ANSWERS/HINTS

EXERCISE 1.1

1. Yes. $0 = \frac{0}{1} = \frac{0}{2} = \frac{0}{3}$ etc., denominator q can also be taken as negative integer.

2. There can be infinitely many rationals betwen numbers 3 and 4, one way is to take them

$3 = \frac{21}{6+1}$, $4 = \frac{28}{6+1}$. Then the six numbers are $\frac{22}{7}, \frac{23}{7}, \frac{24}{7}, \frac{25}{7}, \frac{26}{7}, \frac{27}{7}$.

3. $\frac{3}{5} = \frac{30}{50}, \frac{4}{5} = \frac{40}{50}$. Therefore, five rationals are : $\frac{31}{50}, \frac{32}{50}, \frac{33}{50}, \frac{34}{50}, \frac{35}{50}$.

4. (i) True, since the collection of whole numbers contains all the natural numbers.

(ii) False, for example -2 is not a whole number.

(iii) False, for example $\frac{1}{2}$ is a rational number but not a whole number.

EXERCISE 1.2

1. (i) True, since collection of real numbers is made up of rational and irrational numbers.

(ii) False, no negative number can be the square root of any natural number.

(iii) False, for example 2 is real but not irrational.

2. No. For example, $\sqrt{4} = 2$ is a rational number.

3. Repeat the procedure as in Fig. 1.8 several times. First obtain $\sqrt{4}$ and then $\sqrt{5}$.

EXERCISE 1.3

1. (i) 0.36, terminating. (ii) $0.\overline{09}$, non-terminating repeating.

(iii) 4.125, terminating. (iv) $0.\overline{230769}$, non-terminating repeating.

(v) $0.\overline{18}$ non-terminating repeating. (vi) 0.8225 terminating.

2. $\frac{2}{7} = 2 \times \frac{1}{7} = 0.\overline{285714}$, $\frac{3}{7} = 3 \times \frac{1}{7} = 0.\overline{428571}$, $\frac{4}{7} = 4 \times \frac{1}{7} = 0\overline{571428}$,

$\frac{5}{7} = 5 \times \frac{1}{7} = 0.\overline{714285}$, $\frac{6}{7} = 6 \times \frac{1}{7} = 0.\overline{857142}$

3. (i) $\frac{2}{3}$ [Let $x = 0.666\ldots$ So $10x = 6.666\ldots$ or, $10x = 6 + x$ or, $x = \frac{6}{9} = \frac{2}{3}$]

(ii) $\frac{43}{90}$ (iii) $\frac{1}{999}$

4. 1 [Let $x = 0.9999\ldots$ So $10\,x = 9.999\ldots$ or, $10\,x = 9 + x$ or, $x = 1$]

5. $0.\overline{0588235294117647}$

6. The prime factorisation of q has only powers of 2 or powers of 5 or both.

7. 0.01001000100001…, 0.202002000200002…, 0.003000300003…

8. 0.75075007500075000075…, 0.767076700767000767…, 0.808008000800008…

9. (i) and (v) irrational; (ii), (iii) and (iv) rational.

EXERCISE 1.4

1. Proceed as in Section 1.4 for 2.665.

2. Proceed as in Example 11.

EXERCISE 1.5

1. (i) Irrational (ii) Rational (iii) Rational (iv) Irrational

(v) Irrational

2. (i) $6 + 3\sqrt{2} + 2\sqrt{3} + \sqrt{6}$ (ii) 6 (iii) $7 + 2\sqrt{10}$ (iv) 3

3. There is no contradiction. Remember that when you measure a length with a scale or any other device, you only get an approximate rational value. So, you may not realise that either c or d is irrational.

4. Refer Fig. 1.17.

5. (i) $\frac{\sqrt{7}}{7}$ (ii) $\sqrt{7}+\sqrt{6}$ (iii) $\frac{\sqrt{5}-\sqrt{2}}{3}$ (iv) $\frac{\sqrt{7}+2}{3}$

EXERCISE 1.6

1. (i) 8 (ii) 2 (iii) 5 **2.** (i) 27 (ii) 4 (iii) 8 (iv) $\frac{1}{5}\left[(125)^{-\frac{1}{3}}=\left(5^3\right)^{-\frac{1}{3}}=5^{-1}\right]$

3. (i) $2^{\frac{13}{15}}$ (ii) 3^{-21} (iii) $11^{\frac{1}{4}}$ (iv) $56^{\frac{1}{2}}$

EXERCISE 2.1

1. (i) and (ii) are polynomials in one variable, (v) is a polynomial in three variables, (iii), (iv) are not polynomials, because in each of these exponent of the variable is not a whole number.

