

Answers

Exercise 1.1

- (1) (i) $\{2, 3, 5, 7\}$ (ii) $\{1\}$ (iii) $\{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ (iv) $\{-5\}$
 (2) $\{x \in \mathbb{R} : x^2 = 1\}$
 (3) (i) finite (ii) infinite (iii) infinite (iv) infinite (v) infinite
 (5) not true (6) 0 (7) 128 (8) $\{0, 1, 2, 3\}$
 (9) $A = \{x, y, z\}$ and $B = \{1, 2\}$ (10) $\{(-1, 0), (-1, 1), (0, 2), (1, 2)\}$

Exercise 1.2

- (1) (i) reflexive; not symmetric; transitive (ii) not reflexive; symmetric; not transitive
 (iii) reflexive; not symmetric; not transitive (iv) reflexive; symmetric
 (v) R is an empty set; not reflexive; symmetric; transitive
 (2) (i) (c, c) and (d, d) (ii) (c, a)
 (iii) nothing to include (iv) $(c, c), (d, d), (c, a)$ to be included
 (3) (i) (c, c) (ii) (c, a) (iii) nothing (iv) (c, c) and (c, a)
 (5) $\{(3, 8), (6, 6), (9, 4), (12, 2)\}$; not reflexive; not symmetric; transitive; not an equivalence relation
 (7) $R = \{(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (2, 1), (2, 2), (2, 3), (2, 4), (3, 1), (3, 2), (3, 3), (4, 1),$
 $(4, 2), (5, 1)\}$; not reflexive; symmetric; not transitive; not equivalence
 (8) smallest set is $\{(a, a), (b, b), (c, c)\}$; largest set is $A \times A$

Exercise 1.3

- (1) Yes; inverse is not a function
 (2) $f(-4) = 8, f(1) = 0, f(-2) = 6, f(7) = 0, f(0) = 0$
 (3) $f(-3) = 1, f(5) = 38, f(2) = 1, f(-1) = -5, f(0) = -3$
 (4) (i) a function; not one-to-one and not onto (ii) not a function
 (5) (i) $\{(1, a), (2, a), (3, a), (4, a)\}$ (ii) not possible (iii) not possible
 (iv) $\{(1, a), (2, b), (3, c), (4, d)\}$
 (6) $\mathbb{R} - \{n\pi + (-1)^n \frac{\pi}{6}, n \in \mathbb{Z}\}$ (7) $\emptyset$
 (8) $(-\infty, -\frac{1}{3}] \cup [1, \infty)$ (9) $\mathbb{R} - \{0\}, \mathbb{R} - \{0\}$
 (10) for all $x, (f \circ g) = \mathbf{O}, (g \circ f) = \mathbf{O}$ (12) $f^{-1}(x) = \frac{x+5}{3}$ (13) $x > 0$
 (15) total cost = $0.43m + 50$, airfare = ₹738
 (16) $(A + S)(x) = 55,000 + 0.09x$, total family income = ₹14,05,000

$$(17) (g \circ f)(x) = 62.115x$$

$$(18) \text{ day revenue} = (200 - x)x;$$

$$\text{total cost} = 100(200 - x);$$

$$\text{total profit} = (200 - x)x - 100(200 - x) \text{ in rupees}$$

$$(19) f^{-1}(x) = \frac{9x}{5} + 32$$

$$(20) f^{-1}(x) = \frac{x+4}{3}$$

Exercise 1.5

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(3)	(2)	(4)	(1)	(1)	(4)	(2)	(2)	(3)	(2)	(2)	(3)	(3)	(2)	(4)
16	17	18	19	20	21	22	23	24	25					
(3)	(4)	(3)	(2)	(4)	(4)	(1)	(4)	(2)	(3)					

Exercise 2.1

$$(1) \sqrt{7} \in \mathbb{R} - \mathbb{Q}, \quad -\frac{1}{4} \in \mathbb{Q}, \quad 0 \in \mathbb{Z}, \mathbb{Q},$$

$$3.14 \in \mathbb{Q}, \quad 4 \in \mathbb{N}, \mathbb{Z}, \mathbb{Q}, \quad \frac{22}{7} \in \mathbb{Q}$$

$$(3) \text{ yes, } 4 + \sqrt{3}, 2 + \sqrt{3} \quad (4) \text{ yes, } 2 + \sqrt{3}, 2 - \sqrt{3} \quad (5) \frac{1}{2^{1001}}$$

