ANSWERS

EXERCISE 1.1

1. (ii) and (iv) are sets; all others collections are not sets because these collections are not well defined

2. (i) $\{1, 3, 5, 7, ...\}$; $\{x \mid x = 2n - 1, n \in \mathbf{N}\}$

   (ii) $\{0, 2, 4, 6, ...\}$; $\{x \mid x = 2n, n \in \mathbf{W}\}$

   (iii) $\{..., -4, -2, 0, 2, 4, ...\}$; $\{x \mid x = 2n, n \in \mathbf{I}\}$

   (iv) $\{1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72\}$; $\{x \mid x$ is a factor of $72\}$

   (v) $\{1, 8, 27, 64\}$; $\{x : x = n^3, n \in \mathbf{N}$ and $n < 5\}$

3. (i) $\{-6, -3, 0, 3, 6, ... , 27\}$ (ii) $\{12, 14, 15, 16, 18, 20, 21, 22, 24\}$

   (iii) $\{0, 12, 24, 36, 48, 60, 72, 84, 96\}$ (iv) $\{49, 58, 67, 76, 85, 94\}$

   (v) $\{-3, -1, 1, 3, 5, 7\}$ (vi) $\left\{\dfrac{1}{3}, \dfrac{3}{5}, \dfrac{5}{7}, \dfrac{7}{9}, ..., \dfrac{21}{23}\right\}$

   (vii) $\{-4, -3, -2, -1, 0, 1, 2, 3, 4\}$ (viii) $\{0, 1, 2, 3, 4, 5\}$

   (ix) $\{0, 1, 2, 3, 4, 5, 6\}$

4. (i) $\{x : x = \dfrac{1}{n}, n \in \mathbf{N}$ and $n < 10\}$

   (ii) $\{x : x = \dfrac{n}{n+2}, n$ is odd natural number$\}$ or $\{x : x = \dfrac{2n+1}{2n+3}, n \in \mathbf{W}\}$

   (iii) $\{x : x = \dfrac{1}{n^2}, n \in \mathbf{N}$ and $n \le 10\}$ (iv) $\{x : x = \dfrac{1}{2^n}, n \in \mathbf{W}$ and $n \le 8\}$

   (v) $\{x : x = 5p, p \in \mathbf{I}$ and $-2 \le p \le 20\}$ (vi) $\{x : x \in \mathbf{N}$ and x is a factor of $48\}$

EXERCISE 1.2

1. (i) infinite set   (ii) infinite set   (iii) finite set; 0

   (iv) finite set; 12   (v) finite set; 7   (vi) finite set; 6

   (vii) infinite set   (viii) infinite set   (ix) finite set; 11

2. (i) matches (c)   (ii) matches (a)   (iii) matches (d)

   (iv) matches (b)

3. $\{1, 2, 3, 4, 5\}$ 4. $\{2, 3\}$ 5. A = B

6. (i) false   (ii) false   (iii) false

   (iv) false   (v) true   (vi) true

   (vii) false; for example, let A = $\{1, 2\}$ and B = $\{2, 3\}$

   (viii) false; ϕ has no proper subset   (ix) true

   (x) false; for example, infinite set $\mathbf{N}$ has a finite subset $\{1, 2\}$

7. (i) false   (ii) false   (iii) true   (iv) true

   (v) false   (vi) true   (vii) false   (viii) true

8. (i) A $\leftrightarrow$ B; A $\ne$ B   (ii) A $\leftrightarrow$ B; A $\ne$ B

   (iii) A $\leftrightarrow$ B; A = B   (iv) A is not equivalent to B

9. (i) false   (ii) true   (iii) false   (iv) false

   (v) false   (vi) true

10. There are 8 subsets—ϕ, $\{0\}$, $\{5\}$, $\{10\}$, $\{0, 5\}$, $\{0, 10\}$, $\{5, 10\}$ and $\{0, 5, 10\}$. First seven are proper subsets and the last is improper subset

CHECK YOUR PROGRESS

1. (i) {−1, 4, 9, 14, ..., 39}   (ii) {−4, −3, −2, −1, 0, 1, 2, 3, 4}

(iii) $\left\{-\dfrac{1}{2}, \dfrac{1}{3}, \dfrac{3}{4}, 1\right\}$ (iv) {..., −4, −3, −2}

2. (i) {x : x = 2n, n ∈ I, −5 < n < 6}   (ii) {x : x is a prime number, 10 < x < 32}

3. (i), (ii), (iii), (viii), (ix) are correct and (iv), (v), (vi), (vii) are incorrect

4. (i) False, for {0} is not empty set

(ii) False, for φ is a subset of φ

(iii) True   (iv) False, this collection is not well defined

(v) False, for it is infinite set   (vi) False, for n(A) = 7

(vii) True, for A = {99}   (viii) True, for P = φ   (ix) True

5. (i) False   (ii) True

6. (i) False   (ii) False   (iii) False   (iv) True

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

(vi) False   (vii) True   (viii) True   (ix) False   (x) True

8. There are 8 subsets of P — φ, {E}, {A}, {I}, {E, A}, {E, I}, {A, I} and {E, A, I}. First seven are proper subsets and the last is improper subset

EXERCISE 2.1

1. (i) {0, 1, 2, 3, 4, 5, 6}   (ii) {4}

(iii) {5, 6}   (iv) {0, 1, 2, 3}

2. (i) {0, 1, 2, ..., 8}   (ii) {4, 5}

(iii) {0, 1, 2, 3}   (iv) {6, 7, 8}; Yes

3. (i) {I, N, T, E, G, R, Y, C, K, O}   (ii) {I, N, E, R, G}

(iii) {T, Y}   (iv) {C, K, O}

4. (i) {1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 24, 30}

(ii) {1, 2, 3, 6}   (iii) {4, 8, 12, 24}

(iv) {5, 10, 15, 30}

5. (i) {5, 9}   (ii) {1, 2, 3, 5, 7, 9}

(iii) {1, 2, 3, 4, 6, 7, 8}   (iv) {4, 6, 8}

(v) {1, 2, 3, 7}   (vi) { }

(vii) {1, 2, 3, 5, 7, 9}   (viii) {1, 2, 3, 5, 7, 9}

7. 6   8. (i) 28   (ii) 8   (iii) 12

9. (i) 25   (ii) 28   (iii) 8   (iv) 29   (v) 17   (vi) 4

10. (i) 17   (ii) 21   (iii) 33

EXERCISE 2.2

1. (i) {0, 1, 2, ..., 12}   (ii) {8, 0, 5}   (iii) {0, 5}

(iv) {2, 7, 8, 9, 10, 11, 12}   (v) {8, 10}   (vi) {7, 8, 11}

(vii) {3, 4, 6}   (viii) {2, 4, 6, 9, 12}   (ix) {2, 9, 12}

2. (i) {0}   (ii) {1, 2, 7}

4. (i) 35   (ii) 17   (iii) 13

5. (i) 35   (ii) 40   (iii) 19   (iv) 10

6. 8   7. (i) 37   (ii) 13

8. (i) 6   (ii) 8   9. 13

CHECK YOUR PROGRESS

1. A′ = {x : x ∈ **N**, x = 1 or x is a prime number less than 25};
   A′ = {1, 2, 3, 5, 7, 11, 13, 17, 19, 23}

2. (i) {1, 2, 3, 4, 5, 6 }   (ii) {1, 2, 3, 4, 10, 11, 12}
   (iii) {5, 6, 7, ..., 12}   (iv) {7, 8, 9}   (v) {10, 11, 12}
   (vi) {5, 6}   (vii) {1, 2, 3, 4}   (viii) {1, 2, 3, 4}

4. (i) 24   (ii) 24

5. (i) 24   (ii) 9   (iii) 50   (iv) 26

6. 45°, 45°, 90°   7. 30   8. 20%

EXERCISE 3.1

1. (i) 1   (ii) 0; No   2. 580, 850, 508, 805; 2743

3. 30, 33, 70, 77, 37, 73

4. (i) 8, 9, 80, 90, 89   (ii) 8, 9, 80, 88, 90, 89

5. 10378; 87310   6. 98765, 10234

7. (i) 100002   (ii) 999987

8. (i) 88310; 10038   (ii) 77530; 30057

9. (i) 999287; 100203   (ii) 996987; 106002

10. 9639   11. 1064

12. −6, −5 or −5, −4

13. (i) True   (ii) True   (iii) True   (iv) False

14. (i) 18   (ii) 5   (iii) 40   (iv) −27

EXERCISE 3.2

1. $3^3 \times 37$ 2. (i) $2^2 \times 3^2 \times 5 \times 7 \times 11$ (ii) $2 \times 5 \times 11^2 \times 23$ (iii) $2^6 \times 7^3$

3. 3   4. (i) 1680   (ii) 5040   5. 1673   6. 6165

7. 9720   8. 10080   9. (i) 6   (ii) 16   10. 17

11. (i) co-prime   (ii) not co-prime   (iii) co-prime

12. 15 litres   13. (i) 40   (ii) 2 m

14. 2574   15. 126   16. 210

EXERCISE 3.3

1. (i) $3\frac{2}{7}$ (ii) $7\frac{7}{15}$ (iii) $-11\frac{79}{105}$ 2. (i) $\frac{31}{7}$ (ii) $\frac{632}{47}$ (iii) $-\frac{45}{8}$

3. (i) $\frac{7}{8}$ (ii) $\frac{3}{5}$ (iii) $-\frac{3}{14}$ (iv) $-\frac{12}{5}$

4. (i) $\frac{78}{96}, \frac{68}{96}, \frac{69}{96}$ (ii) $\frac{30}{60}, \frac{40}{60}, \frac{45}{60}, \frac{48}{60}, \frac{50}{60}$ 5. (i) $\frac{5}{12}, \frac{9}{16}, \frac{3}{4}$ (ii) $\frac{2}{3}, \frac{9}{13}, \frac{5}{7}, \frac{5}{6}$

6. (i) $\frac{37}{45}, \frac{11}{15}, \frac{13}{18}$ (ii) $\frac{13}{18}, \frac{17}{24}, \frac{7}{12}, \frac{8}{15}$

7. (i) $\frac{5}{8}$ (ii) $\frac{10}{13}, \frac{17}{21}$ (iii) $\frac{11}{17}, \frac{7}{12}, \frac{10}{19}$

8. (i) $4\frac{1}{3}$ (ii) 1   9. 20   10. (i) $1\frac{53}{70}$ (ii) $\frac{3}{1400}$ 11. 1 metre   12. $\frac{5}{12}$

13. 20   14. 21000   15. $\frac{7}{16}$; ₹8160   16. 16, 40

17. ₹200000   18. 180   19. 80

EXERCISE 3.4

1. (i) $\dfrac{5}{8}$ (ii) $\dfrac{121}{40}$ (iii) $\dfrac{509}{125}$

2. (i) 0·031   (ii) 13·00057   (iii) 0·875   (iv) 7·3125

    (v) 2·8$\dot{3}$ (vi) 0·0$\overline{81}$ (vii) 0.29$\dot{5}\dot{4}$ (vii) 0·$\overline{571428}$

3. (i) 0·3, 0·303, 0·33, 3·03   (ii) 0·6034, 0·6304, 0·634, 0·643

4. (i) 40·1507   (ii) 6·5762   (iii) 0·02763   (iv) 30·0112   (v) 17   (vi) 4·0415

5. (i) 4·32   (ii) 2·625   (iii) 750   6. (i) $2\dfrac{10}{13}$ (ii) 14·075 kg

7. (i) 3·1429   (ii) 3·143   8. 0·1042   9. 4

10. (i) ₹54600   (ii) ₹63750   (iii) ₹28·00   (iv) 4·36 m

     (v) 63·90 m   (vi) 0·076 kg   (vii) 3·45 m

EXERCISE 3.5

1. $\dfrac{73}{126}; \dfrac{4}{9}, \dfrac{73}{126}, \dfrac{5}{7}$ 2. $\dfrac{43}{144}; \dfrac{3}{8}, \dfrac{43}{144}, \dfrac{2}{9}$ 3. 5·15, 5·3, 5·45

4. (i) $3\sqrt{2}$ (ii) $7\sqrt{3}$ (iii) $2\sqrt{3}$ (iv) $10\sqrt{6}$ (v) $\sqrt{5}$ (vi) 15

5. (i) $\dfrac{2\sqrt{10}}{5}$ (ii) $\dfrac{3+\sqrt{2}}{7}$ (iii) $4\,(2-\sqrt{3})$ (iv) $\dfrac{5+\sqrt{13}}{4}$

     (v) $3\sqrt{2}-1$ (vi) $\sqrt{3}+\sqrt{2}$ (vii) $4\sqrt{2}\,(\sqrt{5}+\sqrt{3})$ (viii) $4-\sqrt{15}$

     (ix) $\sqrt{2}-1$ 6. (i) $3\dfrac{5}{11}$ (ii) $\dfrac{16\sqrt{13}}{3}$

7. (i) $2\sqrt{3}, \sqrt{15}, 4, 3\sqrt{2}$ (ii) $3\sqrt{7}, 6\sqrt{2}, 5\sqrt{3}, 4\sqrt{5}, 10$

8. $\sqrt{6}$ 9. $\sqrt{5}, \sqrt{6}$ 10. $\sqrt{13}, \sqrt{14}, \sqrt{15}$

EXERCISE 3.6

1. (i) 26   (ii) 32   (iii) 86   (iv) $3\dfrac{1}{11}$

    (v) $4\dfrac{1}{6}$ (vi) 1·4   (vii) 0·08   (viii) 0·65

2. (i) 9   (ii) $\dfrac{39}{110}$ (iii) 0·5   3. 57

4. (i) 232   (ii) 462   (iii) 2053

5. (i) 4·29   (ii) 2·403   (iii) 30·58   6. (i) 1·41   (ii) 1·4

7. 5·20   8. (i) 25·41   (ii) 10·37   (iii) 2·34

9. 15·9   10. 1·73; 3·73   11. (i) 3   (ii) 2   (iii) 2

12. (i) 3   (ii) 2   (iii) 6   13. (i) 15   (ii) 98   (iii) 205

14. (i) 2   (ii) 98   (iii) 100   15. 998001

16. (i) 24   (ii) 63   (iii) $\dfrac{4}{11}$ (iv) $1\dfrac{10}{13}$ (v) 0·15   (vi) 2·7

17. 3; 27   18. 12; 9

CHECK YOUR PROGRESS

1. 0, 5, 9, 50, 90, 59, 95, 590, 950, 509, 905

2. 100141   3. (i) 80   (ii) −2

4. $2^5 \times 5^5$ 5. 1735   6. 10080

7. 108   **8.** 84   **9.** 124   **10.** No

11. (i) $\frac{3}{4}, \frac{11}{18}, \frac{7}{12}$ (ii) $\frac{11}{12}, \frac{3}{4}, \frac{7}{10}, \frac{5}{9}$ **12.** $\frac{2}{3}, \frac{1}{2}, \frac{3}{7}$

13. $1\frac{23}{45}$ **14.** 300 grams   **15.** 360 runs

16. (i) 2059·307   (ii) 37·00709   (iii) 3·425   (iv) 0·0208   (v) $0.0\overline{27}$

17. (i) 0·05   (ii) −0·03   **18.** $\frac{7}{24}, \frac{13}{48}; \frac{1}{4}, \frac{13}{48}, \frac{7}{24}, \frac{1}{3}$

19. (i) $3(2\sqrt{3}+1)$ (ii) $2(2\sqrt{2}-\sqrt{3})$ **20.** $\sqrt{10}, \sqrt{11}, \sqrt{12}$

21. $\sqrt{21}, \sqrt{22}$ **22.** (i) 98   (ii) $5\frac{1}{7}$ (iii) 0·41

23. (i) 427   (ii) 0·0051   (iii) 0·137   **24.** 2·24; 0·84   **25.** 14   **26.** 92   **27.** 1024

28. (i) 84   (ii) $1\frac{4}{21}$ (iii) 2·6   **29.** 637; 6.