2. (i) 1 (ii) –1 (iii) $\frac{\pi}{2}$ (iv) 0

3. $3x^{35}-4$; $\sqrt{2}\,y^{100}$ (You can write some more polynomials with different coefficients.)

4. (i) 3 (ii) 2 (iii) 1 (iv) 0

5. (i) quadratic (ii) cubic (iii) quadratic (iv) linear
(v) linear (vi) quadratic (vii) cubic

EXERCISE 2.2

1. (i) 3 (ii) –6 (iii) –3

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

3. (i) Yes (ii) No (iii) Yes (iv) Yes
(v) Yes (vi) Yes
(vii) $-\frac{1}{\sqrt{3}}$ is a zero, but $\frac{2}{\sqrt{3}}$ is not a zero of the polynomial (viii) No

4. (i) –5 (ii) 5 (iii) $\frac{-5}{2}$ (iv) $\frac{2}{3}$
(v) 0 (vi) 0 (vii) $-\frac{d}{c}$

EXERCISE 2.3

1. (i) 0 (ii) $\frac{27}{8}$ (iii) 1 (iv) $-\pi^3 + 3\pi^2 - 3\pi + 1$ (v) $-\frac{27}{8}$

2. $5a$ **3.** No, since remainder is not zero.

EXERCISE 2.4

1. $(x + 1)$ is a factor of (i), but not the factor of (ii), (iii) and (iv).

2. (i) Yes (ii) No (iii) Yes

3. (i) -2 (ii) $-\left(2+\sqrt{2}\right)$ (iii) $\sqrt{2}-1$ (iv) $\frac{3}{2}$

4. (i) $(3x - 1)(4x - 1)$ (ii) $(x + 3)(2x + 1)$ (iii) $(2x + 3)(3x - 2)$ (iv) $(x + 1)(3x - 4)$

5. (i) $(x - 2)(x - 1)(x + 1)$ (ii) $(x + 1)(x + 1)(x - 5)$

(iii) $(x + 1)(x + 2)(x + 10)$ (iv) $(y - 1)(y + 1)(2y + 1)$

EXERCISE 2.5

1. (i) $x^2 + 14x + 40$ (ii) $x^2 - 2x - 80$ (iii) $9x^2 - 3x - 20$

(iv) $y^4 - \frac{9}{4}$ (v) $9 - 4x^2$

2. (i) 11021 (ii) 9120 (iii) 9984

3. (i) $(3x + y)(3x + y)$ (ii) $(2y - 1)(2y - 1)$ (iii) $\left(x+\frac{y}{10}\right)\left(x-\frac{y}{10}\right)$

4. (i) $x^2 + 4y^2 + 16z^2 + 4xy + 16yz + 8xz$

(ii) $4x^2 + y^2 + z^2 - 4xy - 2yz + 4xz$

(iii) $4x^2 + 9y^2 + 4z^2 - 12xy + 12yz - 8xz$

(iv) $9a^2 + 49b^2 + c^2 - 42ab + 14bc - 6ac$

(v) $4x^2 + 25y^2 + 9z^2 - 20xy - 30yz + 12xz$

(vi) $\frac{a^2}{16}+\frac{b^2}{4}+1-\frac{ab}{4}-b+\frac{a}{2}$

5. (i) $(2x + 3y - 4z)(2x + 3y - 4z)$ (ii) $\left(-\sqrt{2}\,x+y+2\sqrt{2}\,z\right)\left(-\sqrt{2}\,x+y+2\sqrt{2}\,z\right)$

6. (i) $8x^3 + 12x^2 + 6x + 1$ (ii) $8a^3 - 27b^3 - 36a^2b + 54ab^2$

(iii) $\frac{27}{8}x^3 + \frac{27}{4}x^2 + \frac{9}{2}x + 1$ (iv) $x^3 - \frac{8}{27}y^3 - 2x^2y + \frac{4xy^2}{3}$