Exercise 2.2

$$(1)(i) -4 < x < 10 \quad (ii) \mathbb{R} \quad (iii) \frac{11}{3} \leq x \leq \frac{13}{3} \quad (iv) -7 < x < 7$$

$$(2) \left(-\infty, \frac{5}{12}\right) \cup \left(\frac{7}{12}, \infty\right) \quad (3) \left(-\infty, \frac{-7}{3}\right] \cup \left[\frac{7}{3}, \infty\right) \quad (4) -\frac{15}{2} \leq x \leq \frac{11}{2}$$

$$(5) -\frac{3}{10} < x < \frac{7}{10} \quad (6) \text{ no solution}$$

Exercise 2.3

$$(1)(i) [-1, 4) \quad (ii) [-3, 5] \quad (iii) (-\infty, 3) \quad (iv) (-\infty, 5)$$

$$(2)(i) 1, 2, 3, 4 \quad (ii) \dots, -3, -2, -1, 0, 1, 2, 3, 4$$

$$(3)(i) \left(-\infty, -\frac{9}{2}\right] \quad (ii) \dots, -7, -6, -5 \quad (iii) \text{ no solution}$$

$$(5) 93 \quad (6) \text{ between } 120\ell \text{ and } 300\ell \quad (7) (11, 13), (13, 15), (15, 17), (17, 19)$$

$$(8) t = 9 \text{ seconds, } 11 \text{ seconds} \quad (9) \text{ less than } 10 \text{ hours} \quad (10) \text{ less than ₹21,000 or greater than ₹33,000}$$

Exercise 2.4

$$(1) x^2 - 4x - 21 = 0 \quad (2) -\frac{2}{5}(x^2 - 2x - 4) \quad (3) x^2 + \frac{\sqrt{2}}{3}x + \frac{1}{3} = 0$$

$$(6)(i) b = 0 \quad (ii) 3b^2 = 16ac \quad (iii) c = a$$

- (8) (i) real and distinct (ii) real and distinct (iii) real and distinct
 (9) (i) not intersect (ii) intersect at two points (iii) touch at only one point
 (10) $\left(x + \frac{5}{2}\right)^2 - \left(\frac{3}{2}\right)^2$

Exercise 2.5

- (1) $\left[-3, \frac{5}{2}\right]$ (2) $[1, 2]$

Exercise 2.6

- (1) $-\frac{5}{2}$ and $\frac{5}{2}$ (2) $\frac{3 + \sqrt{53}}{2}$ and $\frac{3 - \sqrt{53}}{2}$ (3) $x = \pm 2$ (4) $x = -\frac{3}{5}$ or -1

Exercise 2.7

- (1) $(x^2 + \sqrt{2}x + 1)(x^2 - \sqrt{2}x + 1)$ (2) $a = 5$

Exercise 2.8

- (1) $(0, 1) \cup (2, \infty)$ (2) $\left(-\infty, \frac{3}{2}\right) \cup (2, 4)$ (3) $(-3, -2] \cup [2, 5)$

Exercise 2.9

- (1) $\frac{1}{2a(x-a)} - \frac{1}{2a(x+a)}$ (2) $\frac{7}{3(x-2)} + \frac{2}{3(x+1)}$
 (3) $\frac{1}{6(x-1)} + \frac{2}{15(x+2)} + \frac{-3x+1}{10(x^2+1)}$ (4) $\frac{1}{(x-1)^2} + \frac{1}{(x-1)^3}$
 (5) $\frac{1}{2(x^2-1)} - \frac{2}{2(x^2+1)}$ (6) $\frac{1}{x} - \frac{2}{x^2+1}$
 (7) $1 + \frac{13}{x-3} - \frac{7}{x-2}$ (8) $x + \frac{9}{x+2} - \frac{13}{x+3}$
 (9) $-\frac{14}{9(x+1)} - \frac{11}{3(x+1)^2} + \frac{14}{9(x-2)}$ (10) $\frac{4}{x+1} + \frac{2x-3}{x^2+1}$
 (11) $2 + \left(\frac{2}{x+3} - \frac{1}{x-1}\right)$ (12) $\frac{3}{x+1} + \frac{4-3x}{x^2+1}$