EXERCISE 4.1

1. (i) 1 : 1   (ii) 120 : 1   (iii) 1 : 8   (iv) 40 : 3

2. (i) 5 : 9   (ii) 7 : 11   (iii) 4 : 3 : 10   (iv) 30 : 14 : 21

3. 1 : 12   **4.** (i) 3 : 5   (iii) 0·9 : 1   (iii) $\frac{1}{2} : \frac{1}{3}$ (iv) 3·5 : 4·5

5. (i) 5 : 12, 9 : 16, 3 : 4   (ii) 3 : 8, 9 : 14, 5 : 7, 20 : 21

6. Science   **7.** ₹ 300, ₹ 750   **8.** ₹ 20, ₹ 30, ₹ 40

9. ₹ 100, ₹ 160, ₹ 550   **10.** 36 : 65   **11.** 4 : 5

12. (i) 42 : 35 : 40   (ii) 8 : 12 : 33   (iii) 15 : 12 : 14

13. A = 14, C = 35   **14.** 4 : 3 : 2   **15.** ₹ 189   **16.** ₹ 935

17. 80, 128   **18.** ₹ 900; ₹ 315, ₹ 360

19. ₹ 256, ₹ 384, ₹ 672   **20.** ₹ 2150, ₹ 1935, ₹ 3010   **21.** 54, 90, 144   **22.** 301

23. 60 kg   **24.** 10, 20   **25.** 18, 20   **26.** 14

EXERCISE 4.2

1. (i), (ii) and (iii) are true   **2.** (ii) and (iii) are in proportion

3. (i) 40   (ii) $1\frac{3}{7}$ (iii) 2·8   **4.** (i) 45   (ii) 5 pencils

5. (i) 13·5   (ii) $\frac{11}{7}$ (iii) ₹ 137·5   (iv) 7 m

6. Yes   **7.** (i) 9   (ii) 4·05   (iii) $21\frac{7}{8}$ (iv) 15 paise

8. (i) 12   (ii) $\frac{2}{21}$ (iii) 0·4   (iv) 0·009

9. 20   **10.** (i) 9·3   (ii) 9·14   (iii) 3·2   **11.** 1 m 35 cm

CHECK YOUR PROGRESS

1. 41 : 294   **2.** 1 : 3   **3.** 11 years 3 months

4. (i) 27 m   (ii) 90 m   (iii) 3 : 10   **5.** 57, 95   **6.** 10 : 9, 20 : 15 : 18

7. ₹ 376, ₹ 564, ₹ 705   **8.** ₹ 340, ₹ 510, ₹ 1020   **9.** 625

10. ₹ 36000 per month   **11.** ₹ 4060   **12.** $\frac{3}{20}$ **13.** ₹ 6·25

14. 1·5 kg   **15.** 0·14

EXERCISE 5.1

1. ₹181·25
2. ₹35
3. 13
4. ₹1728
5. 572
6. 396
7. 30
8. 2 hours
9. 16
10. 36 minutes
11. 10 days
12. 36 days
13. 300
14. ₹1710
15. 12
16. 10

EXERCISE 5.2

1. $\frac{5}{6}$ th
2. $4\frac{4}{9}$ days
3. A gets ₹2100, B gets ₹1400

4. 6 days
5. $5\frac{5}{11}$ days
6. $7\frac{1}{2}$ minutes
7. $2\frac{1}{2}$ days

8. $13\frac{1}{3}$ days
9. 3 days
10. $3\frac{3}{4}$ days

11. 1 day; A gets ₹480, B gets ₹160, C gets ₹320
12. 120 days
13. 12 days
14. 8 days; A takes $17\frac{1}{7}$ days, B takes 24 days and C takes 40 days
15. 48 hours

CHECK YOUR PROGRESS

1. 8
2. Can't say
3. ₹472·50
4. 5 days
5. 30
6. 46 days
7. 50 men
8. 6 days
9. 12 days
10. 30 hours
11. (i) $10\frac{2}{7}$ days
    (ii) $\frac{4}{7}, \frac{3}{7}$
    (iii) ₹2100
12. $1\frac{1}{3}$ days; 28 gm, 21 gm, 14 gm
13. 30 days

EXERCISE 6.1

1. 27 km
2. 3 hours 20 minutes
3. 6 km/hr
4. (i) 12·5 m/sec
   (ii) 150 m/sec
   (iii) 1·25 m/sec

   (iv) 40 m/sec
   (v) $\frac{1}{8}$ m/sec
   (vi) 1·25 m/sec

5. (i) 72 km/hr
   (ii) 5·4 km/hr
   (iii) 0·9 km/hr
6. 15 km/hr
7. 60 km/hr
8. 11 km/hr

9. $46\frac{2}{3}$ km/hr
10. $13\frac{1}{3}$ km/hr

11. 80 km/hr
12. 45 minutes
13. $16\frac{2}{3}$ km/hr
14. Rabbit will be 6·5 km ahead
15. 2 km
16. 60 km
17. 1 km, 15 minutes
18. (i) 10 seconds
    (ii) 30 seconds
19. (i) 54 km/hr
    (ii) 28 seconds
20. 40 km/hr
21. 280 m
22. 540 m
23. (i) 54 km/hr
    (ii) 210 m
24. (i) 90 km/hr
    (ii) 75 m

EXERCISE 6.2

1. 18 km
2. 5 hours
3. 360 km
4. 12 sec
5. 10·5 sec
6. (i) 18 sec
   (ii) 1 minute 30 seconds
7. (i) 3 minutes
   (ii) 6 minutes
8. 1·5 km/hr
9. 1·5 km/hr
10. 12·5 km/hr
11. 42 km, 7 hours

CHECK YOUR PROGRESS

1. 25 m/sec
2. 60 km/hr
3. 630 km
4. 180 km
5. At 1 p.m., 175 km from Delhi
6. The horse galloped 6 km in 6 minutes and trotted 4 km in 20 minutes.
7. 405 m
8. 36 sec
9. (i) 210 m   (ii) 315 m
10. 250 m
11. 800 m
12. 45 km/hr

EXERCISE 7

1. (i) $3\frac{14}{25}$ (ii) $\frac{1}{40}$ (iii) $\frac{1}{6}$ (iv) $\frac{1}{40}$

2. (i) 150%   (ii) 45%   (iii) 125%   (iv) $233\frac{1}{3}$%

3. (i) 0·75, 75%   (ii) 0·625, 62·5%   (iii) 0·1875, 18·75%   (iv) 0·0875, 8·75%

4. (i) 0·6667, 66·67%   (ii) 0·8333, 83·33%   (iii) 0·5714, 57·14%   (iv) 2·2222, 222·22%

5. (i) 85%   (ii) $72\frac{2}{9}$%   (iii) 116·25%

6. (i) 0·2   (ii) 0·02   (iii) 0·0325   (iv) 0·0007

7. (i) ₹ 13·50   (ii) 1·6 m   (iii) $1\frac{9}{16}$ kg   (iv) 3·12

8. (i) 25%   (ii) 15%   (iii) 125%   (iv) 150%

9. (i) 20%   (ii) 130%   (iii) $44\frac{4}{9}$%

10. (i) 600   (ii) 150   (iii) 1200

11. (i) 78   (ii) 675   12. (i) 260   (ii) 850

13. ₹ 12600   14. ₹ 11000   15. 1650   16. 12·5%

17. 45%   18. 90000; 10%   19. 1280

20. (i) Maths   (ii) Hindi   (iii) 87%

21. (i) 40%   (ii) 60%   (iii) 500

22. ₹ 1275   23. 70 kg   24. (i) ₹ 34   (ii) ₹ 24

25. No   26. $16\frac{2}{3}$%   27. 25%

28. $16\frac{2}{3}$%   29. 80   30. 600; 40%

CHECK YOUR PROGRESS

1. 29·17%   2. 18·75%   3. $2\frac{1}{12}$%

4. (i) 10 hours   (ii) $9\frac{1}{2}$ hours   5. 550

6. 10%   7. (i) 35%   (ii) 600   8. 40   9. ₹ 4320

10. ₹ 14520   11. 38%   12. 8% increase

13. 52%   14. ₹ 180000   15. $11\frac{1}{9}$%

16. 38%   17. 250%

EXERCISE 8.1

1. (i) Profit 17%   (ii) loss 7·5%   (iii) loss 11%   (iv) profit $8\frac{1}{3}$%
2. 6·25%   3. 12·5%   4. Profit 12·5%

5. Profit ₹ 20000; 8%   6. $11\frac{1}{9}$%   7 (i) $32\frac{4}{7}$%   (ii) 60

8. Profit $33\frac{1}{3}$%   9. Loss 25%   10. Profit 40%

11. (i) ₹ 2548·80   (ii) ₹ 351·50   (iii) ₹ 1680   (iv) ₹ 328·50

12. ₹ 2·25   13. Profit 15%   14. Profit $6\frac{2}{3}$%

15. ₹ 203   16. ₹ 16200

17. (i) ₹ 500   (ii) ₹ 600   (iii) ₹ 480   (iv) ₹ 5720

18. Loss ₹ 400; 25%   19. Gain 25%

20. 12%   21. ₹ 1631·25   22. ₹ 324   23. 10

24. Loss 1%   25. ₹ 1300   26. ₹ 650   27. ₹ 690

EXERCISE 8.2

1. (i) ₹ 69, ₹ 506   (ii) ₹ 1062·50, ₹ 11687·50

2. (i) ₹ 58·5, 7·5%   (ii) ₹ 3990; 14%

3. ₹ 306   4. ₹ 800   5. (i) ₹ 640   (ii) ₹ 512

6. (i) ₹ 1980   (ii) ₹ 1800   7. (i) ₹ 780   (ii) ₹ 975

8. (i) ₹ 2160   (ii) ₹ 1836   (iii) 53%

9. (i) ₹ 2000   (ii) ₹ 1680   (iii) 5%

10. (i) ₹ 450   (ii) ₹ 300   11. 8%   12. Loss 4%

13. ₹ 24453   14. Second option   15. 37%

CHECK YOUR PROGRESS

1. Profit 20%   2. Profit $6\frac{2}{3}$%   3. 25%   4. $33\frac{1}{3}$%

5. 20%   6. (i) ₹ 1127   (ii) ₹ 1428   7. ₹ 87400

8. ₹ 7656   9. (i) ₹ 5400   (ii) ₹ 1350

10. Loss ₹ 1000, 4%   11. ₹ 750   12. ₹ 200   13. ₹ 224

14. (i) ₹ 500   (ii) ₹ 400   15. (i) ₹ 234   (ii) ₹ 260

16. ₹ 5000   17. 14·5%   18. ₹ 180; ₹ 216; 20%

EXERCISE 9.1

1. (i) ₹ 975, ₹ 4975   (ii) ₹ 40, ₹ 1240   (iii) ₹ 688·80, ₹ 3376·80

(iv) ₹ 437·50, ₹ 5437·50   (v) ₹ 272, ₹ 1632

2. ₹ 122·50, ₹ 3797·50   3. ₹ 1260   4. 6·5% p.a.

5. $3\frac{1}{2}$ years   6. (i) ₹ 13000   (ii) ₹ 10000

7. 24% p.a.   8. 12% p.a.   9. 15 years

10. ₹ 119500   11. ₹ 44800   12. ₹ 7500

13. ₹ 6750, $3\frac{1}{3}$% p.a.   14. 9% p.a.