7. (i) 970299 (ii) 1061208 (iii) 994011992

8. (i) $(2a+b)(2a+b)(2a+b)$ (ii) $(2a-b)(2a-b)(2a-b)$

(iii) $(3-5a)(3-5a)(3-5a)$ (iv) $(4a-3b)(4a-3b)(4a-3b)$

(v) $\left(3p-\frac{1}{6}\right)\left(3p-\frac{1}{6}\right)\left(3p-\frac{1}{6}\right)$

10. (i) $(3y+5z)(9y^2+25z^2-15yz)$ (ii) $(4m-7n)(16m^2+49n^2+28mn)$

11. $(3x+y+z)(9x^2+y^2+z^2-3xy-yz-3xz)$

12. Simiplify RHS.

13. Put $x+y+z=0$ in Identity VIII.

14. (i) -1260. Let $a=-12, b=7, c=5$. Here $a+b+c=0$. Use the result given in Q13.

(ii) 16380

15. (i) One possible answer is : Length = $5a-3$, Breadth = $5a-4$

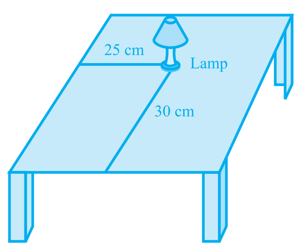
(ii) One possible answer is : Length = $7y-3$, Breadth = $5y+4$

16. (i) One possible answer is : 3, x and $x-4$.

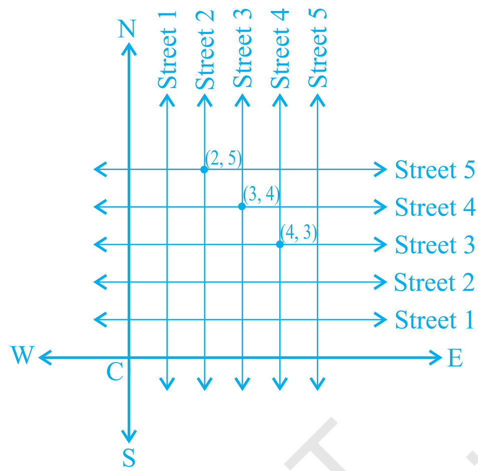
(ii) One possible answer is : $4k$, $3y+5$ and $y-1$.

EXERCISE 3.1

1. Consider the lamp as a point and table as a plane. Choose any two perpendicular edges of the table. Measure the distance of the lamp from the longer edge, suppose it is 25 cm. Again, measure the distance of the lamp from the shorter edge, and suppose it is 30 cm. You can write the position of the lamp as (30, 25) or (25, 30), depending on the order you fix.



2. The Street plan is shown in figure given below.



Both the cross-streets are marked in the figure above. They are *uniquely* found because of the two reference lines we have used for locating them.