Exercise 2.11

- (1)(i) 25 (ii) $\frac{1}{8}$ (iii) $\frac{1}{100}$ (iv) $\frac{1}{9}$ (v) $\frac{1}{3}$
 (2) 8 (3) $\frac{1}{\sqrt{2}}$ (4) $\frac{1}{2}$ (5) 2

$$(6) \frac{21 + 7\sqrt{2} + 3\sqrt{6} + 2\sqrt{3}}{7} \quad (7) \ 5 \quad (8) \ \frac{2 + 2\sqrt{6}}{5}$$

Exercise 2.12

$$(1) \log_b y = x, \quad (0, \infty), \quad (-\infty, \infty)$$

$$(2) \frac{5}{6} \quad (3) \ 64 \quad (4) \ 2 \quad (11) \ 2\sqrt{2} \quad (12) \ -10$$

Exercise 2.13

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(2)	(1)	(2)	(3)	(2)	(2)	(3)	(1)	(2)	(2)	(2)	(3)	(3)	(2)	(3)
16	17	18	19	20										
(1)	(3)	(1)	(1)	(4)										

Exercise 3.1

$$(1)(i) \text{ first quadrant} \quad (ii) \text{ second quadrant} \quad (iii) \text{ fourth quadrant} \quad (iv) \text{ fourth quadrant}$$

$$(v) \text{ second quadrant}$$

$$(2)(i) \ 35^\circ \quad (ii) \ 165^\circ \quad (iii) \ 70^\circ \quad (iv) \ 90^\circ \quad (v) \ 270^\circ \quad (8) \ k \in [-1, 1]$$

$$(9) \sec \theta = \frac{p^2 + 1}{2p}; \tan \theta = \frac{p^2 - 1}{2p}; \sin \theta = \frac{p^2 - 1}{p^2 + 1} \quad (12) \ (c^2 + bd)^2 = (ad + cb)^2 + (ac - b^2)^2$$

Exercise 3.2

$$(1)(i) \ \frac{\pi}{6} \text{ radians} \quad (ii) \ \frac{3\pi}{4} \text{ radians} \quad (iii) \ -\frac{41\pi}{36} \text{ radians} \quad (iv) \ \frac{5\pi}{6} \text{ radians} \quad (v) \ \frac{11\pi}{6} \text{ radians}$$

$$(2)(i) \ 60^\circ \quad (ii) \ 20^\circ \quad (iii) \ 72^\circ \quad (iv) \ 420^\circ \quad (v) \ 200^\circ$$

$$(3) \ r \approx 31.82 \text{ meters} \quad (4) \ s = \frac{20\pi}{3} = 20.92\text{cm} \quad (5) \ \theta = 12^\circ 36' \quad (6) \ s = 7.16\text{feet}$$

$$(7) \ r_1 : r_2 = 5 : 4$$

$$(8) \text{ Angle of sector} \approx 65^\circ 27' 16'' \quad (9) \ 6000^\circ \quad (10) \ 14^\circ \quad (11) \ \frac{3\pi}{4}$$

Exercise 3.3

$$(1)(i) \ \frac{\sqrt{3}}{2} \quad (ii) \ -\frac{1}{2} \quad (iii) \ \frac{1}{2} \quad (iv) \ -\frac{1}{\sqrt{3}} \quad (v) \ -\frac{1}{\sqrt{3}} \quad (vi) \ \sqrt{3} \quad (vii) \ \frac{\sqrt{3}}{2}$$

$$(2) \sin \theta = \frac{2\sqrt{6}}{7}; \cos \theta = \frac{5}{7}; \tan \theta = \frac{2\sqrt{6}}{5};$$

$$\operatorname{cosec} \theta = \frac{7}{2\sqrt{6}}; \sec \theta = \frac{7}{5}; \cot \theta = \frac{5}{2\sqrt{6}}$$

