) Continuous at $x = 1$
- 3) i) Discontinuous at $x = 2$
ii) Continuous at $x = 2$
iii) Continuous at $x = \frac{8}{3}$
iv) Continuous at $x = 3$
- 4) i) $k = \frac{3}{2}$
ii) $k = (\log 5)^2$
iii) $a = 2, b = -4$
iv) $a = \frac{1}{2}, b = \frac{1}{2}$

MISCELLANEOUS EXERCISE - 8

- I) 1) Continuous on its domain except at $x = 5$
2) Continuous
3) Continuous
4) Discontinuous
5) Discontinuous
- II) 1) $k = e^6$, 2) $k = 125$ 3) $k = \frac{3}{2}$
- III) 1) $a = 1$, $b = -1$
2) $a = -1$, $b = -22$
3) $a = \frac{1}{3}$, $b = \frac{3}{2}$

9. DIFFERENTIATION

Exercise 9.1

- I) 1) $12x^{11}$ 2) $-9x^{-10}$
3) $\frac{3}{2}\sqrt{x}$ 4) $\frac{21}{2}\sqrt{x}$
5) 0
- II) 1) $5x^4 + 12x^3$ 2) $\frac{3\sqrt{x}}{2} + \frac{1}{x} - e^x$
3) $\frac{5x^{3/2}}{2} + 7x^{2/5}$ 4) $x^{5/2} + x^{-3/5}$
5) $\frac{9}{2}x^{7/2} + 5x^{3/2} + \frac{1}{2\sqrt{x}}$
- III) 1) $x^2 + 3x^2 \log x$ 2) $\left(x^{5/2} + \frac{5}{2}x^{3/2}\right)e^x$
3) $e^x \left(\frac{1}{x} + \log x\right)$ 4) $3^x x^2 (x \log 3 + 3)$
- IV) 1) $\frac{-4a^2x}{(x^2 - a^2)^2}$
2) $\frac{-6x^4 + 30x^2 - 24x}{(2x^3 - 4)^2}$
3) $\frac{(x^3 - 5)\frac{1}{x} - \log x \cdot 3x^2}{(x^3 - 5)^2}$
4) $\frac{12e^x}{(3e^x + 2)^2}$
5) $e^x \left[\frac{(x + e^x)(x + 1) - x(1 + e^x)}{(x + e^x)^2} \right]$
- V) 1) $6x$ 2) $\frac{3\sqrt{x}}{2}$
3) $\frac{-2}{(2x + 3)^2}$ 4) $\frac{9}{(2x + 7)^2}$



Exercise 9.2

I) 1) $\frac{1}{(x+1)^2}$ 2) $1 - \frac{1}{x^2}$
 3) $\frac{-e^x}{(e^x+1)^2}$ 4) $\frac{e^x}{(e^x+1)^2}$
 5) $\frac{\log x - 1}{(\log x)^2}$ 6) $\frac{2^x(\log x \log 2) - \frac{1}{x}}{(\log x)^2}$
 7) $\frac{4e^x}{(2e^x+1)^2}$ 8) $\frac{(2x+1-x^2)e^x+2x}{(e^x+1)^2}$

II) 1) -3 2) -6 3) -5
 4) $\frac{dc}{dx} = 256$; $AC = \frac{359}{4}$
 5) 25
 6) $MC = 40\log 2$; $AC = 19$
 7) -3
 8) $\frac{dc}{dx} = 20.e^4$; $AC = 5e^4$
 9) $R = 27650$, A.R. = 2765,
 M.R. = 7855
 10) 23
 11) $AC = x + 15 + \frac{81}{x}$, $MC = 2x + 15$.
 at $x = 10$, $MC = 35$ For $AC = MC$ $x = 9$

MISCELLANEOUS EXERCISE - 9

I. 1) $5x^4$ 2) $\frac{-2}{x^3}$
 3) $\frac{1}{2\sqrt{x}}$ 4) $\frac{3}{2}x^{1/2}$
 5) $-\frac{1}{2x^{\frac{3}{2}}}$ 6) $7^x \log 7$

II. 1) $2x - \frac{2}{x^3}$ 2) $\left(1 + \frac{1}{\sqrt{x}}\right)$
 3) $1 - \frac{1}{x^2}$ 4) $3x^2 - 4x + \frac{1}{2\sqrt{x}}$
 5) $2x + 2^x \log 2$ 6) $-3 + 2x$
 7) $\frac{1}{(2+x)^2}$ 8) $\frac{-\log x}{x^2}$
 9) $\frac{e^x(x \log x - 1)}{x(\log x)^2}$
 10) $2x^2 \log x + (x^2 + 1) + (x^2 + 1) \log x$

III. 1) -3. The rate of change of demand is negative it means, the demand will fall when the price becomes Rs. 2/-.
 2) $\frac{-3}{4}$, The rate of change of demand is negative means, the demand falls when the price becomes Rs. 4/-.
 3) 150, The rate of change of supply w.r.t. price is positive means, supply will increase if the price increase.
 4) $AC = x + 4 + \frac{4}{x}$; $MC = 18$
 5) -3 6) -6
 7) -5
 8) $\frac{dc}{dx} = 256$, $AC = \frac{353}{4}$
 9) 23
 10) $AC = x + 15 + \frac{81}{x}$,
 $MC = 2x + 15$ at $x = 10$
 $MC = 35$ for $AC = MC$, $x = 9$