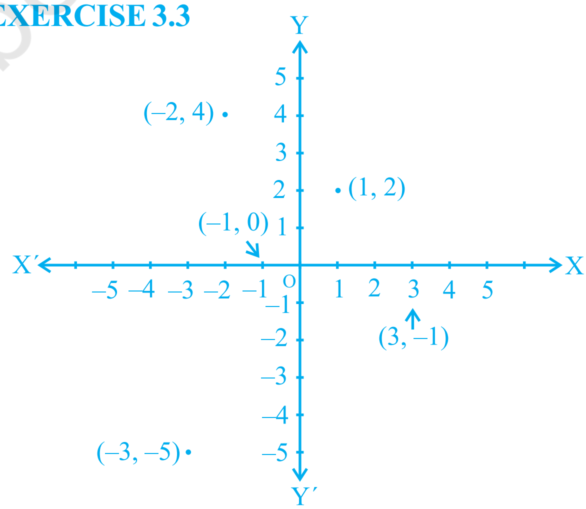
EXERCISE 3.2

1. (i) The x - axis and the y - axis (ii) Quadrants (iii) The origin

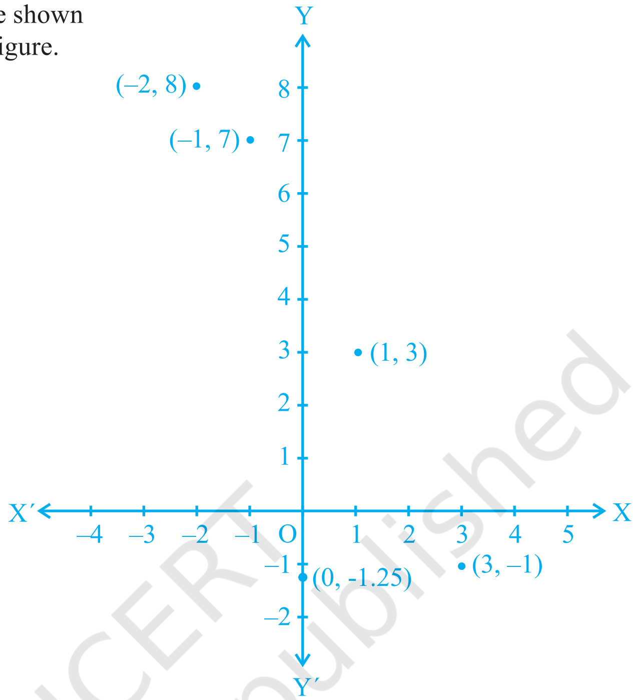
2. (i) (– 5, 2) (ii) (5, –5) (iii) E (iv) G (v) 6 (vi) – 3 (vii) (0, 5) (viii) (–3, 0)

EXERCISE 3.3

1. The point (–2, 4) lies in quadrant II, the point (3, –1) lies in the quadrant IV, the point (– 1, 0) lies on the negative x - axis, the point (1, 2) lies in the quadrant I and the point (–3, –5) lies in the quadrant III. Locations of the points are shown in the adjoining figure.



2. Positions of the points are shown by dots in the adjoining figure.



EXERCISE 4.1

1. $x - 2y = 0$

2. (i) $2x + 3y - 9.3\overline{5} = 0;\ a = 2,\ b = 3,\ c = -9.3\overline{5}$

(ii) $x - \dfrac{y}{5} - 10 = 0; a = 1,\ b = \dfrac{-1}{5},\ c = -10$

(iii) $-2x + 3y - 6 = 0;\ a = -2, b = 3, c = -6$

(iv) $1\,x - 3y + 0 = 0;\ a = 1, b = -3, c = 0$

(v) $2x + 5y + 0 = 0;\ a = 2, b = 5, c = 0$

(vi) $3x + 0.y + 2 = 0; a = 3, b = 0, c = 2$

(vii) $0.x + 1.y - 2 = 0;\ a = 0, b = 1, c = -2$

(viii) $-2x + 0.y + 5 = 0; a = -2, b = 0, c = 5$

EXERCISE 4.2

1. (iii), because for every value of x, there is a corresponding value of y and vice-versa.

2. (i) (0, 7), (1, 5), (2, 3), (4, –1)

(ii) $(1, 9-\pi), (0, 9), (-1, 9+\pi), \left(\dfrac{9}{\pi}, 0\right)$

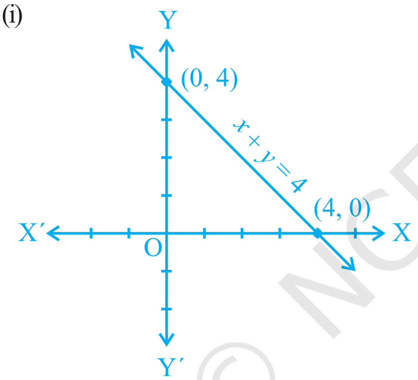
(iii) $(0, 0), (4, 1), (-4, 1), \left(2, \dfrac{1}{2}\right)$

3. (i) No (ii) No (iii) Yes (iv) No (v) No

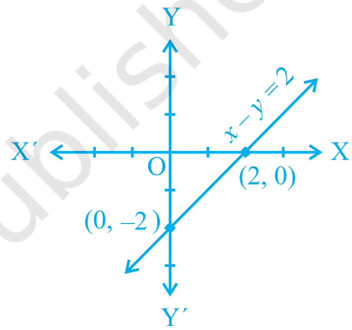
4. 7

EXERCISE 4.3

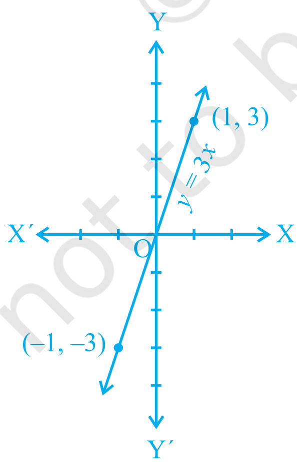
1. (i)