EXERCISE 9.2

1. ₹ 1260   2. ₹ 153   3. ₹ 9159·20; ₹ 1159·20

4. ₹ 15972; ₹ 3972   5. ₹ 24334

6. (i) ₹ 1875   (ii) ₹ 50700   (iii) ₹ 2028

7. ₹ 660; ₹ 7986   8. ₹ 5724; ₹ 724   9. ₹ 128

CHECK YOUR PROGRESS

1. ₹2080
2. 25% p.a., 12 years
3. ₹7500
4. ₹2812·50
5. ₹4560
6. 5 years 4 months
7. 12·5% p.a., ₹5480
8. ₹388·50
9. ₹720

EXERCISE 10.1

1. (i) monomial   (ii) monomial   (iii) binomial
  (iv) trinomial   (v) binomial   (vi) binomial
  (vii) multinomial   (viii) trinomial   (ix) multinomial

2. (i) -9; p^2q^2r (ii) $-\frac{7}{9}$; xy^2 (iii) $\frac{4}{9}$; a^2b^2cd

  (iv) $\frac{3}{4}$; $\frac{1}{x^2y}$ (v) $\frac{3}{2}$; $\frac{x^2y}{z}$ (vi) $-\frac{2}{3}$; $\frac{x^2y}{z}$

3. (i) $-\frac{2}{3}pq^2r^5$ (ii) $\frac{1}{3}p^2qr^5$ (iii) $-\frac{2}{3}p^2qr^4$ (iv) $-2pqr^4$

  (v) $\frac{1}{3}pr^4$ (vi) $-\frac{2}{3}r^5$ (vii) $-\frac{2}{3}p^3q^2$ (viii) p^2qr^3

4. (i) $3abc$, $-\frac{2}{3}cab$, $7bac$; $-5ab^2$, $\frac{2}{7}b^2a$ (ii) $7pq^2$, $\frac{2}{3}q^2p$; $-3p^2q$, $-\pi qp^2$; $\sqrt{5}\,qp$, $4pq$

  (iii) $3x^2yz$, $-\sqrt{5}\,yzx^2$; $\sqrt{7}\,xyz^2$, $-\frac{4}{3}z^2xy$; $\frac{2}{5}y^2xz$, $9xzy^2$

5. (i) polynomial; 4   (ii) not a polynomial   (iii) polynomial; 5
  (iv) not a polynomial   (v) polynomial; 7

EXERCISE 10.2

1. (i) $\frac{9}{2}ab$ (ii) $-x+4y$
  (iii) $2pq-p^2$ (iv) $-\frac{13}{3}x+\frac{31}{5}y-3z$

2. (i) $12p^2$ (ii) $-12xy$ (iii) $\frac{26}{21}p^2q^2r$ (iv) $5y^2+\frac{3}{2}x^2$

3. (i) $x^2-4xy-y^2$ (ii) $2x^4-\frac{4}{3}x^3-\frac{17}{2}x^2+8x-\frac{1}{5}$ (iii) $\frac{59}{30}p-\frac{3}{2}q-\frac{25}{3}r$

4. (i) $3a-11b+19c-6$ (ii) $8x+10y-5z+5$
  (iii) $11x^3+2x^2-29x+14$ (iv) $-7ax+by+16cz$

5. $8x^2-4y^2+6xy$

6. (i) $-2a+8b-20c+5$ (ii) $4x^2-xy-2y^2+5$
  (iii) $-p^2-9q^2-r^2-9$ (iv) $4m^4+3m^3+3m^2-7m+9$

7. $2p+9q-5r-1$ 8. $-4x-y+16z+6$

9. $4x^2-9xy+7y^2-10$

10. $3x^3-12x^2+3x+7$

11. $-2a^2+2ab+b^2-3a-3$ 12. $-2y^3+3y^2-5y-2$

13. (i) $12a+b-5c$ (ii) $11a-7b$
  (iv) $-4a-13b+9c$ (iv) $-11a-12b+11c$ 14. $3p^2-p+9$

EXERCISE 10.3

1. (i) $-\frac{7}{2}x^5y^2$ (ii) $-\frac{5}{2}p^4q^4r$ (iii) $-6a^5b^3$ (iv) $\frac{1}{7}x^4y^3z^2$

2. (i) $-9x^2yz+15xy^2z-21xyz^2$ (ii) $-4p^3q+6p^2q^2-10pq^3-10pq$

(iii) $\frac{70}{3}a^3b^2 - 28a^2b^3 + 10a^2b^2 + 105ab$ (iv) $-42x^8 + 24x^6 - 30x^5 + 4x^4 - 36x^3$

3. (i) $15x^2 + 14x - 8$ (ii) $acx^2 + adx + bcx + bd$

   (iii) $-12p^2 + 29p - 14$ (iv) $6x^3 - 10x^2 + 9x - 15$

   (v) $2a^2 - \frac{5}{3}a + \frac{1}{3}$ (vi) $15x^2 - 34xy + 15y^2$

4. (i) $6x^3 + 11x^2 - 1$ (ii) $x^2 - 4y^2 + 3x + 6y$

   (iii) $10x^3 - 21x^2 + 13x - 6$ (iv) $-9x^4 + 21x^3 - 10x^2 - 15x + 25$

5. (i) $6x^4 - x^3 - 19x^2 + 9x + 5$ (ii) $-15y^4 - 19y^3 + 5y^2 + 7y - 2$

   (iii) $10p^2 - 11pq - 6q^2 + 19p + 19q - 15$

6. (i) $x^3 + 9x^2 + 26x + 24$ (ii) $x^4 - 25x^2 + 144$

7. $10x^4 + 40x^3y - 27x^2y^2 + 67xy^3 + 12y^4$

EXERCISE 10.4

1. (i) $-5a$ (ii) $-\frac{3xy^2}{2z^2}$ (iii) $\frac{13r^4}{8p^2q}$ (iv) $-\frac{7b}{8a}$

2. (i) $-4x + 3y - 7z$ (ii) $3x^3 - \frac{8}{3}x^2 - 4 + \frac{1}{x}$

   (iii) $4a - 6a^2b + \frac{2}{ab} - \frac{1}{3a^2b^2}$ (iv) $-7q^2 + 16pq - \frac{15q}{2p} + \frac{11}{pq} - \frac{9}{p^2}$

3. (i) Quotient $= 3x + 5$, remainder $= 0$ (ii) Quotient $= y^2 - y + 1$, remainder $= 0$

   (iii) Quotient $= 4x + 3$, remainder $= 10$ (iv) Quotient $= 3 - 2x$, remainder $= 2$

   (v) Quotient $= 2p - 3$, remainder $= 0$ (vi) Quotient $= x^2 - 4x + 4$, remainder $= 0$

4. (i) Quotient $= 2x^2 + 5x + 3$, remainder $= -4$

   (ii) Quotient $= y^2 - 3y + 4$, remainder $= 5$

   (iii) Quotient $= m^2 - 5m - 5$, remainder $= 2$

5. (i) Quotient $= a + 1$, remainder $= 0$ (ii) Quotient $= 4x - 3$, remainder $= -3$

   (iii) Quotient $= 3x^2 - 2x + 7$, remainder $= 32x + 12$

6. $2x - 3y$

EXERCISE 10.5

1. (i) $-53p + 63q$ (ii) $-50x^3 + 10x^2 - x - 21$ 2. (i) $34a - 21b$ (ii) $3y$

3. (i) $19p - 2$ (ii) 0 (iii) $\frac{a^2}{2} - 6a$

CHECK YOUR PROGRESS

1. (i) polynomial, 4 (ii) not a polynomial

   (iii) polynomial; 5 (iv) not a polynomial

2. $3x^2 - x + 12$ 3. $-2x^4 + 2x^3 - 11x^2 - 7x - 6$

4. $-2x^3 + 7x^2y - 3xy^2 + 10y^3$ 5. $-4x^5 + 20x^4 - 33x^3 + 28x^2 - 14x + 3$

6. Quotient $= x - \frac{1}{2}$, remainder $= 0$ 7. Quotient $= 5x^2 - 2x - 7$, remainder $= 4x - 7$

8. $(a^2 - 4ab + 4b^2)$ sq. units   9. (i) $8x - 10y$ (ii) $7x^2 + \frac{6}{5}$

EXERCISE 11.1

1. $5x - 23 = 3x + 7$ 2. $7x = 2(x + 10 + x)$ 3. $y + 4 = 3(y - 2)$

4. $A = \pi r^2$ 5. $A = \pi(R^2 - r^2)$ 6. $10x + y = 4(x + y)$

7. $d = n - 3$
8. $M = 2x + y + \frac{1}{2}z + \frac{1}{4}t$

9. $E = 26(260x + 235y)$, where E is the monthly earning in rupees.

10. $\dfrac{8x + 7(45 - x)}{45}$
11. $\dfrac{xt + ys}{t + s}$ km/hr
12. $C = 50y + 10(x - y)$

EXERCISE 11.2

1. (i) $R = \dfrac{100(A - P)}{PT}$
(ii) $b = \dfrac{A - 2a}{2}$
(iii) $x = \dfrac{b}{a + 2}$
(iv) $g = \dfrac{2(ut - s)}{t^2}$

(v) $v = \dfrac{2s - ut}{t}$
(vi) $n = \dfrac{l(m^2 - 1)}{m^2 + 1}$
(vii) $h = \dfrac{A - 2\pi r^2}{2\pi r}$
(viii) $r = \sqrt{\dfrac{V}{\pi h}}$

2. $T = \dfrac{100(A - P)}{PR}$; $2\frac{1}{2}$
3. $b = \dfrac{P - 2l}{2}$; 14
4. $b = \dfrac{ac}{a - c}$; 75
5. $g = \dfrac{4\pi^2 l}{T^2}$; 980

6. (i) 18
(ii) 13
(iii) 1·4
(iv) 8

7. $d = \dfrac{2(S - an)}{n(n - 1)}$; 3
8. $h = \dfrac{V}{\pi(R^2 - r^2)}$; 12

CHECK YOUR PROGRESS

1. $10(9 - x) + x - 9 = 45$
2. $n = \dfrac{l - a + d}{d}$; 13

3. $s = \dfrac{v^2 - u^2}{2a}$; 43·75
4. $x = y(y - 1)$; 156

EXERCISE 12

1. (i) 72
(ii) 64
(iii) 81
(iv) $2\frac{10}{27}$

(v) $\dfrac{4}{5}$
(vi) 2
(vii) $6\frac{1}{5}$
(viii) 7

2. (i) 49
(ii) 32
(iii) $-\dfrac{1}{8}$

(iv) $15\frac{5}{8}$
(v) 81
(vi) $\dfrac{1}{27}$

3. (i) $\dfrac{8}{81}$
(ii) -48
(iii) $\dfrac{5}{96}$

4. (i) $2^3 \times 11$
(ii) $2^6 \times 3$
5. (i) $\dfrac{5^2}{7^2 \times 11^7}$
(ii) $\dfrac{3^4}{5^6}$

6. (i) $5x^4 y^6$
(ii) $a^{-15} b^{10}$
(iii) $-\dfrac{8y^6}{27x^3 z^6}$

(iv) $2g^5 - 2g^3 + 2g - \dfrac{2}{g}$

7. (i) 25
(ii) $\dfrac{1}{4}$
(iii) $2\frac{1}{4}$

(iv) $\dfrac{1}{8}$
(v) $\dfrac{2}{3}$
(vi) $\dfrac{16}{81}$

8. (i) $2x$
(ii) $9p^{-2}$
(iii) $81xy^{-3}$
(iv) $2p^2 q^{-3}$
(v) $x^3 y^{-2} z^4$
(vi) $p^3 q^{-9}$

9. (i) $\dfrac{y^2}{x^2}$
(ii) $\dfrac{a^5}{b^7}$
(iii) $\dfrac{3^3 z}{x^5 y^5}$
(iv) $\dfrac{1}{x^{2/3} y^{1/2}}$

11. (i) x^{n+6}
(ii) $\dfrac{1}{25}$
(iii) 1

12. (i) 231   (ii) $5\frac{1}{3}$ (iii) $43\frac{1}{15}$

15. (i) -1 (ii) 3   (iii) 2   (iv) -2

CHECK YOUR PROGRESS

1. (i) $5\frac{13}{27}$ (ii) 19   2. 6×7^{-21}

3. (i) 1   (ii) $\frac{8}{9}x$ (iii) $a + b$ 6. -1

EXERCISE 13.1

1. (i) $x^2 + 8x + 15$ (ii) $y^2 - 3y - 10$
2. (i) $a^2 + 5a - 24$ (ii) $t^2 - 17t + 66$
3. (i) $a^2 + \frac{5}{6}a + \frac{1}{6}$ (ii) $b^2 - \frac{4}{15}b - \frac{4}{15}$
4. (i) $x^2 - \frac{19}{7}x - \frac{6}{7}$ (ii) $x^2 - 0{\cdot}3x - 0{\cdot}28$
5. (i) $40 + 3x - x^2$ (ii) $33 - 14z + z^2$
6. (i) $4x^2 + 20x + 21$ (ii) $25y^2 + 35y - 18$
7. (i) $49c^2 - 98c + 33$ (ii) $p^4 - 2p^2 - 15$
8. (i) $9x^4 - 6x^2 - 35$ (ii) $21 + 4xy - x^2y^2$
9. (i) $\frac{y^2}{9} - 3y + 14$ (ii) $10x^2 + 29xy + 10y^2$
10. (i) $21a^2 - 29ab - 10b^2$ (ii) $12m^2n^2 - 2mn - 30$
11. (i) $12x^4 - 7x^2y^2 - 10y^4$ (ii) $14c^4 - 25c^2d^2 + 6d^4$
12. (i) $3a^2b^2 - abc - 10c^2$ (ii) $6x^3 + 19x^2 + 8x - 5$

EXERCISE 13.2

1. (i) $x^2 - 49$ (ii) $25x^2 - 81$
2. (i) $y^2 - \frac{4}{9}$ (ii) $16 - 9x^2$
3. (i) $16x^2 - 121y^2$ (ii) $\frac{4}{9}p^2 - \frac{16}{25}q^2$
4. (i) $9 - a^2b^2$ (ii) $p^2 - \frac{1}{q^2}$
5. (i) $\frac{4}{a^2} - \frac{25}{b^2}$ (ii) $\frac{1}{25x^2} - \frac{9}{4y^2}$
6. (i) $9x^4 - \frac{4}{25}y^4$ (ii) $1{\cdot}96a^2 - 0{\cdot}09b^2$
7. (i) $y^4 - 16$ (ii) $16p^4 - 81$
8. (i) $x^4 - a^4$ (ii) $x^4 - y^4z^4$
9. (i) 9936   (ii) 89964
   (iii) $99{\cdot}84$ (iv) $224{\cdot}91$

EXERCISE 13.3

1. (i) $9a^2 + 42ab + 49b^2$ (ii) $64 + 80p + 25p^2$
2. (i) $4x^2 + \frac{12x}{y} + \frac{9}{y^2}$ (ii) $3p^2 + \frac{4}{5}\sqrt{3}\,pq + \frac{4}{25}q^2$

3. (i) $\dfrac{4x^2}{9y^2} + 2 + \dfrac{9y^2}{4x^2}$ (ii) $\dfrac{a^2}{3} + 6 + \dfrac{27}{a^2}$

4. (i) $4m^4 + \dfrac{12}{7}m^2n^2 + \dfrac{9}{49}n^4$ (ii) $9a^2b^2 + 3abc + \dfrac{c^2}{4}$

5. (i) $9a^2 - 42a + 49$ (ii) $9p^2 - 30pq + 25q^2$

6. (i) $\dfrac{x^2}{4} - \dfrac{1}{3}xy + \dfrac{y^2}{9}$ (ii) $\dfrac{4}{m^2} - \dfrac{12}{mn} + \dfrac{9}{n^2}$

7. (i) $9x^2 - 2 + \dfrac{1}{9x^2}$ (ii) $6c^2 - 8\sqrt{3}\,cd + 8\,d^2$

8. (i) $4a^2 + 20a + 25$ (ii) $9b^2 - 12b + 4$

   (iii) $16p^2 + \dfrac{16}{3}p + \dfrac{4}{9}$ (iv) $\dfrac{4}{9}z^2 - \dfrac{20}{21}z + \dfrac{25}{49}$