$$\begin{aligned}
(3)(i) \quad \sin \theta &= -\frac{\sqrt{3}}{2}; \quad \operatorname{cosec} \theta = -\frac{2}{\sqrt{3}}; \quad \sec \theta = -2; \quad \tan \theta = \sqrt{3}; \quad \cot \theta = \frac{1}{\sqrt{3}} \\
(ii) \quad \sin \theta &= \frac{\sqrt{5}}{3}; \quad \operatorname{cosec} \theta = \frac{3}{\sqrt{5}}; \quad \sec \theta = \frac{3}{2}; \quad \tan \theta = \frac{\sqrt{5}}{2}; \quad \cot \theta = \frac{2}{\sqrt{5}} \\
(iii) \quad \cos \theta &= \frac{\sqrt{5}}{3}; \quad \operatorname{cosec} \theta = -\frac{3}{2}; \quad \sec \theta = \frac{3}{\sqrt{5}}; \quad \tan \theta = -\frac{2}{\sqrt{5}}; \quad \cot \theta = -\frac{\sqrt{5}}{2} \\
(iv) \quad \sec \theta &= -\sqrt{5}; \quad \cos \theta = -\frac{1}{\sqrt{5}}; \quad \cot \theta = -\frac{1}{2}; \quad \sin \theta = \frac{2}{\sqrt{5}}; \quad \operatorname{cosec} \theta = \frac{\sqrt{5}}{2} \\
(v) \quad \cos \theta &= \frac{5}{13}; \quad \sin \theta = -\frac{12}{13}; \quad \operatorname{cosec} \theta = -\frac{13}{12}; \quad \tan \theta = -\frac{12}{5}; \quad \cot \theta = -\frac{5}{12}
\end{aligned}$$

(5) $\theta = 60^\circ, 120^\circ, 240^\circ, 300^\circ$,

Exercise 3.4

$$\begin{aligned}
(1)(i) \quad \sin(x+y) &= \frac{220}{221} & (ii) \quad \cos(x-y) &= \frac{171}{221} & (iii) \quad \tan(x+y) &= \frac{220}{21} \\
(2)(i) \quad \sin(A+B) &= \frac{187}{205} & (ii) \quad \cos(A-B) &= \frac{156}{205} & (3) \quad \cos(x-y) &= \frac{4}{5} \\
(4) \quad \sin(x-y) &= -\frac{87}{425} & (5) \quad \cos 105^\circ &= \frac{1-\sqrt{3}}{2\sqrt{2}}; & \sin 105^\circ &= \frac{\sqrt{3}+1}{2\sqrt{2}}; \\
&\tan\left(\frac{7\pi}{12}\right) & &= -(2+\sqrt{3}) \\
(7) \quad 4x^2 - 2\sqrt{6}x + 1 &= 0 & (16) \quad 0 & (22) \quad 1 & (24) \quad \frac{2}{11}
\end{aligned}$$

Exercise 3.5

$$(1)(i) \quad \frac{161}{289} \quad (ii) \quad -\frac{7}{25} \quad (iii) \quad \frac{3713}{4225} \quad (2)(i) \quad \frac{2\sqrt{3}}{5}, \quad \frac{1}{3\sqrt{2}}$$

Exercise 3.6

$$\begin{aligned}
(1)(i) \quad \frac{1}{2} [\sin 63^\circ + \sin 7^\circ] & \quad (ii) \quad \frac{1}{2} [\sin 6x + \sin 2x] & (iii) \quad \frac{1}{2} [\sin 12\theta + \sin 8\theta] \\
(iv) \quad \frac{1}{2} [\cos 7\theta + \cos 3\theta] & \quad (v) \quad \frac{1}{2} [\cos \theta - \cos 9\theta] & (2)(i) \quad 2 \cos 55^\circ \sin 20^\circ \\
(ii) \quad 2 \cos 40^\circ \cos 25^\circ & \quad (iii) \quad 2 \sin 45^\circ \cos 5^\circ & (iv) \quad 2 \sin 55^\circ \sin 20^\circ
\end{aligned}$$

Exercise 3.8

$$\begin{aligned}
(1)(i) \quad \theta &= -\frac{\pi}{4}; \quad \theta = n\pi + (-1)^n \left(-\frac{\pi}{4}\right), \quad n \in \mathbb{Z} \\
(ii) \quad \theta &= \frac{\pi}{6}; \quad \theta = n\pi + \frac{\pi}{6}, \quad n \in \mathbb{Z} \\
(iii) \quad \theta &= -\frac{\pi}{6}; \quad \theta = n\pi + \left(-\frac{\pi}{6}\right), \quad n \in \mathbb{Z} \\
(2)(i) \quad x &= 0, \frac{\pi}{2}, \pi, \frac{3\pi}{2} & (ii) \quad x = \frac{2\pi}{3}, \frac{4\pi}{3}, \pi \\
(iii) \quad x &= \frac{\pi}{2}, \frac{\pi}{6}, \frac{5\pi}{6} & (iv) \quad x = 0, \pi
\end{aligned}$$