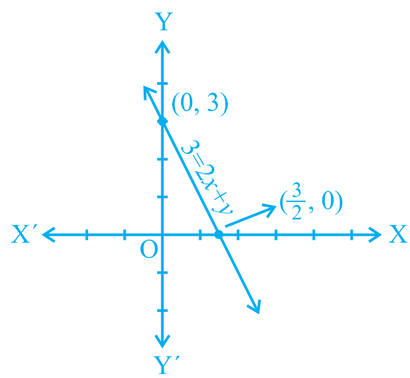
(ii)



(iii)



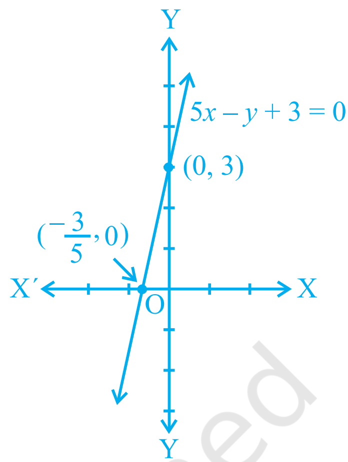
(iv)



2. $7x - y = 0$ and $x + y = 16$; infintely many [Through a point infinitely many lines can be drawn]

3. $\frac{5}{3}$

4. $5x - y + 3 = 0$

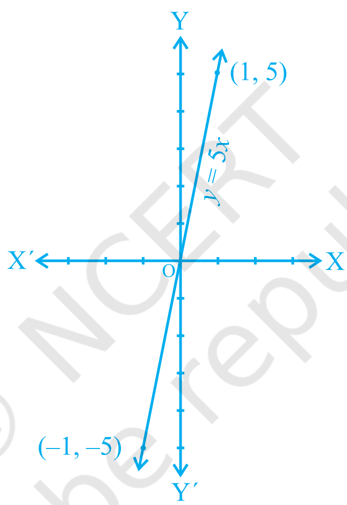


5. For Fig. 4.6, $x + y = 0$ and for Fig. 4.7, $y = -x + 2$.

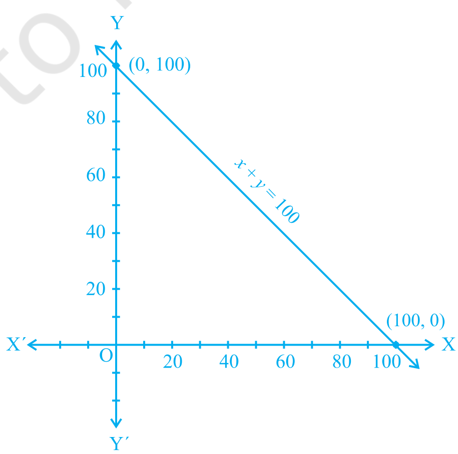
6. Supposing x is the distance and y is the work done. Therefore according to the problem the equation will be $y = 5x$.

(i) 10 units

(ii) 0 unit



7. $x + y = 100$



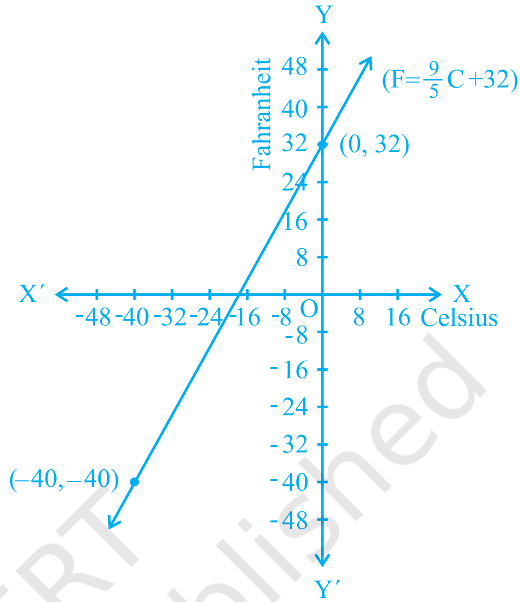
8. (i) See adjacent figure.