   (v) $9x^2 + 15xy + \dfrac{35}{54}y^2$ (vi) $25c^4 - 20c^2d + 4d^2$

   (vii) $6a^2 - 6a + \dfrac{3}{2}$ (viii) $4p^2 - 2 + \dfrac{1}{4p^2}$

9. (i) 251001   (ii) 1010025   (iii) 106·09

10. (i) 39601   (ii) 994009   (iii) 96·04

11. (i) $(4x + 5y)^2$ (ii) $(2p + 11)^2$

   (iii) $(3a - 7b)^2$ (iv) $\left(5m - \dfrac{n}{3}\right)^2$

12. (i) 14   (ii) 194

13. (i) 51   (ii) 2599

14. 29   15. 15   16. 33   17. 3

18. (i) ± 7 (ii) $\pm\sqrt{33}$ 19. (i) $\pm\sqrt{85}$ (ii) ± 7

20. (i) 23   (ii) 527   21. (i) 3   (ii) 7

EXERCISE 13.4

1. (i) $a^2 + b^2 + c^2 - 2ab + 2bc - 2ca$ (ii) $4x^2 + 9y^2 + 25z^2 + 12xy + 30yz + 20zx$

2. (i) $4p^2 + 9q^2 + 1 - 12pq - 6q + 4p$ (ii) $x^2 + \dfrac{1}{x^2} + 3 - \dfrac{2}{x} - 2x$

3. (i) $8a^3 + b^3 + 12a^2b + 6ab^2$ (ii) $343c^3 + 64d^3 + 588c^2d + 336cd^2$

4. (i) $8x^3 - 36x^2 + 54x - 27$ (ii) $a^3 - 125b^3 - 15a^2b + 75ab^2$

5. (i) $8x^3 + 12x + \dfrac{6}{x} + \dfrac{1}{x^3}$ (ii) $27a^3 - 9a + \dfrac{1}{a} - \dfrac{1}{27a^3}$

6. 29   7. 59   8. ± 11 9. 26

10. 152   11. 335   12. 52   13. 140

14. 198   15. 36   16. 243   17. 728

CHECK YOUR PROGRESS

1. (i) $10x^2 - 31xy + 24y^2$ (ii) $12p^4 + p^2q^2 - 35q^4$

   (iii) $\dfrac{x^2}{9} - \dfrac{y^2}{16}$ (iv) $\dfrac{4}{a^2} - \dfrac{9}{b^2}$

3. (i) $25a^2 + 20abc + 4b^2c^2$ (ii) $9m^2n^2 - 6mnp + p^2$

   (iii) $4x^2 + 9y^2 + z^2 - 12xy - 6yz + 4zx$ (iv) $9x^2 + 4y^2 + 1 - 12xy + 4y - 6x$

   (v) $27x^3 + 54x^2 + 36x + 8$ (vi) $8 - 36p + 54p^2 - 27p^3$

4. $\dfrac{1}{2x^2} - 2$

5. $x^2 + 2xy + y^2 - 1$

6. (i) 7   (ii) 47   7. (i) ±6   (ii) ±2

8. (i) ±7   (ii) ±3$\sqrt{5}$ 9. 36   10. 0

11. 76   12. (i) 7   (ii) 47   (iii) 18

EXERCISE 14.1

1. (i) $4xy^2(2y + 3x)$ (ii) $3ax^2(5x - 3)$
2. (i) $7py(3y - 8)$ (ii) $2x^2(2x - 3)$
3. (i) $2\pi r(r - 2)$ (ii) $2(9m + 8n)$
4. (i) $5abc(5c - 3ab)$ (ii) $14pq^2r(2p - 3r)$
5. (i) $2x(4x^2 - 3x + 5)$ (ii) $2(7mn + 11m - 31p)$
6. (i) $6pq(3pq - 4q + 5p)$ (ii) $3a^2b^2(9ab - 6b + 25a)$
7. (i) $5(2p - 3q)(3a - 2b)$ (ii) $3(x^2 + y^2)(a + 2b)$
8. (i) $2(x + 2y)^2(3x + 6y + 4)$ (ii) $7(a - 3b)[2(a - 3b)^2 - 3p]$
9. $5(2p + q)[2a(2p + q)^2 - 3b(2p + q) + 7]$

EXERCISE 14.2

1. (i) $(x + y)(x - 1)$ (ii) $(y - z)(y - 5)$
2. (i) $(x - y)(5y - 7)$ (ii) $(5p - 8q)(p - 2)$
3. (i) $(a - b)(ab + 3)$ (ii) $(x - 3)(x^2 + 1)$
4. (i) $(2y - 1)(3xy - 5)$ (ii) $(x - 2y)(3a + 4b)$
5. (i) $(x + y)(x + y^2)$ (ii) $(y - x)(y + x^2)$
6. (i) $(b + 1)(ab - 1)$ (ii) $(a - 2b)(2 - x)$
7. (i) $(5 + 2r)(ph - 2qk)$ (ii) $(x - a)(x - 2b)$
8. (i) $(bx - ay)(ax - by)$ (ii) $(x^2 + y^2)(a^2 + b^2)$
9. (i) $(a - 2b)(a^2 + b)$ (ii) $3(x - 1)(xy + 4)$
10. (i) $(a + b)(ab - bc + xy)$ (ii) $(a - b)(x^2 + y^2 + z^2)$
11. (i) $(x - 1)(2 - x + a)$ (ii) $(ax + by)(1 + a - ax - by)$

EXERCISE 14.3

1. (i) $(2p + 3)(2p - 3)$ (ii) $(2x + 13y)(2x - 13y)$
2. (i) $(3xy + 5)(3xy - 5)$ (ii) $\left(4x + \dfrac{1}{12}\right)\left(4x - \dfrac{1}{12}\right)$
3. (i) $5(2x + 3y)(2x - 3y)$ (ii) $\left(\dfrac{3}{4} + 5ab\right)\left(\dfrac{3}{4} - 5ab\right)$
4. (i) $(2a + 3b + 4c)(2a + 3b - 4c)$ (ii) $(1 + b - c)(1 - b + c)$
5. (i) $(4x + 3y)(2x + 3y)$ (ii) $5(m + n)(n - m)$
6. (i) $(9a + b)(a + 9b)$ (ii) $(13x + 4)(5x + 8)$
7. (i) $x(x + 5)(x - 5)$ (ii) $7(3pq + 1)(3pq - 1)$
8. (i) $8b(2a + 3b)(2a - 3b)$ (ii) $(a + b)(3a + 3b + 5)(3a + 3b - 5)$
9. (i) $(x + y + 1)(x - y - 1)$ (ii) $(a - b + c)(a - b - c)$
10. (i) $(3x + y - 2)(3x - y + 2)$ (ii) $(2a + 2b + 1)(2a - 2b + 1)$
11. (i) $(25 + p^2)(5 + p)(5 - p)$ (ii) $5y(y^2 + 9)(y + 3)(y - 3)$
12. (i) 984000   (ii) 356000   (iii) 72   (iv) 21
13. $a(b + c)(b - c)$

EXERCISE 14.4

1. (i) $(x + 1)(x + 2)$ (ii) $(z + 4)(z + 6)$
2. (i) $(x + 7)(x + 8)$ (ii) $(p + 5)(p + 17)$

3. (i) $(x - 4)(x - 6)$

(ii) $(m - 2)(m - 21)$

4. (i) $(x + 6)(x - 9)$

(ii) $(a + 3)(a - 10)$

5. (i) $(y + 3)(y - 8)$

(ii) $(t + 27)(t - 4)$

6. (i) $(3x + 2)(x + 4)$

(ii) $(3y + 4)(y + 2)$

7. (i) $(7x - 8)(2x - 1)$

(ii) $(4x - 7)(3x + 5)$

8. (i) $(x + 2)(5x - 3)$

(ii) $(x - 3)(2x + 3)$

9. (i) $(2x + 5)(3x - 2)$

(ii) $(1 - 2x)(5 + 6x)$

10. (i) $(1 - 21y)(1 + 3y)$

(ii) $(3x + 4y)(x - 3y)$

11. (i) $(x + 5y)(x - 8y)$

(ii) $(2pq - 3)(5pq - 3)$

12. (i) $(ab + 5)(2ab - 9)$

(ii) $(4x + 5)(3x - 2)$

13. (i) $(a + b + 3)(a + b - 14)$

(ii) $(4 + 5p + 5q)(2 - p - q)$

14. (i) $(x - 2y - 5)(x - 2y - 1)$

(ii) $(1 + 4x - 6y)(7 - 8x + 12y)$

CHECK YOUR PROGRESS

1. (i) $3x^2y(7y^2 - 4x)$

(ii) $6pq(4q - 3p - 10)$

2. (i) $5(2x - 3)[3(2x - 3)^2 - 2]$

(ii) $(b - c)[a(b + c) + d]$

3. (i) $(x + 1)(2a^2 - b)$

(ii) $(p - a)(p - 2b)$

4. (i) $(x - z)(xz + y^2)$

(ii) $5a(a - 1)(a^2 + 6)$

5. (i) $(c - d)(bc - bd - a + 3)$

(ii) $(p + 4q)(p - 4q)$

6. (i) $3p(2p + 1)(2p - 1)$

(ii) $(5x + 2y)(x - 2y)$

7. (i) $(a - y)(x + b)(x - b)$

(ii) $(3x + y - 4)(3x - y + 4)$

8. (i) $(x + 8)(x - 6)$

(ii) $(p - 15)(p + 8)$

9. (i) $(x - 2)(3x + 2)$

(ii) $(3ab - 4)(5ab - 2)$

10. (i) $(x + 11y)(x - 9y)$

(ii) $\pi a(a^2 + \pi b)(a^2 - \pi b)$

11. (i) $(3a - 3b + 11)(a - b - 4)$

(ii) $(a + 3)(a - 3)(a + 1)(a - 1)$

12. (i) 800000

(ii) 24

EXERCISE 15.1

1. (i) $2xy; 12x^2y^2$

(ii) $6a^2b^2; 36a^3b^5$

2. (i) $4xy^2; 84x^3y^3z^2$

(ii) $8abc; 336a^2b^2c^2d$

3. (i) $mn; 30m^3n^3$

(ii) $3ab^2; 60a^4b^4$

4. (i) $3pq^2r; 36p^3q^3r^3$

(ii) $5y; 60x^3y^3z^5$

5. (i) $x + 3y; x(x + 3y)(x - 3y)$

(ii) $3x - 4y; 5x(3x + 4y)(3x - 4y)$

6. (i) $2a - 5; (2a + 5)(2a - 5)^2$

(ii) $2(x + 2y); 12x(x + 2y)(x - 2y)$

7. (i) $x + 3; (x + 3)^2(2x + 1)$

(ii) $2a + 1; (2a + 1)^2(3a + 2)$

8. (i) $x + 2; 6x(x + 2)^2(x + 3)$

(ii) $x - 3; 4(x - 3)^2(x + 3)(2x + 7)$

EXERCISE 15.2

1. (i) $-\dfrac{2}{3a}$

(ii) $\dfrac{2p^2}{5qr}$

2. (i) $\dfrac{1}{x(x + 2)}$

(ii) $\dfrac{x - 4}{x}$

3. (i) $\dfrac{1}{2 - 3x}$

(ii) $\dfrac{x - 1}{x^2}$

4. (i) $\dfrac{x + 1}{x + 3}$

(ii) $\dfrac{xy}{x + y}$

5. (i) $\dfrac{3y}{x - 2y}$

(ii) $\dfrac{3(x - 2)}{x - 5}$

6. (i) $\dfrac{x - y}{x + y}$

(ii) $\dfrac{2x + 1}{3x + 1}$

7. (i) 3

(ii) $\dfrac{x(x + 1)}{2(x - 2)}$

8. (i) $\dfrac{3}{m - 3}$

(ii) $\dfrac{x(3x + 4y)}{x + 5}$

9. (i) $\dfrac{13m + 10}{15}$ (ii) $\dfrac{5x}{2(5x - 1)}$ 10. (i) $\dfrac{5t + 7}{(t + 1)(t + 2)}$ (ii) $-\dfrac{2}{m^2 - 4}$

11. (i) $\dfrac{2}{x + y}$ (ii) $-\dfrac{2}{(x - 1)(x - 2)(x - 3)}$

CHECK YOUR PROGRESS

1. $6xyz^2$; $360x^3y^4z^4$ 2. $2(x - 2y)$; $12x(x - 2y)^2 (x + 2y) (x + 3y)$

3. (i) $\dfrac{2ab (a - b)}{a + b}$ (ii) $\dfrac{3x - y}{4x - y}$ 4. (i) $\dfrac{a}{b}$ (ii) $\dfrac{(x + 1) (x + 3)}{x^2 (x - 3)}$

5. (i) $\dfrac{x + 1}{p + 1}$ (ii) $\dfrac{x - 1}{x + 1}$ 6. (i) $\dfrac{x + 7y}{(x - y) (x + y)}$ (ii) $\dfrac{5x - 1}{(x + 1) (2x - 1) (3x - 1)}$

EXERCISE 16.1

1. (i) 3   (ii) $\dfrac{11}{3}$ 2. (i) $\dfrac{10}{9}$ (ii) 4

3. (i) 22   (ii) $6\dfrac{1}{2}$ 4. (i) $\dfrac{3}{5}$ (ii) 60

5. (i) -2 (ii) $-3\cdot 7$ 6. (i) 16   (ii) 17

7. (i) -10 (ii) -2 8. (i) -1 (ii) $\dfrac{1}{5}$

9. (i) $2\dfrac{1}{4}$ (ii) $3\dfrac{1}{2}$ 10. $78\dfrac{1}{2}$ 11. $x = 6$, $p = \dfrac{5}{6}$

12. $x = -\dfrac{7}{5}$; $y = \dfrac{7}{9}$

EXERCISE 16.2

1. -7 2. 3   3. 10, 11; 12, 13   4. -2, 0, 2

5. 4, 5, 6   6. 25, 27   7. $\dfrac{7}{15}$ 8. 10, 25

9. 3   10. 62   11. 27   12. ₹36, ₹30

13. 27   14. 8 years, 2 years   15. 28 years, 4 years

16. 15 years, 9 years   17. 32, 25   18. 75, 125, 175

19. 28   20. 12   21. 65°, 115°   22. 50°, 60°, 70°

23. 3; 22 units   24. 30 cm   25. 322 cm²

26. $2[(x + 10) + (x + 8)] = 2 \times 2(10 + 8)$; 323 cm²

27. 25 km/hr, 30 km/hr   28. 60 km/hr, 90 km/hr

29. 0·6 km   30. 25 km/hr

EXERCISE 16.3

1. (i) $\{-1, 0, 1, 3\}$ (ii) $\{-7, -5, -3\}$ (iii) $\{3\}$

(iv) $\{-3, -1, 0, 1, 3\}$ (v) $\{-7, -5, -3, -1, 0\}$ (vi) $\{0, 1, 3\}$

2. (i)