- (3)(i) $x = (2n+1)\frac{\pi}{6}$ or $x = \frac{n\pi}{2} + (-1)^n \frac{\pi}{12}$, $n \in \mathbb{Z}$
(ii) $\theta = n\pi + (-1)^n \frac{\pi}{6}$ or $\theta = n\pi + (-1)^n \frac{\pi}{2}$, $n \in \mathbb{Z}$
(iii) $\theta = (2n+1)\frac{\pi}{4}$ or $\theta = 2n\pi$, $n \in \mathbb{Z}$
(iv) $\theta = \frac{n\pi}{3}$ or $\theta = n\pi \pm \frac{\pi}{3}$, $n \in \mathbb{Z}$
(v) $\theta = 2n\pi$ or $\theta = \frac{2n\pi}{3} + \left(\frac{-\pi}{6}\right)$, $n \in \mathbb{Z}$
(vi) $\theta = (8n+1)\frac{\pi}{4}$, $n \in \mathbb{Z}$
(vii) $\theta = 2n\pi + \frac{\pi}{6} \pm \frac{\pi}{3}$, $n \in \mathbb{Z}$
(viii) $\theta = 2n\pi - \frac{\pi}{2} \pm \frac{2\pi}{3}$, $n \in \mathbb{Z}$
(ix) $\theta = \frac{n\pi}{3} + \frac{\pi}{18}$, $n \in \mathbb{Z}$
(x) $\theta = n\pi \pm \frac{\pi}{10}$, $n \in \mathbb{Z}$
(xi) $x = 2n\pi \pm \frac{\pi}{3}$, $n \in \mathbb{Z}$

Exercise 3.9

- (2) $\angle A = 75^\circ$ (9) $40m, 40m, 40m$ (10) $4m, 4m, 4m$ and $4\sqrt{3}$ sq.meter.

Exercise 3.10

- (1) no such triangle exist (3) $\angle A = 15^\circ, \angle B = 105^\circ$ (7) $\frac{5\sqrt{2}}{\sqrt{3}-1}$ km (8) $2\sqrt{13}$ km
(9) $3 + \sqrt{73}$ km (10) 7 km
(11) Total Cost: 155800 and Perimeter $180 + 20\sqrt{27}$ feet
(12) $x = 100$ km (13) $\sqrt{5 - 2\sqrt{2}}$ km
(14) $2\sqrt{6} + 2\sqrt{3} + 6$ km (15) $AB = 10\sqrt{3}$ km

Exercise 3.11

- (1)(i) $\theta = \frac{\pi}{4}$ (ii) $\theta = \frac{\pi}{6}$ (iii) $\theta = -\frac{\pi}{2}$ (iv) $\theta = \frac{3\pi}{4}$ (v) $\theta = \frac{\pi}{3}$

Exercise 3.12

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(4)	(1)	(1)	(1)	(4)	(4)	(1)	(2)	(4)	(2)	(3)	(2)	(3)	(3)	(2)
16	17	18	19	20										
(4)	(1)	(1)	(1)	(1)										

Exercise 4.1

- (1)(i) 17 (ii) 6 (iii) 20 (iv) 720 (v) 120
 (2)(i) 151200 (ii) 24 (3)(i) 12 (ii) 24 (4)(i) 64 (ii) 24
 (5)(i) 90 (ii) 64 (6)(i) 144 (ii) 80 (7)(i) 48 (ii) 90
 (8)(i) 9000 (ii) 4536 (iii) 4464 (9)(i) 36 (ii) 60 (10) 13
 (11) 400 (12)(i) 42 (ii) 78 (13)(i) 4^6 (ii) 3^{10} (iii) 10^{12}
 (14)(i) 720 (ii) 144 (iii) 4 (iv) 144 (v) 220 (vi) $(n+3)(n+2)$
 (15)(i) 15 (ii) 120 (iii) $\frac{n(n-1)}{2}$ 16.(i) 4 (ii) 100

Exercise 4.2

- (1) 10 (2) 4 (3)(i) 336 (ii) 172800 (4) 720
 (5)(i) 4^{10} (ii) $3^4 \times 5^6$ (iii) $11!$ (6)(i) 4^5 (ii) 15^5
 (7) 144 (8)(i) $14!$ (ii) $9! \times 6!$ (iii) $8! \times {}^9P_6$ (9) 34650
 (10) 1260 (11) 6912 (12) 60 (13)(i) 2^8 (ii) 28
 (14)(i) 43200 (ii) 151200 (iii) 19807200 (iv) 151200 (15)(i) 180
 (ii) 60 (iii) 30 (16)(i) 379 (ii) 135 (17) 120, NIGHT
 (18) 7 (19) 399960 (20) 571956