(ii) 86º F

(iii) 35° C

(iv) 32° F, –17.8° C (approximately)

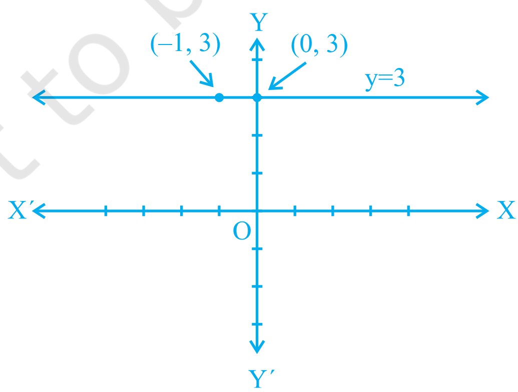
(v) Yes, – 40° (both in F and C)



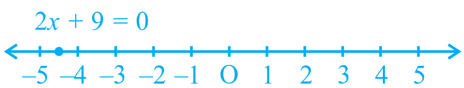
EXERCISE 4.4

1. (i)

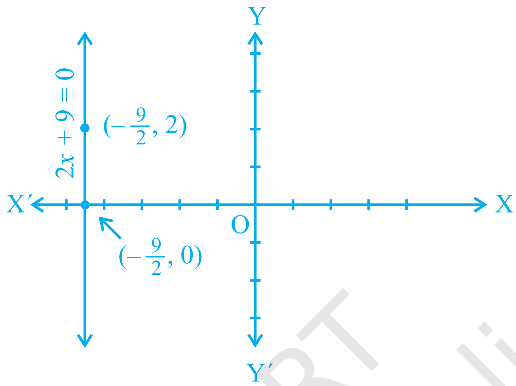
(ii)



2. (i)



(ii)



EXERCISE 5.1

1. (i) False. This can be seen visually by the student.

(ii) False. This contradicts Axiom 5.1.

(iii) True. (Postulate 2)

(iv) True. If you superimpose the region bounded by one circle on the other, then they coincide. So, their centres and boundaries coincide. Therefore, their radii will coincide.

(v) True. The first axiom of Euclid.

3. There are several undefined terms which the student should list. They are consistent, because they deal with two different situations — (i) says that given two points A and B, there is a point C lying on the line in between them; (ii) says that given A and B, you can take C not lying on the line through A and B.

These 'postulates' do not follow from Euclid's postulates. However, they follow from Axiom 5.1.

4. $$AC = BC$$

So, $$AC + AC = BC + AC$$ (Equals are added to equals)

i.e., $$2AC = AB$$ (BC + AC coincides with AB)

Therefore, $$AC = \frac{1}{2} AB$$

5. Make a temporary assumption that different points C and D are two mid-points of AB. Now, you show that points C and D are not two different points.

6. AC = BD (Given) (1)

AC = AB + BC (Point B lies between A and C) (2)

BD = BC + CD (Point C lies between B and D) (3)

Substituting (2) and (3) in (1), you get

AB + BC = BC + CD

So, AB = CD (Subtracting equals from equals)

7. Since this is true for any thing in any part of the world, this is a universal truth.

EXERCISE 5.2

1. Any formulation the student gives should be discussed in the class for its validity.

2. If a straight line l falls on two straight lines m and n such that sum of the interior angles on one side of l is two right angles, then by Euclid's fifth postulate the line will not meet on this side of l. Next, you know that the sum of the interior angles on the other side of line l will also be two right angles. Therefore, they will not meet on the other side also. So, the lines m and n never meet and are, therefore, parallel.