(ii)

(iii)

(iv)

(v)

(vi)

3.
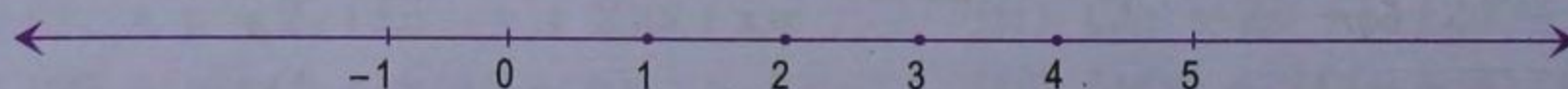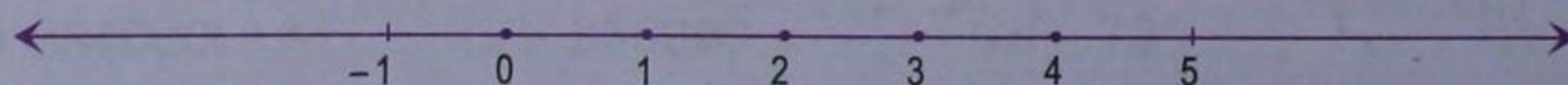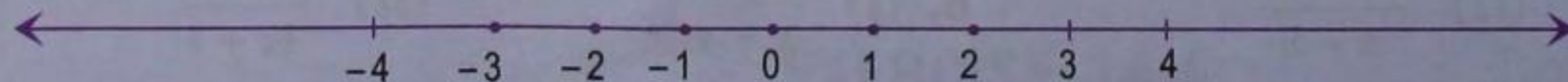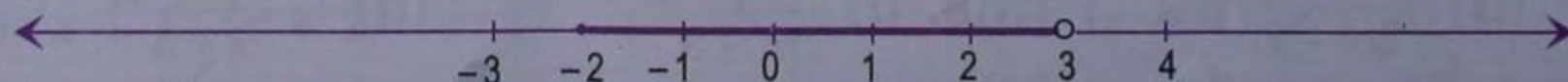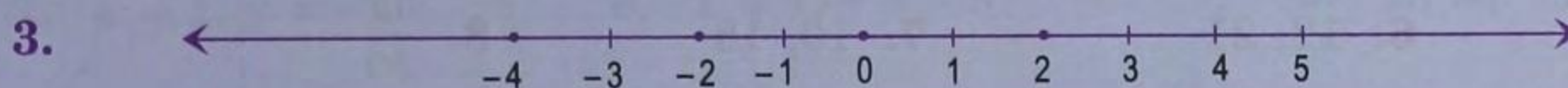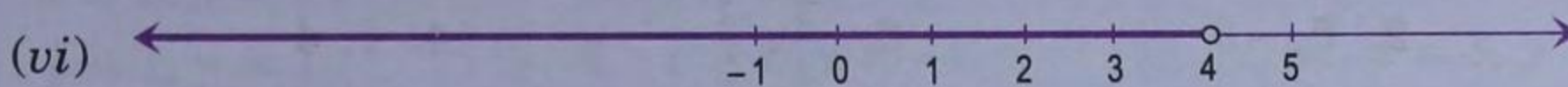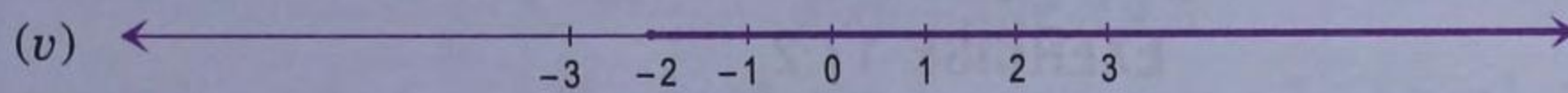
4. (i) {1, 2, 3}   (ii) {−1, 0, 1, 2}   (iii) {−5}   (iv) φ

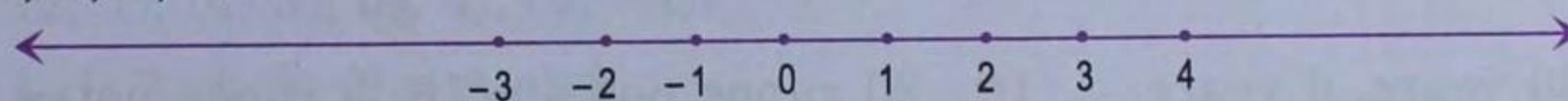5. (i) {6, 9, 12}   (ii) {−6, −3}   (iii) {−6, −3, 0}

6. (i) {1, 2, 3}   (ii) {0, 1, 2, 3, 4}   (iii) {1, 2, 3, 4}   (iv) {−1, 0, 1, 2, ...}

7. (i) {1, 2, 3, 4, 5}   (ii) {0, 1, 2}   (iii) {0, 1, 2, 3, 4, 5}   (iv) {..., −8, −7, −6}

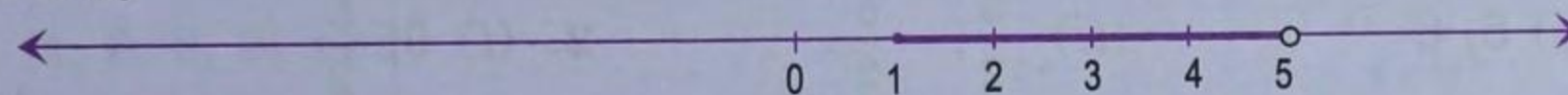8. (i) {1, 2, 3, 4}   (ii) {0, 1}   (iii) {0, 1, 2, 3}   (iv) {1, 2, 3, 4}

9. {−3, −2, −1, 0, 1}

10. {0, 1}

11. (i) {1, 2, 3}
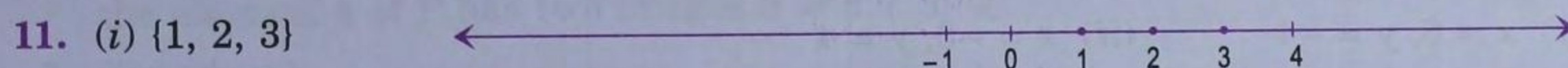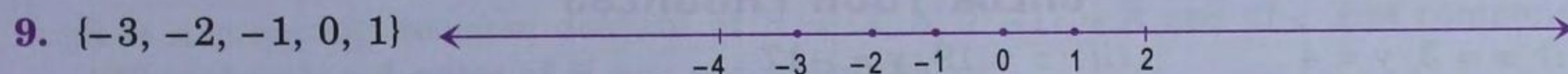
(ii) {−3, −2, −1, 0, 1, 2, 3, 4}

(iii) $\{x : x \in \mathbf{R}, -3 < x \le 6\}$
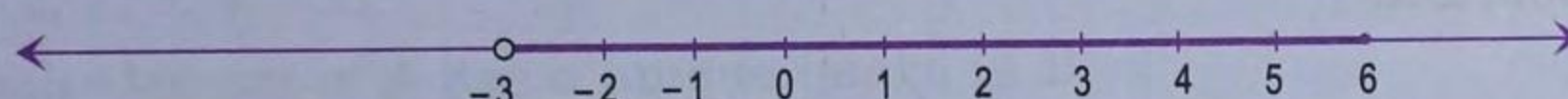
(iv) $\{x : x \in \mathbf{R}, 1 \le x < 5\}$

CHECK YOUR PROGRESS

1. (i) −1   (ii) −3   (iii) $\dfrac{3}{2}$ (iv) 1

2. 22, 24   3. 2   4. 17   5. 72

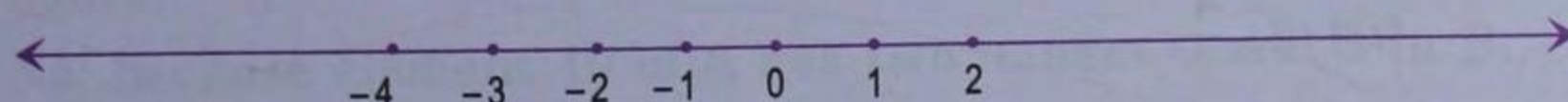6. Ankita 12 years, Anu 14 years

7. 5 years   8. 19   9. 17   10. 240   11. 195 km

12.
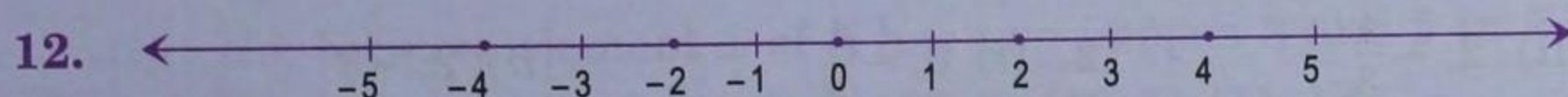
13. (i) {0, 1, 2, 3, 4, 5}
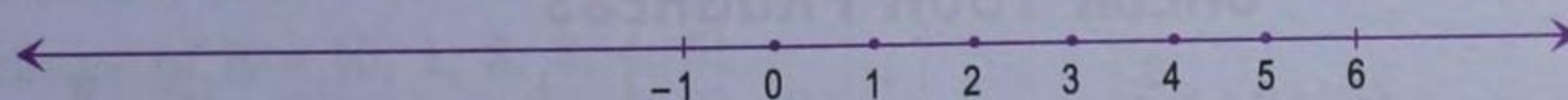
(ii) {−4, −3, −2, −1, 0, 1, 2}

EXERCISE 17.1

1. (i) $x = 5, y = 4$ (ii) $x = 6, y = -2$ 2. (i) $x = 1, y = 4$ (ii) $x = 1, y = -5$

3. (i) $x = -8, y = -4$ (ii) $x = 1, y = 2$ 4. (i) $x = 2, y = 1$ (ii) $x = 7, y = -2$

5. (i) $x = 4, y = -1$ (ii) $x = 7, y = 2$ 6. (i) $x = 11, y = 14$ (ii) $x = 8, y = 9$

7. (i) $p = 20, q = -12$ (ii) $a = 4, b = 3$ 8. (i) $x = 2, y = 5$ (ii) $x = -3, y = 9$

9. (i) $x = 10, y = 6$ (ii) $x = 3, y = 2$ 10. (i) $x = 2, y = 1$ (ii) $x = -1, y = -2$

11. (i) $x = 1, y = -1$ (ii) $x = -2, y = -3$ 12. (i) $x = \dfrac{1}{3}, y = -\dfrac{1}{2}$ (ii) $x = 2, y = 5$

EXERCISE 17.2

1. 24, 16

2. 5, −3

3. $\frac{3}{2}, \frac{1}{2}$

4. 7, 4

5. 22, 13

6. 12, 21

7. 10, 15

8. $\frac{17}{30}$

9. 48

10. 25

11. Eraser ₹3, pen ₹4

12. ₹206

13. ₹3

14. 8

15. Sumitra 52 years, daughter 12 years.

16. Sujata 26 years, Sushma 21 years.

17. ₹6000, ₹8000

18. $x = 3\frac{1}{2}, y = 1\frac{1}{2}$

19. (i) 10 km/hr   (ii) 4 km/hr

CHECK YOUR PROGRESS

1. (i) $x = 3, y = 4$ (ii) $x = 19, y = -17$

2. (i) $x = -\frac{7}{8}, y = -\frac{1}{4}$ (ii) $x = 12, y = 2$

3. (i) $x = 6, y = -4$ (ii) $x = -3, y = 4$

4. 10, 7

5. 11, 8

6. $\frac{12}{60}$

7. 32

8. 15

9. 30 years, 6 years

10. 20 rupee notes = 16, 5 rupee notes = 12

11. 500, 200

EXERCISE 18

1. (i) 5, 6   (ii) $\frac{5}{2}, -\frac{5}{2}$

2. (i) 0, $\frac{5}{2}$ (ii) 8, −6

3. (i) 3, −2   (ii) 1, $\frac{1}{2}$

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

5. (i) $\frac{5}{2}, -5$ (ii) 7, −7

6. (i) $\frac{9}{2}, -2$ (ii) 0, $-\frac{11}{6}$

7. (i) $-\frac{1}{2}, -\frac{1}{2}$ (ii) −8, 16

8. (i) $\frac{2}{3}, -\frac{2}{7}$ (ii) −1, $\frac{3}{2}$

9. (i) −5, $\frac{1}{6}$ (ii) 2, $\frac{1}{2}$

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

11. (i) 4, 3   (ii) 2, $-\frac{4}{3}$

12. (i) 5, $-\frac{1}{2}$ (ii) 2, −3

CHECK YOUR PROGRESS

1. (i) −3, $\frac{1}{2}$ (ii) 2, $-\frac{2}{3}$

2. (i) $\frac{1}{4}, \frac{1}{4}$ (ii) −2, $-\frac{3}{2}$

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

EXERCISE 19.1

1. (i) True   (ii) False   (iii) True   (iv) False

   (v) False   (vi) True   (vii) False   (viii) False

3. Rectangle; 15 square units

4. Isosceles triangle; 10 square units

5. (0, 0), (6, 0), (6, 4), (0, 4)
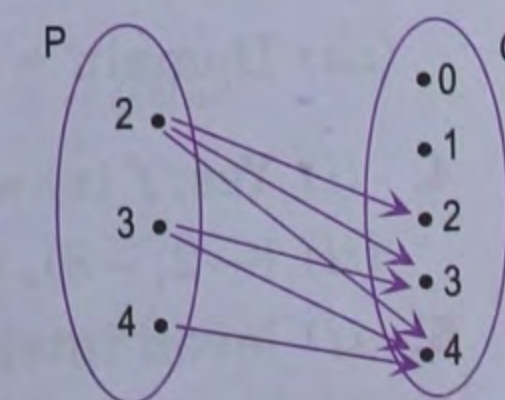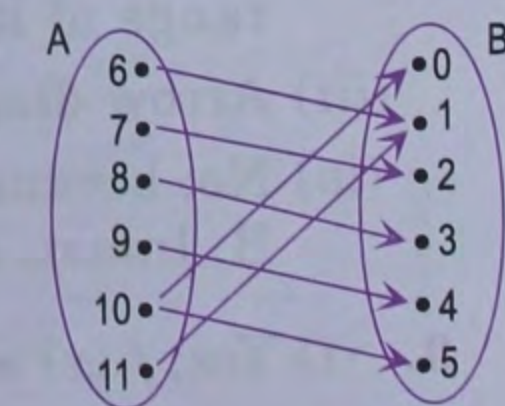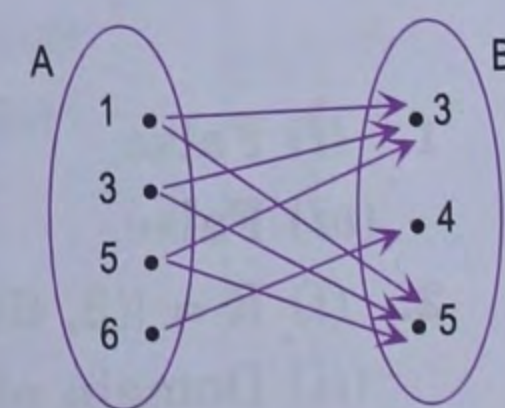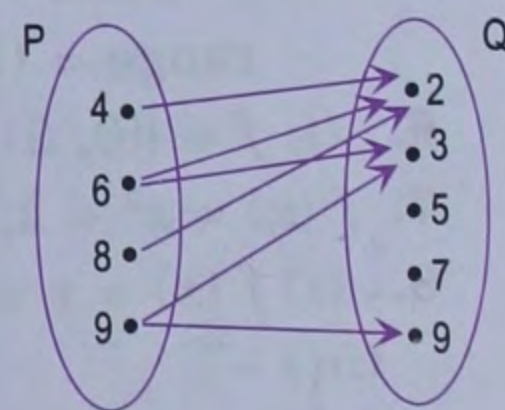
EXERCISE 19.3