Exercise 4.3

- (1) 1 (2) 3 (3) 10, 3 (6) 20
 (9) (i) ${}^{14}C_7 = 3432$ (ii) ${}^{15}C_2 = 105$ (iii) ${}^{20}C_2 = 190$ (iv) ${}^{100}C_5$ (v) ${}^5C_3 \times {}^4C_2 \times {}^2C_1 = 120$
 (10) (i) $2^4 = 16$ (ii) $2^5 = 32$ (iii) 2^n
 (11) (i) ${}^{25}C_3$ (ii) ${}^{25}P_3$
 (12) ${}^{10}P_2 \times {}^8C_4 = 6300$ (13)(i) ${}^{10}C_3 = 120$ (ii) ${}^{10}C_5 = 252$
 (14) ${}^5C_2 \times {}^{20}C_3 = 11400$ (i) ${}^4C_1 \times {}^{20}C_3 = 4560$ (ii) ${}^5C_2 \times {}^{19}C_3 = 9690$
 (15) ${}^7C_3 = 35$ (16) 4512 (17) 546 (18)(i) 280 (ii) 336 (iii) 736
 (19) 485 (20) 64 (21) 2454
 (22) ${}^{15}C_3 = 455$ (23) 364 (24)(i) 50 (ii) 161 (25) 15

Exercise 4.5

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(2)	(2)	(1)	(2)	(4)	(2)	(1)	(4)	(2)	(2)	(3)	(4)	(2)	(3)	(1)
16	17	18	19	20	21	22	23	24	25					
(4)	(2)	(3)	(4)	(3)	(2)	(2)	(2)	(1)	(2)					

Exercise 5.1

- (1)(i) $8x^6 - 36x^3 + 54 - \frac{27}{x^3}$ (ii) $2[16x^8 + 216x^4(1 - x^2) + 81(1 - x^2)^2]$
 (2)(i) 108243216 (ii) 96059601 (iii) 4782969
 (3) $(1.01)^{10^6} > 10000$ (4) 10 (5) 15, x^6 term is not possible.
 (6) 26235 (7) $-\frac{40}{27}$ (8) '01'
 (13) $n = 15$ (14) $n = 55$ (15) $n = 7$ or 14

Exercise 5.2

- (1)(i) G.P (ii) None of them. (iii) G.P
 (iv) None of them (v) None of them (vi) None of them (vii) A.G.P
 (2)(i) 2, 2, 4, 4, 6, 6, ... (ii) 1, 2, 3, 5, 8, 13, ... (iii) 1, 2, 3, 6, 11, 20, ...
 (3)(i) $a_n = \begin{cases} n+1 & \text{if } n \text{ is odd} \\ n & \text{if } n \text{ is even} \end{cases}$ (ii) $a_n = \frac{n}{n+1}, \forall n \in \mathbb{N}$ (iii) $a_n = \frac{2n-1}{2n}, \forall n \in \mathbb{N}$
 (iv) $a_n = \begin{cases} 7-n & \text{if } n \text{ is odd} \\ 8+n & \text{if } n \text{ is even} \end{cases}$
 (4) 12, 18, 27 (5) $t_n = \frac{1}{n^2} - \frac{1}{(n+1)^2}$ (8) 5, 45

Exercise 5.3

- (1) $a = \frac{133}{25}, d = -\frac{2}{75}, S_{20} = \frac{304}{3}$ (2) $S_{17} = 527$
 (3)(i) $S_n = \frac{8}{81}[10(10^n - 1) - 9n]$ (ii) $S_n = \frac{6}{81}[10(10^n - 1) - 9n]$
 (4) $S_n = \frac{4}{9}(4^n - 1) - \frac{n}{3}$ (5) $\frac{3n-2}{3^{n-1}}, \frac{3^n - (3n-2)}{2 \cdot 3^{n-1}} + \frac{3^{n-1} - 1}{4 \cdot 3^{n-3}}$
 (6) $n = 15$ (8) 20 months (9) 2480 metres (10) $120, 480, 30(2)^n$
 (11) $500 \left(\frac{11}{10}\right)^{10} = 1296.87$ (12) 15th day