EXERCISE 6.1

1. 30°, 250° 2. 126° 4. Sum of all the angles at a point = 360°

5. ∠ QOS = ∠ SOR + ∠ ROQ and ∠ POS = ∠ POR – ∠ SOR. 6. 122°, 302°

EXERCISE 6.2

1. 130°, 130° 2. 126° 3. 126°, 36°, 54° 4. 60° 5. 50°, 77°

6. Angle of incidence = Angle of reflection. At point B, draw BE ⊥ PQ and at point C, draw CF ⊥ RS.

EXERCISE 6.3

1. 65° 2. 32°, 121° 3. 92° 4. 60° 5. 37°, 53°

6. Sum of the angles of Δ PQR = Sum of the angles of Δ QTR and ∠ PRS = ∠ QPR + ∠ PQR.

EXERCISE 7.1

1. They are equal. 6. ∠ BAC = ∠ DAE

EXERCISE 7.2

6. $\angle BCD = \angle BCA + \angle DCA = \angle B + \angle D$ **7.** each is of 45°

EXERCISE 7.3

3. **(ii)** From (i), $\angle ABM = \angle PQN$

EXERCISE 7.4

4. Join BD and show $\angle B > \angle D$. Join AC and show $\angle A > \angle C$.

5. $\angle Q + \angle QPS > \angle R + \angle RPS$, etc.

EXERCISE 8.1

1. 36°, 60°, 108° and 156°.

6. (i) From Δ DAC and Δ BCA, show $\angle DAC = \angle BCA$ and $\angle ACD = \angle CAB$, etc.

(ii) Show $\angle BAC = \angle BCA$, using Theorem 8.4.

EXERCISE 8.2

2. Show PQRS is a parallelogram. Also show PQ || AC and PS || BD. So, $\angle P = 90°$.

5. AECF is a parallelogram. So, AF || CE, etc.

EXERCISE 9.1

1. (i) Base DC, parallels DC and AB; (iii) Base QR, parallels QR and PS;

(v) Base AD, parallels AD and BQ

EXERCISE 9.2

1. 12.8 cm. **2.** Join EG; Use result of Example 2.

6. Wheat in Δ APQ and pulses in other two triangles or pulses in Δ APQ and wheat in other two triangles.

EXERCISE 9.3

4. Draw $CM \perp AB$ and $DN \perp AB$. Show $CM = DN$. **12.** See Example 4.

EXERCISE 9.4 (Optional)

7. Use result of Example 3 repeatedly.

EXERCISE 10.1

1. (i) Interior (ii) Exterior (iii) Diameter
(iv) Semicircle (v) The chord (vi) Three

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

EXERCISE 10.2

1. Prove exactly as Theorem 10.1 by considering chords of congruent circles.

2. Use SAS axiom of congruence to show the congruence of the two triangles.

EXERCISE 10.3

1. 0, 1, 2. Two **2.** Proceed as in Example 1.

3. Join the centres O, O′ of the circles to the mid-point M of the common chord AB. Then, show $\angle$ OMA = 90° and $\angle$ O′MA = 90°.

EXERCISE 10.4

1. 6 cm. First show that the line joining centres is perpendicular to the radius of the smaller circle and then that common chord is the diameter of the smaller circle.

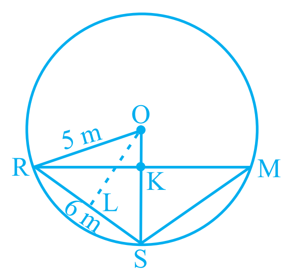
2. If AB, CD are equal chords of a circle with centre O intersecting at E, draw perpendiculars OM on AB and ON on CD and join OE. Show that right triangles OME and ONE are congruent.

3. Proceed as in Example 2. **4.** Draw perpendicular OM on AD.

5. Represent Reshma, Salma and Mandip by R, S and M respectively. Let KR = x m (see figure).

Area of Δ ORS = $\frac{1}{2}x \times 5$. Also, area of Δ ORS = $\frac{1}{2}$ RS $\times$ OL = $\frac{1}{2} \times 6 \times 4$.

Find x and hence RM.



6. Use the properties of an equilateral triangle and also Pythagoras Theorem.

EXERCISE 10.5

1. $45°$ **2.** $150°, 30°$ **3.** $10°$

4. $80°$ **5.** $110°$ **6.** $\angle BCD = 80°$ and $\angle ECD = 50°$

8. Draw perpendiculars AM and BN on CD (AB || CD and AB < CD). Show $\Delta AMD \cong \Delta BNC$. This gives $\angle C = \angle D$ and, therefore, $\angle A + \angle C = 180°$.