1. $x = 2, y = -2$ 2. $x = 2, y = 1$ 3. $x = -1, y = -1$

4. $x = 1, y = 1$ 5. $x = 2, y = -1$ 6. $x = 3, y = 4$

7. $x = 1, y = -1$ 8. $x = 1, y = -3$ 9. 28 sq. units

CHECK YOUR PROGRESS

1. Parallelogram; 24 sq. units   2. $(2, -2)$; 25 sq. units

4. The two lines are parallel.

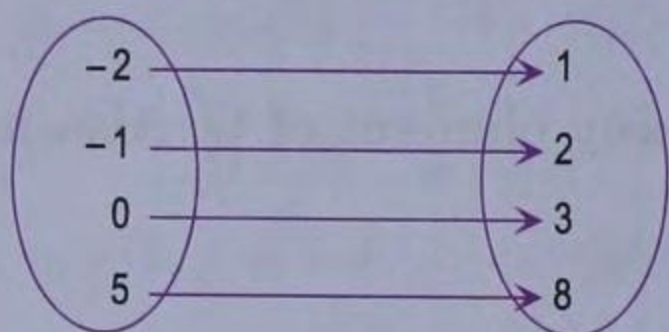5. (i) $x = 5, y = 2$ (ii) $x = 4, y = 5$

EXERCISE 20.1

1. R is a mapping because domain of R = {3, 5, 7 −1} = A and the first components of different ordered pairs of R are not repeated.

2. No; because the element 10 of P is not associated to any element of Q. Also note that the element 4 of P has two images 5 and 7 in Q.

3. (i) and (iv)

4. (i) R = {(−1, − 2), (2, 1), (4, 3), (5, 4), (0, −1)}

   (ii) Domain of R = {−1, 2, 4, 5, 0} = A and

   range of R = {−2, 1, 3, 4, −1}

   (iii) Yes; because each element of A has a unique image in B.

5. (i) R = {(4, 2), (6, 2), (6, 3), (8, 2), (9, 3), (9, 9)}

   (ii) Domain of R = {4, 6, 8, 9} and

   range of R = {2, 3, 9}

   (iii) R can be represented by an arrow diagram shown in the adjoining figure.

   (iv) No; because element 6 of P has been associated to two elements 2 and 3 of Q.

6. (i) R = {(1, 3), (1, 5), (3, 3), (3, 5), (5, 3), (5, 5), (6, 4)}

   (ii) R can be represented by an arrow diagram shown in the adjoining figure.

   (iii) No; because element 1 of A has two images 3 and 5 in B.

7. (i) R = {(6, 1), (7, 2), (8, 3), (9, 4), (10, 0), (10, 5), (11, 1)}

   (ii) Domain of R = {6, 7, 8, 9, 10, 11} = A and

   range of R = {0, 1, 2, 3, 4, 5}

   (iii) R can be represented by an arrow diagram shown in the above figure.

   (iv) No; because element 10 of A has two images 0 and 5 in B.

8. (i) R = {(2, 2), (2, 3), (2, 4), (3, 3), (3, 4), (4, 4)}

   (ii) Domain of R = {2, 3, 4} and

   range of R = {2, 3, 4}

   (iii) R can be represented by an arrow diagram shown in the adjoining figure.

   (iv) No; because element 2 of P has three images 2, 3 and 4 in Q.

EXERCISE 20.2

1. (i) {(a, e) (b, e), (c, i)}. Not a function as d has no image.

   (ii) {(a, e), (b, e), (c, i), (c, k), (d, k)}. Not a function as c does not have a unique image.

   (iii) {(a, e), (b, e), (c, i), (d, k)}. It is a function.

   (iv) {(−2, 4), (2, 4), (−3, 9), (3, 9)}. It is a function.

2. (i) {(−3, 9), (−1, 1), (0, 0), (4, 16), (7, 49)}

   (ii) Yes; $f(x) = x^2$ (iii) {−3, −1, 0, 4, 7}   (iv) {9, 1, 0, 16, 49}

3. (i) $\left\{ \left(2, \frac{1}{2}\right), (1, 1), \left(3, \frac{1}{3}\right), \left(4, \frac{1}{4}\right) \right\}$ (ii) Yes; $f(x) = \frac{1}{x}$

   (iii) {2, 1, 3, 4}   (iv) $\left\{ \frac{1}{2}, 1, \frac{1}{3}, \frac{1}{4} \right\}$

4. (i) Arrow diagram is

   (ii) Yes; each image is 3 more than pre-image;

   $f(x) = x + 3$

   (iii) Domain = {−2, −1, 0, 5}, range = {1, 2, 3, 8}

5. (i) Yes; $g(x) = 10x$

   (ii) Domain = {1, 2, 3, 4, ...} = **N**,

   range = {10, 20, 30, 40, ...}

6. (i) f = {(0, 5), (2, 9), (4, 13), (6, 17)}   (ii) {5, 9, 13, 17}

7. $f(x) = x^2 + 2$; (i) 123   (ii) 11   (iii) 2   (iv) 11   (v) 123

8. (i) $f(x) = x + 3$ (ii) $f(−2) = 1$, $f(0) = 3$, $f(2) = 5$

   (iii) −1   (iv) 1

CHECK YOUR PROGRESS

1. (i) False   (ii) False   (iii) False   (iv) True   (v) True

   (vi) False   (vii) True   (viii) True   (ix) True   (x) True

2. (i) R = {(3, 6), (4, 5), (4, 7), (4, 9), (5, 6), (7, 6)}

   (ii) Domain of R = {3, 4, 5, 7} = A and

   range of R = {5, 6, 7, 9} = B

   (iii) Arrow diagram is shown in the adjoining figure.

   (iv) No; because the element 4 of A does not have a unique image in B. Infact, element 4 of A has three images 5, 7 and 9 in B.

3. (i) Yes; $f(x) = x + \frac{1}{x}$; $f(5) = 5\frac{1}{5}$ (ii) 6

   (iii) Domain = {1, 2, .., 10}   (iv) Range = $\left\{ 2, 2\frac{1}{2}, 3\frac{1}{3}, ..., 10\frac{1}{10} \right\}$

4. (i) Yes; $f(x) = x^3$

   (ii) {(−2, −8), (−1, −1), (0, 0), (1, 1), (2, 8)}

5. (i) {even integers}   (ii) 6   (iii) 54

6. (i) Yes; {(a, 1), (b, 2), ..., (y, 25), (z, 26)}   (ii) 8   (iii) 'x'
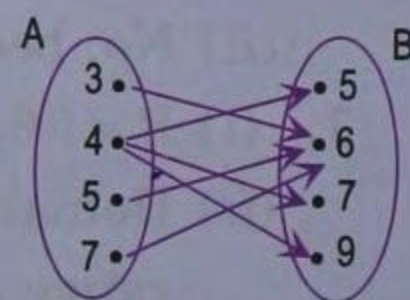
EXERCISE 21.1

1. $35°, 55°$
2. $50°$
3. $30°, 105°$
4. $50°, 130°$
5. $x = 115°, y = 65°$
6. (i) $59°$ (ii) $75°$ (iii) $36°$
7. $x = 45°, y = 75°, z = 90°, p = 150°$
8. $75°, 105°$
9. (i) $70°$ (ii) $110°$
10. 32 (i) $40°$ (ii) $140°$ (iii) $103°$
11. $x = 35°, y = 45°, z = 100°$
13. (i) Yes (ii) No

EXERCISE 21.2

1. (i) $x = 65°, y = 115°, z = 115°, p = 115°$ (ii) $a = 62°, c = 48°, b = 70°$
   (iii) $x = 44°, y = 24°, z = 112°$
2. (i) $x = 35°, y = 135°$ (ii) $x = 36°, y = 108°$ (iii) $x = 25°, y = 45°$
3. $x = 62°, y = 78°, z = 102°$
4. (i) $a = 72°, b = 72°, c = 108°, d = 72°$
   (ii) $a = 112°, b = 48°, c = 20°, d = 48°$
   (iii) $a = 85°, b = 62°, c = 118°, d = 118°$
5. (i) $a = 136°, b = 46°, c = 44°$
   (ii) $a = 72°, b = 108°, c = 115°$
   (iii) $x = 30°$
6. (i) $a = 70°, b = 110°, c = 68°, d = 70°, e = 112°$
   (ii) $a = 110°, b = 70°, c = 38°, d = 142°$
7. (i) $x = 60°, y = 60°, z = 70°, t = 110°$
   (ii) $x = 57°$
8. (i) Yes (ii) Yes (iii) No
9. $28°$

CHECK YOUR PROGRESS

1. $25°, 65°$
2. $50°$
3. $35°$ (i) $125°$ (ii) $109°$
4. (i) $x = 50°, y = 50°, z = 130°$ (ii) $72°$ (iii) $120°$ (iv) $50°$
5. (i) $x = 42°, y = 63°, z = 75°, p = 138°$ (ii) $x = 75°, y = 15°$
   (iii) $x = 145°, y = 55°, z = 125°$
6. (i) 38 (ii) 23
7. $\angle x = 39°, \angle y = 96°, \angle z = 39°$
8. $37°$
9. $50°$

EXERCISE 22.1

1. (i) equal (ii) equal (iii) $45°, 45°, 90°$ (iv) 60
2. (i) $40°$ (ii) $40°$ (iii) $70°$
3. (i) $x = 49°, y = 41°$ (ii) $x = 56°, y = 34°, z = 124°$ (iii) $x = 108°$
4. (i) $x = 35°, y = 115°$ (ii) $x = 50°, y = 68°$ (iii) $x = 36°$
5. (i) $x = 50°, y = 40°, z = 130°$, (ii) $x = 55°, y = 75°, z = 105°$
6. (i) $x = 35°, y = 97°$ (ii) $x = 52°$ (iii) $x = 110°$
7. (i) $x = 51°, y = 39°$ (ii) $x = 64°, y = 52°$ (iii) $x = 98°, y = 77°$
8. (i) $x = 55°, y = 125°, z = 105°$ (ii) $x = 32°, y = 64°, z = 52°$ (iii) $x = 108°$
9. (i) $35°$ (ii) $75°$
10. $54°, 60°, 66°$
11. $66°, 24°$
13. 44
14. $80°, 80°, 20°$
15. $55°, 55°, 70°$
16. $72°, 54°, 54°$
17. (i) 34 (ii) 70 (iii) $44°$

EXERCISE 22.2

1. (*i*) BC   (*ii*) AB   2. (*i*) PQ   (*ii*) QR; QR, PR, PQ
3. (*i*) ∠A   (*ii*) ∠B ; ∠A, ∠C, ∠B
4. AB   5. PR   6. (*i*) AB   (*ii*) BC
7. (*i*) ∠C   (*ii*) ∠A   8. AB, AC, BC   9. AC, DC, AD
10. Greatest side is BC and smallest side is AC

EXERCISE 22.3

1. (*i*) congruent; S.S.S.   (*ii*) congruent; A.A.S.
   (*iii*) congruent; R.H.S.   (*iv*) congruent; A.S.A.
   (*v*) not congruent; included angles are not equal
   (*vi*) not congruent; corresponding sides are not equal
2. (*i*) congruent; S.A.S.
   (*ii*) not necessary; included angle may not be equal
   (*iii*) congruent; A.A.S.   (*iv*) congruent; R.H.S.
   (*v*) congruent; S.S.S.
9. (*i*) $x = 15°, y = 43°$ (*ii*) $x = 60, y = 5$ units
   (*iii*) $x = 5$ units, $y = 16$ units.