Exercise 5.4

- (1)(i) $\frac{1}{5} \left[1 - \frac{x}{5} + \frac{x^2}{25} - \frac{x^3}{125} + \dots \right] \quad |x| < 5$
- (ii) $\frac{2}{9} \left[1 - 2 \left(\frac{4x}{3} \right) + 3 \left(\frac{4x}{3} \right)^2 - 4 \left(\frac{4x}{3} \right)^3 + \dots \right] \quad |x| < \frac{3}{4}$
- (iii) $5^{\left(\frac{2}{3} \right)} \left[1 + \frac{2}{15}x^2 - \frac{1}{225}x^4 + \frac{4}{81 \times 125}x^6 + \dots \right] \quad x^2 < 5$
- (iv) $2^{\left(-\frac{2}{3} \right)} \left[1 - \frac{x}{3} + \frac{5}{36}x^2 - \frac{5}{81}x^3 + \dots \right] \quad |x| < 2$
- (2) $(1001)^{\left(\frac{1}{3} \right)} \approx 10.00333$
- (5)(i) $1 + 5x + \frac{25x^2}{2} + \frac{125x^3}{6} + \frac{625x^4}{24} + \frac{625x^5}{24} + \dots$
- (ii) $1 - 2x + 2x^2 - \frac{4x^3}{3} + \frac{2x^4}{3} - \frac{4x^5}{15} + \dots$
- (iii) $1 + \frac{1}{2}x + \frac{1}{8}x^2 + \frac{1}{48}x^3 + \frac{1}{384}x^4 + \dots$
- (6)(i) $4x - 8x^2 + \frac{64x^3}{3} - \frac{64x^4}{3} + \dots \quad \text{for } |x| < \frac{1}{4}$
- (ii) $-2x - \frac{4x^2}{2} - \frac{8x^3}{3} - \frac{16x^4}{4} - \dots \quad \text{for } |x| < \frac{1}{2}$
- (iii) $2 \left[3x + \frac{27x^3}{3} + \frac{243x^5}{5} + \frac{2187x^7}{7} + \dots \right] \quad \text{for } |x| < \frac{1}{3}$
- (iv) $-2 \left[2x + \frac{8x^3}{3} + \frac{32x^5}{5} + \frac{128x^7}{7} + \dots \right] \quad \text{for } |x| < \frac{1}{2}$
- (8) $\left(\frac{15}{16} \right)^{\frac{1}{8}} \simeq 0.99196 \quad (9) \frac{28}{3} \quad (10) \frac{1}{2} \log_e^{10}$

Exercise 5.5

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(4)	(4)	(4)	(4)	(2)	(3)	(1)	(3)	(4)	(1)	(1)	(4)	(4)	(2)	(3)
16	17	18	19	20										
(2)	(2)	(3)	(3)	(2)										

Exercise 6.1

- (1)(i) $x^2 + y^2 = 81$ (ii) $\frac{x^2}{81} + \frac{y^2}{36} = 1$ (2)(i) $y = \pm 2$ (ii) $x = \pm 3$
- (3) $x^{2/3} + y^{2/3} = a^{2/3}$ (4) $k = -24, \quad b = -\frac{1}{4}$ (5) $x^2 + y^2 = 16$

$$\begin{aligned}
(6) \quad & x^2 + y^2 - 4x - 4y + 8 = 0 & (7) \quad & x^2 + y^2 - 5x + 8y + 16 = 0 \\
(8) \quad & y^2 = 2x & (10) \quad & 8x^2 + 36y^2 - 16x + 252y + 431 = 0 \\
(11) \quad & \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 & (12) \quad & 9x^2 - 33x - 3y + 35 = 0 \\
(13) \quad & x^2 + y^2 - 12x + 9y + 63 = 0 & (14) \quad & (5 - \sqrt{21}, 3), (5 + \sqrt{21}, 3), (8, -3), (2, -3) \\
(15) \quad & \frac{x^2}{25} + \frac{y^2}{9} = 1
\end{aligned}$$

Exercise 6.2

$$\begin{aligned}
(1)(i) \quad & y = 5x - 4 & (ii) \quad & 3x - y = 2 & (iii) \quad & 2x + 3y = 5 & (iv) \quad & x + \sqrt{3}y = (1 + \sqrt{3}) \\
(3) \quad & 10x + 3y = 25 \\
(5)(i) \quad & C = \frac{5}{9}(F - 32) & (\text{or}) \quad & F = \frac{9}{5}C + 32 & (ii) \quad & C = 37^\circ & (iii) \quad & F = 100.4^\circ \\
(6)(i) \quad & 4400\text{metre} & (ii) \quad & D = 3000\text{metre} & (iii) \quad & T = 22\text{seconds} & (7) \quad & P = 1,55,000 \\
(8) \quad & \sqrt{3}x + y = 24 & (9) \quad & 3x - 4y = 12, x - 2y = 2 & (11) \quad & (13, 7), (-11, -3) \\
(12)(i) \quad & y = 12.5x - 150 & (ii) \quad & 12\text{seconds} & (iii) \quad & 80\text{seconds} \\
(13)(ii) \quad & x - 2y + 4 = 0 & (iii) \quad & 2\text{cm} & (iv) \quad & 14\text{kg} & (v) \quad & 5\text{cm} \\
(14)(i) \quad & y = -\frac{71}{120}x + 14.2, \quad 0 \leq x \leq 24 \\
(ii) \quad & y = f(x) \text{ is a periodic function with period } 24, f(x) = f(x + 24) \\
(15)(i) \quad & \text{The minimum length} = 3280\text{units} \\
(ii) \quad & 180, 360 \text{ and } 540\text{units} \\
(iii) \quad & \text{The slope at each turning point is } \frac{9}{40}
\end{aligned}$$

Exercise 6.3

$$\begin{aligned}
(2) \quad & 5x - 4y - 15 = 0 & (3)(i) \quad & \frac{8}{5} & (ii) \quad & \frac{23}{5} \\
(4)(i) \quad & x + 3y + 2 = 0 & (ii) \quad & 4x - 3y - 7 = 0 & (5) \quad & x + 5y - 31 = 0 \\
(6)(i) \quad & x + 1 = 0 & (ii) \quad & x - y = 0 & (iii) \quad & 2x + y + 3 = 0 \\
(7) \quad & 12x + 5y + 6 = 0, \quad \text{and} \quad 4x - 3y - 25 = 0 & & 12x + 5y - 20 = 0 & (8) \quad & 4x - 3y + 15 = 0, \quad \text{and} \\
(9) \quad & 2x + 3y - 18 = 0 & (10) \quad & 7\sqrt{2}, \text{ and } (-3, 5) \\
(12) \quad & (i) \frac{14}{13}, \quad (ii) \frac{5}{2} & (13)(i) \quad & 4x - 3y + k = 0, k \in \mathbb{R} & (ii) \quad & 3x + 4y + k_1 = 0, k_1 \in \mathbb{R} \\
(14) \quad & \sqrt{3}x - y - 2\sqrt{3} = 0 & (15) \quad & A \left(\frac{13}{5}, 0 \right) & (16) \quad & x + 5y = \pm 10 \\
(17) \quad & (0, 7) & (18)(i) \quad & y = \begin{cases} 1.50x, & 0 \leq x \leq 10 \\ x + 5, & x > 10 \end{cases} & (ii) \quad & ₹45 \\
(19) \quad & y = 5x - 7, \quad y = 5x + 10 \\
(20) \quad & y + 3 = 0, & & 2x + y + 3 = 0, \text{ and} & & 2x - y - 3 = 0
\end{aligned}$$

Exercise 6.4

- (1) $x^2 - xy - 2y^2 + 2x - 13y - 15 = 0$
- (6) $3x^2 - 13xy - 10y^2 + 33x + 73y - 126 = 0$
- (ii) $3x + 4y - 11 = 0, 2x - y = 0$
- (10) $y = x$
- (11) $p = 6, q = 17(\text{or}) - \frac{67}{6}$
- (13) $k = -5(\text{or}) - \frac{35}{4}$
- (7)(i) $x + y = 0, 3x - y = 0$
- (iii) $x + y - 5 = 0, 2x - 3y + 4 = 0$
- (12) $k = -1$
- (14) $\frac{8}{5}$
- (15) $\sqrt{5}$

Exercise 6.5

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(4)	(4)	(3)	(4)	(3)	(2)	(2)	(4)	(2)	(3)	(1)	(2)	(3)	(4)	(2)
16	17	18	19	20	21	22	23	24	25					
(1)	(3)	(2)	(1)	(2)	(1)	(3)	(1)	(3)	(4)					