EXERCISE 22.4

1. (*i*) 17 cm   (*ii*) 24 cm   (*iii*) 40 cm   (*iv*) 20 cm   (*v*) 2 cm   (*vi*) 7 cm
2. (*i*) Yes   (*ii*) No   (*iii*) Yes   3. 12 m   4. (*i*) 25 m   (*ii*) 24 m
5. (*a*) 24 cm   (*b*) 17 cm   6. 15 m
7. (*i*) 24 cm   (*ii*) 10 cm; 90°   8. 24 cm
9. (*i*) 17 cm   (*ii*) 68 cm

CHECK YOUR PROGRESS

1. (*i*) 66°   (*ii*) 20°
2. (*i*) $x = 46°, y = 26°, z = 72°$ (*ii*) $x = 65°, y = 67°, z = 92°$
3. (*i*) $x = 12, y = 70$ (*ii*) $x = 60, y = 45$
4. $22\frac{1}{2}°, 22\frac{1}{2}°, 135°$ 6. 110°   7. ∠P
8. CA < 14 cm and CA > 2 cm   9. BD, DC, AB.
13. (*a*) 13 cm   (*b*) 9 cm
14. (*i*) 3 cm   (*ii*) 4 cm ; 90°   15. 16 cm

EXERCISE 23.1

1. 95°   2. 67°   3. 73°   4. 75°   5. 50°
6. (*i*) 100   (*ii*) 100°, 80°, 70°, 110°
7. 48°, 72°, 96°, 144°   8. 60°, 100°, 120°   9. 75°, 120°
10. ∠A = 72°, ∠D = 108°, ∠B = 84°, ∠C = 96°
11. (*i*) 24   (*ii*) 76°   (*iii*) 54°

EXERCISE 23.2

1. (i) False   (ii) True   (iii) True   (iv) True   (v) False
   (vi) True   (vii) False   (viii) True   (ix) False
2. $\angle A = 55°$, $\angle B = 125°$ 3. 19   cm   4. 75°, 105°, 75°, 105°
5. $x = 43°$, $y = 137°$ 6. $\angle A = 75°$, $\angle B = 86°$, $\angle C = 94°$, $\angle D = 105°$
7. (i) 54°   (ii) 126°   8. (i) 31°   (ii) 59°   (iii) 59°
9. (i) 40°   (ii) 80°   (iii) 100°
10. (i) 66°   (ii) 38°   (iii) 76°   14. $\angle A = \angle B = 78°$, $\angle D = 102°$
15. (i) 17°   (ii) 73°   (iii) 45°   (iv) 73°

EXERCISE 23.3

1. (i) 720°   (ii) 1080°   (iii) 1440°   2. (i) 1620° (ii) 3060° (iii) 4140°
3. (i) 120°   (ii) $\left(128\frac{4}{7}\right)°$ (iii) 135°   (iv) 144°   (v) 160°   (vi) 165°
4. (i) 5   (ii) 8   (iii) 15   (iv) 7
5. (i) 20   (ii) 5   (iii) 6   (iv) 9   (v) 11
6. (i) 9   (ii) 13   (iii) 21   7. (i) Yes   (ii) No   (iii) No   (iv) No
8. (i) No   (ii) Yes   (iii) Yes
9. 92   10. 156°, 132°, 108°, 84°, 60°   11. 140°   12. 135°
13. (i) 30°   (ii) 150°   (iii) 12   14. 6   15. 165°
16. (i) 108°   (ii) 36°   (iii) 72°

CHECK YOUR PROGRESS

1. 29°   2. 108°, 118°   3. (i) 106°   (ii) 80°   (iii) 100°
4. 54°, 72°, 108° and 126°; no   5. 72°, 108°, 72°, 108°
6. $x = 40°$, $y = 35°$ 7. 31 : 35
8. (i) 36°   (ii) 24°   (iii) 96°
9. $x = 42°$, $y = 96°$, $z = 64°$ 12. 171°   13. 16
14. 23   15. 4   16. 5   17. 6   18. 50   19. 10
20. (i) 135°   (ii) 22° 30'   (iii) 112° 30'

EXERCISE 24.2

2. Equilateral triangle   3. Isosceles triangle
4. 90°; right angled triangle
5. $\angle P = 60°$, $\angle R = 60°$; equilateral triangle   6. $\angle A = \angle C = 52\frac{1}{2}°$
7. 5 cm   8. 45°
14. Each angle = 60°   16. 90°

EXERCISE 25

1. (i) 37 cm²   (ii) 18·5 cm²
2. (i) 42 sq. units   (ii) 42 sq. units   3. 19 sq. units
4. (i) 35·2 cm²   (ii) 17·6 cm²
5. (i) 24 cm²   (ii) 12 cm²

CHECK YOUR PROGRESS

2. 5 cm   3. 6 units

EXERCISE 26

1. (i) diameter   (ii) the centre, the circle   (iii) on the circle
   (iv) passes through   (v) equal   (vi) 90°
2. (i) False   (ii) True   (iii) True   (iv) True
   (v) True   (vi) True   (vii) False   (viii) True
3. 2·5 cm   6. 4 cm   7. 12 cm
8. (i) $x = 58°, y = 40°$ (ii) $x = 37°, y = 53°$ (iii) 45°   (iv) 32°
   (v) $x = 50°, y = 130°$ (vi) $x = 45°, y = 22\frac{1}{2}°$ (vii) 25°
   (viii) $x = 45°, y = 45°$ (ix) $x = 54°, y = 27°$
9. (i) $x = 17, y = 8·5$ (ii) $x = 13, y = 12$ (iii) $x = 30, y = 18$

CHECK YOUR PROGRESS

3. 90°   4. 4 cm   6. (i) 55°   (ii) 25°

EXERCISE 27.1

1. (i) One   (ii) none   (iii) one
   (iv) one   (v) one   (vi) none
   (vii) four   (viii) three   (ix) four
2. (i) None   (ii) none   (iii) none
   (iv) none   (v) none   (vi) two
   (vii) four   (viii) three   (ix) four
3. (i) False   (ii) False   (iii) True
   (iv) False   (v) False   (vi) False

EXERCISE 27.2

1. (i) (3, −5)   (ii) (−3, −4)   (iii) (−2, 6)   (iv) (0, −3)   (v) (−3, 0)
2. (i) (2, 5)   (ii) (−3, −4)   (iii) (2, −6)   (iv) (3, 0)   (v) (0, −2)
3. A′ (−3, −4), B′ (2, −5); Yes   4. P′ (−2, −5), Q′ (−3, 7); Yes
5. A′ (−2, −3), B′ (−3, 4), C′ (0, 5); Yes
6. (i) (4, −3)   (ii) (5, 3)   (iii) (−2, −5)   (iv) (3, 0)   (v) (0, 3)
7. (i) (−4, 3)   (ii) (−5, −3)   (iii) (2, 5)   (iv) (−3, 0)   (v) (0, −3)
8. A′ (−4, −3), B′ (−2, 5); Yes

CHECK YOUR PROGRESS

1. (i) Two   (ii) two   (iii) none
2. (i) Two   (ii) two   (iii) three
3. A′ (2, 3), B (−1, −2), C′ (0, 2); yes   4. (−4, −1), (0, 7), (2, 5)
5. P′ (−3, −2), Q′ (7, 4)   6. A′ (5, −3), B′ (4, 2), C′ (−6, −5)
7. A′ (0, 3), B′ (−3, 1), C′ (−2, −4), D′ (2, −3), E′ (4, 1)

EXERCISE 28.1

1. 40 cm   2. (i) 20 cm   (ii) 41 cm
3. (i) 90 cm²   (ii) 66·15 cm²   (iii) 5950 cm²   (iv) 16 cm
   (v) 11 cm   (vi) 9·4 cm   (vii) 87 cm
4. 30 cm²   5. (i) 6 cm²   (ii) 34·56 cm²
6. 336 cm²; 33·6 cm   7. (i) 60 cm²   (ii) 8 cm

8. (*i*) 9·92 cm²   (*ii*) 3·3 cm   9. 15·6 cm²

10. 54 cm   11. 62·4 cm², 10·4 cm   12. 96 cm²

13. (*i*) 6 cm²   (*ii*) 5 cm   (*iii*) 2·4 cm   14. 144 cm²

15. 48 cm²   16. 120 m, 100 m, 100 m

EXERCISE 28.2

1. (*i*) 169 cm²   (*ii*) 112 cm

2.

Length	Breadth	Perimeter	Area
2·3 m	90 cm	6·4 m	2·07 m²
2·7 m	85 cm	710 cm	22950 cm²
15 m	11 m	52 m	165 m²
9·6 cm	7·4 cm	34 cm	71·04 cm²
21 cm	17 cm	76 cm	357 cm²
10·4 cm	8·6 cm	38 cm	89·44 cm²

3. 32 cm; 64 cm²   4. (*i*) 240 cm²   (*ii*) 360 cm²

5. (*i*) 96 cm²   (*ii*) 875 cm²   6. ₹1638

7. 122·36 m²   8. (*i*) 42 cm², 46 cm   (*ii*) 50 cm²; 54 cm   9. ₹9776

10. ₹1460   11. 12 m; 2 m   12. (*i*) 128 m   (*ii*) 2·5 m

13. 156 cm²   14. (*i*) 252 cm²   (*ii*) 245 cm²

EXERCISE 28.3

1. (*i*) 3 m²   (*ii*) 3·06 m²   2. 16 cm   3. (*i*) 24 cm   (*ii*) 120 cm²

4. 273 cm²   5. 66·5 m²

6. (*i*) 65 m²   (*ii*) 45·5 m²   (*iii*) 19·5 m²

7. (*i*) 182 cm²   (*ii*) 46 cm²   (*iii*) 46 cm²

8. (*i*) 9 cm   (*ii*) 247·5 cm²   (*iii*) 67·5 cm²

9. 18·6 cm   10. 128 cm²

11. 35 cm, 25 cm   12. 39 cm, 42 cm

13. Base = 14 cm, altitude = 7 cm

EXERCISE 28.4

1. (*i*) 44 cm; 154 cm² (*ii*) 132 cm; 1386 cm²   (*iii*) 22 cm; 38·5 cm²

2. 346·5 m²   3. 8·8 m   4. 40216 km

5. 14 cm   6. 9 cm; 81π cm²   7. 12 cm; 24π cm

8. 105·6 m   9. 50000   10. 94·5 cm²

11. 962·5 cm²   12. 14 cm   13. 77 cm, 63 cm

14. (*i*) 38 cm; 50·75 cm²   (*ii*) 88 cm; 504 cm²

15. 44 cm; 42 cm²   16. (*i*) 88 cm   (*ii*) 308 cm²

CHECK YOUR PROGRESS

1. 98 cm²   2. ₹9450000   3. 27·05 cm²

4. Side = 12 cm, altitude = 8 cm

5. ₹2250   6. 18 minutes

7. 42 m; 59·4 m   8. 119·8 cm²; 11·98 cm

9. (*i*) 12 cm, 18 cm   (*ii*) 40 cm

10. (*i*) 8 cm   (*ii*) 40 cm²   11. 54 cm²   12. 31·4 cm

13. 88 cm   14. 44 cm   15. 196 cm²

16. ₹ 20790   17. 1480·5 m²   18. 300%

EXERCISE 29

1. (*i*) 343 cm³; 294 cm²; 12·12 cm   (*ii*) 91·125 cm³; 121·5 cm²; 7·79 cm

2. 864 cm² ; 1728 cm³   3. (*i*) 15·59 cm   (*ii*) 729 cm³

4. (*i*)560 cm³; 412 cm²; 272 cm²; 14·59 cm

    (*ii*)945000 cm³; 60600 cm²; 33600 cm²; 188·41 cm

5. (*i*) 6 cm; 126 cm²; 8·37 cm   (*ii*) 8 cm; 562 cm²; 18·38 cm

6. (*i*) 8 cm   (*ii*) 352 cm²   7. 2560 cm³   8. 2 m

9. 4 cm   10. ₹ 11520   11. ₹ 510·39

12. (*i*) 450   (*ii*) ₹ 32400   13. ₹ 756

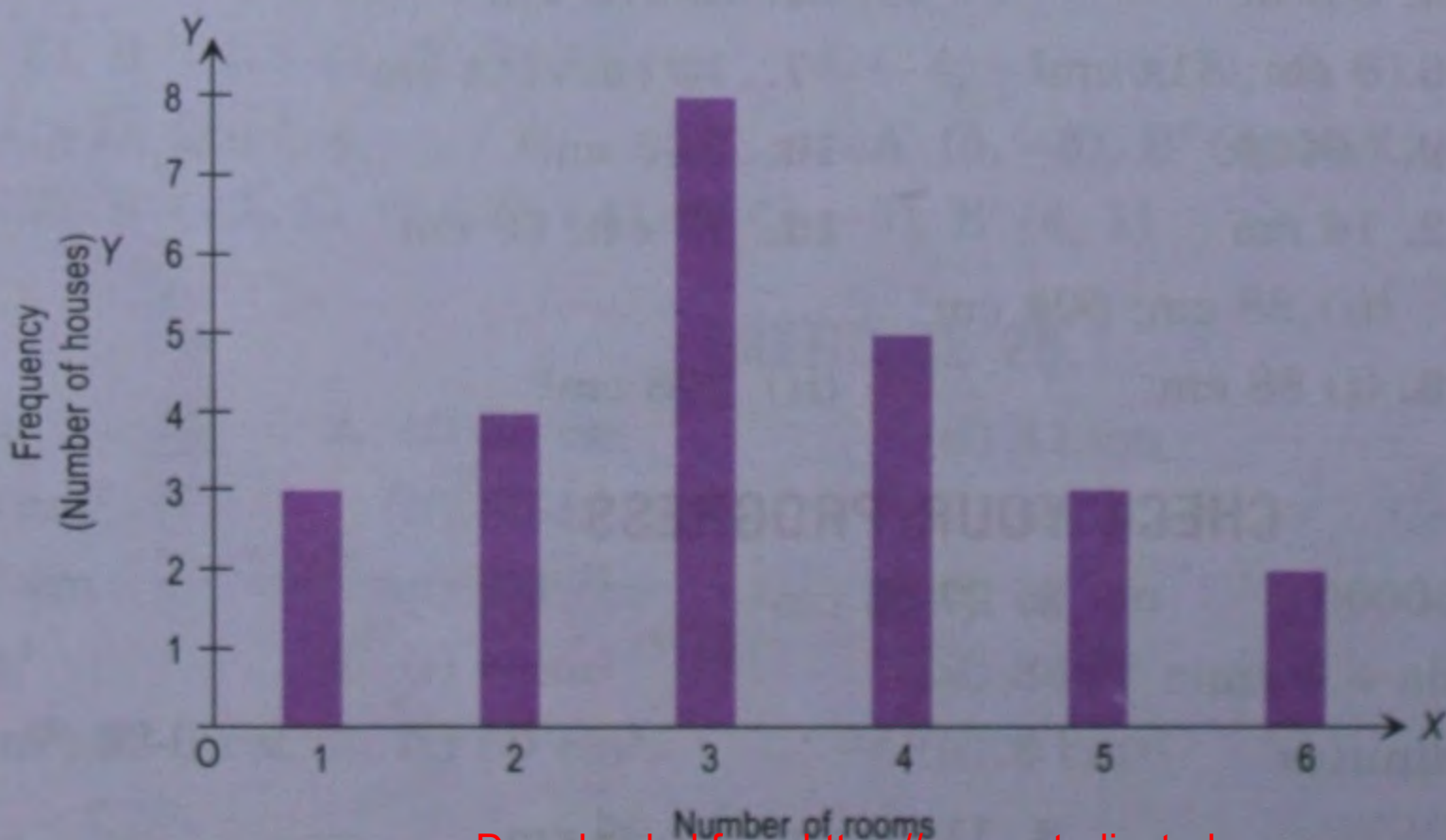## CHECK YOUR PROGRESS

1. (*i*) 24·25 cm   (*ii*) 2744 cm³   2. 504000 cm³; 38200 cm²

3. (*i*) 8 cm   (*ii*) 448 cm³   4. ₹ 1350   5. 7·39 cm
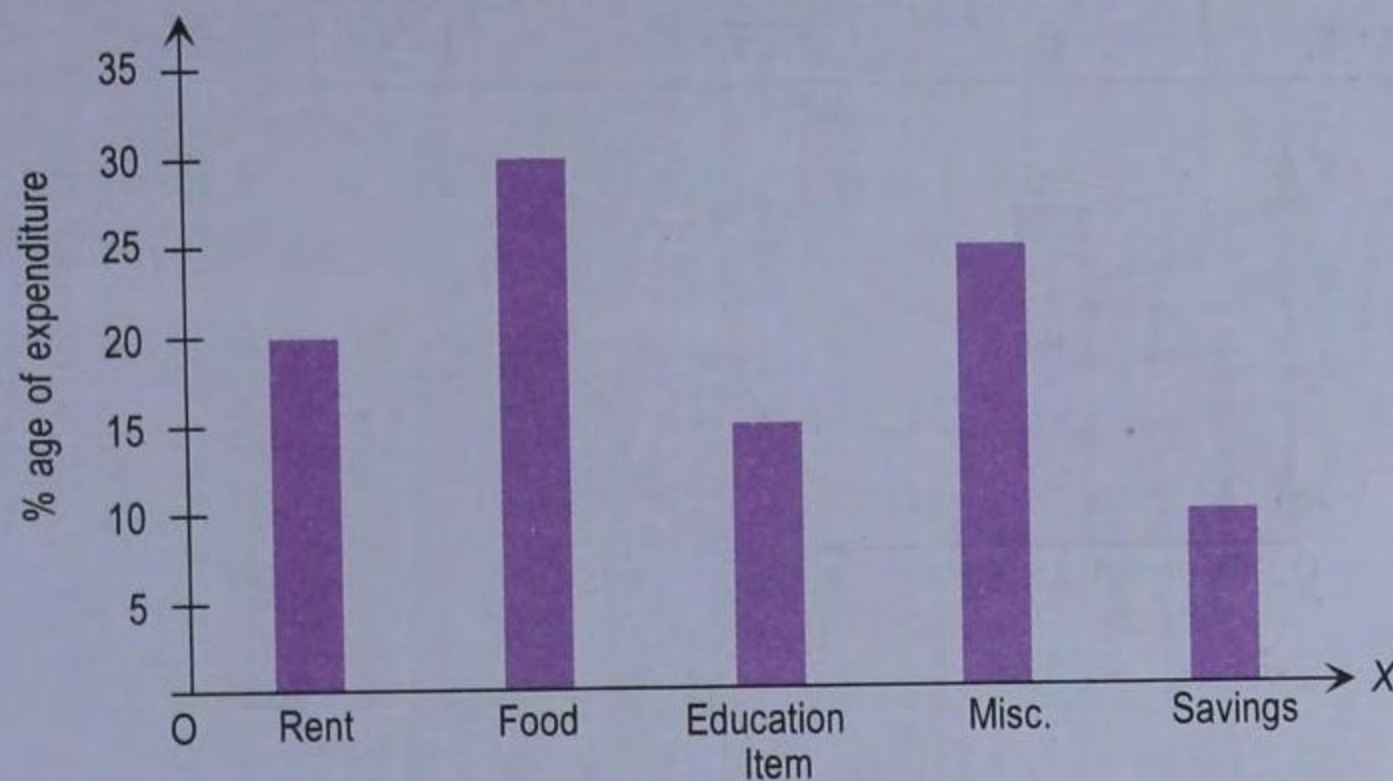
EXERCISE 30.1

1. (*a*) 1, 1, 1, 2, 2, 2, 2, 3, 3, 3, 3, 3, 3, 3, 3, 4, 4, 4, 4, 4, 5, 5, 5, 6, 6

    (*b*) The simple frequency distribution table is given below :

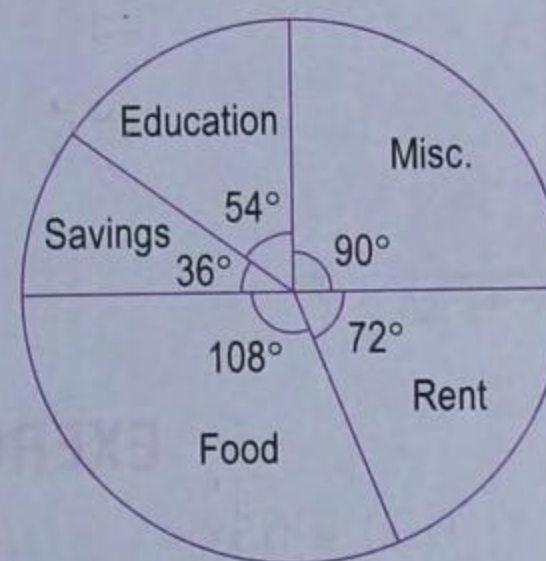| Number of rooms (Variate)	Tally marks	Number of houses (frequency)
1	III	3
2	IIII	4
3	ⵜⵀ III	8
4	ⵜⵀ	5
5	III	3
6	II	2
Total		25

(*c*) Column graph showing number of rooms in the houses :

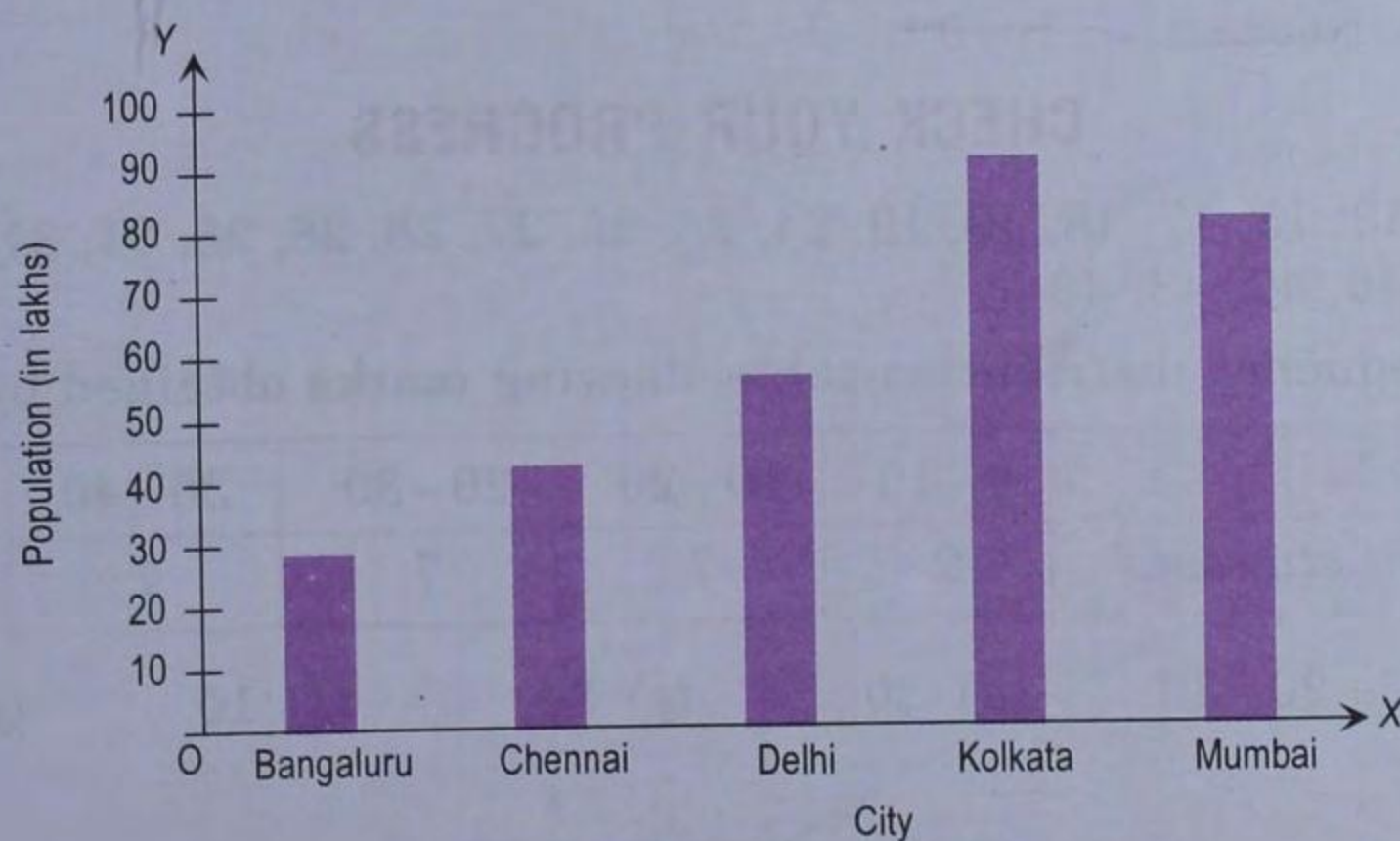**2.** (a) Column graph showing monthly expenditure of a family :

(b) Pie chart showing monthly expenditure of a family :

3. P – 1000, Q – 2000, R – 4000, S – 3000

4. (a) Column graph showing population of five major metros of India in 1981

(b) Population of Kolkata was highest because the bar corresponding to it is the highest.

EXERCISE 30.2

1. (a) 3, 6, 10, 12, 14, 15, 17, 20, 23, 25, 27, 28, 28, 30, 35, 37, 37, 37, 38, 40, 40, 40, 41, 42, 48

(b)

Marks	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50
Number of students	2	5	6	6	6

(c) 10 – 20; 10; 10; 20; 15   (d) 30 – 40; 10; 30; 40; 35

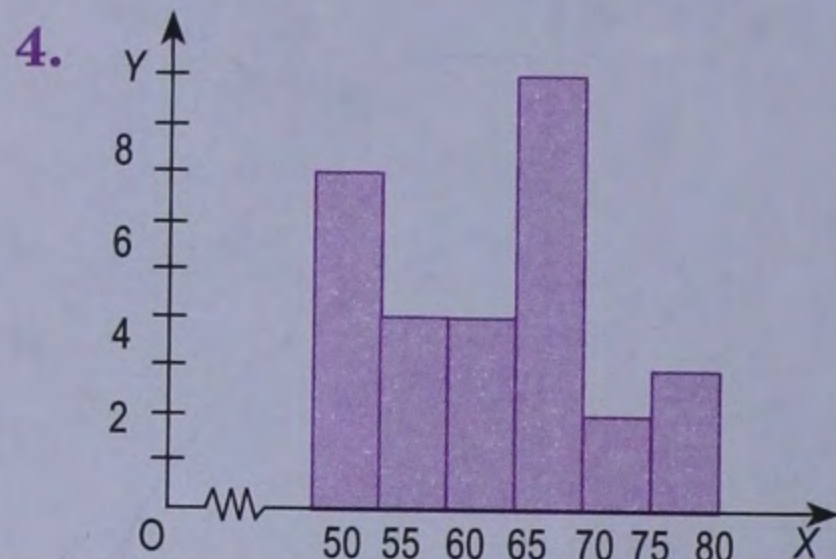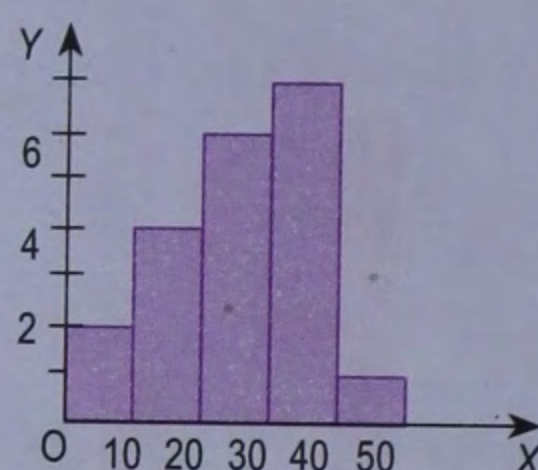**2.** (a) 14, 16, 16, 17, 17, 17, 18, 18, 18, 18, 18, 19, 19, 19, 20, 20, 20, 20, 21, 21, 22, 22, 22, 22, 22, 23, 23, 23, 23, 23, 24, 24, 24, 24, 24, 25, 26, 27, 30, 31

(b)

Weight (kg)	10 – 15	15 – 20	20 – 25	25 – 30	30 – 35
Number of students	1	13	21	3	2

3.

Marks	0−10	10−20	20−30	30−40	40−50
No. of students	2	4	6	7	1

4.

EXERCISE 30.3

1. (*i*) 31   (*ii*) 4   (*iii*) 4·55   (*iv*) 35·5

2. (*i*) 4   (*ii*) 4·5   **3.** (*i*) 3   (*ii*) 22

4. Mean = 2·625, median = 2·5, mode = 3   **5.** Mean = 3·9, median = 3·5, mode = 3
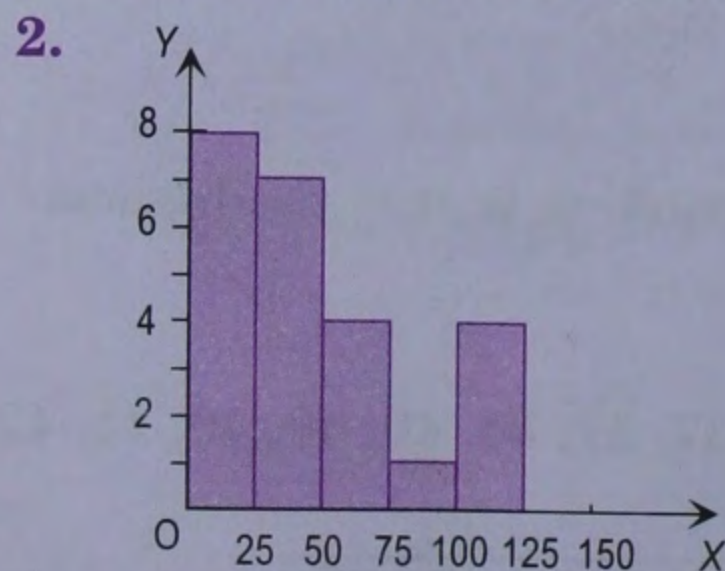
6. Mean = 2·9, mode = 4

CHECK YOUR PROGRESS

1. (*a*) 03, 05, 10, 13, 15, 17, 18, 19, 19, 24, 25, 25, 27, 28, 28, 28, 31, 31, 31, 32, 35, 36, 38, 40, 44, 45, 46, 47, 48, 49

(*b*) Grouped frequency distribution table showing marks obtained by students.

Marks	0−10	10−20	20−30	30−40	40−50
Number of students	2	7	7	7	7

(*c*) Third class is 20−30   (*d*) 20   (*e*) 30   (*f*) 10   (*g*) 25

2.

3. (*i*) 14   (*ii*) 15   (*iii*) 16

4. 23   **5** Mean = 69·18 cm, mode = 69 cm