EXERCISE 10.6 (Optional)

2. Let O be the centre of the circle. Then perpendicular bisector of both the chords will be same and passes through O. Let r be the radius, then $r^2 = \left(\frac{11}{2}\right)^2 + x^2$ $= \left(\frac{5}{2}\right)^2 + (6 - x)^2$, where x is length of the perpendicular from O on the chord of length 11 cm. This gives $x = 1$. So, $r = \frac{5\sqrt{5}}{2}$ cm. **3.** 3 cm.

4. Let $\angle AOC = x$ and $\angle DOE = y$. Let $\angle AOD = z$. Then $\angle EOC = z$ and $x + y + 2z = 360°$.

$\angle ODB = \angle OAD + \angle DOA = 90° - \frac{1}{2}z + z = 90° + \frac{1}{2}z$. Also $\angle OEB = 90° + \frac{1}{2}z$

8. $\angle ABE = \angle ADE$, $\angle ADF = \angle ACF = \frac{1}{2}\angle C$.

Therefore, $\angle EDF = \angle ABE + \angle ADF = \frac{1}{2}(\angle B + \angle C) = \frac{1}{2}(180° - \angle A) = 90° - \frac{1}{2}\angle A$.

9. Use Q. 1, Ex. 10.2 and Theorem 10.8.

10. Let angle-bisector of $\angle A$ intersect circumcircle of ΔABC at D. Join DC and DB. Then $\angle BCD = \angle BAD = \frac{1}{2}\angle A$ and $\angle DBC = \angle DAC = \frac{1}{2}\angle A$. Therefore, $\angle BCD = \angle DBC$ or, DB = DC. So, D lies on the perpendicular bisector of BC.

EXERCISE 12.1

1. $\frac{\sqrt{3}}{4}a^2$, 900, 3 cm^2 **2.** ₹ 1650000 **3.** $20\sqrt{2}$ m^2

4. $21\sqrt{11}$ cm^2 **5.** 9000 cm^2 **6.** $9\sqrt{15}$ cm^2

EXERCISE 12.2

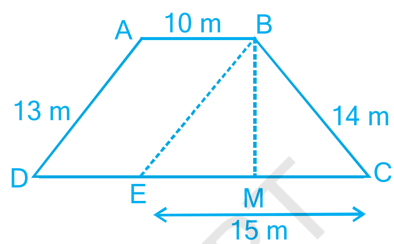
1. 65.5 m^2 (approx.) **2.** 15.2 cm^2 (approx.) **3.** 19.4 cm^2 (approx.)

4. 12 cm **5.** 48 m^2 **6.** $1000\sqrt{6} \text{ cm}^2$, $1000\sqrt{6} \text{ cm}^2$

7. Area of shade I = Area of shade II = 256 cm^2 and area of shade III = 17.92 cm^2

8. ₹ 705.60 **9.** 196 m^2

[See the figure. Find area of Δ BEC = 84 m^2, then find the height BM.]



EXERCISE 13.1

1. (i) 5.45 m^2 (ii) ₹ 109 **2.** ₹ 555 **3.** 6 m **4.** 100 bricks.

5. (i) Lateral surface area of cubical box is greater by 40 cm^2.

(ii) Total surface area of cuboidal box is greater by 10 cm^2.

6. (i) 4250 cm^2 of glass (ii) 320 cm of tape. [Calculate the sum of all the edges (The 12 edges consist of 4 lengths, 4 breadths and 4 heights)].

7. ₹ 2184 **8.** 47 m^2

EXERCISE 13.2

1. 2 cm **2.** 7.48 m^2 **3.** (i) 968 cm^2 (ii) 1064.8 cm^2 (iii) 2038.08 cm^2

[Total surface area of a pipe is (inner curved surface area + outer curved surface area + areas of the two bases). Each base is a ring of area given by π ($R^2 - r^2$), where R = outer radius and r = inner radius].

4. 1584 m^2 **5.** ₹ 68.75 **6.** 1 m

7. (i) 110 m^2 (ii) ₹4400 **8.** 4.4 m^2

9. (i) 59.4 m^2 (ii) 95.04 m^2

[Let the actual area of steel used be x m^2. Since $\frac{1}{12}$ of the actual steel used was wasted, the area of steel which has gone into the tank = $\frac{11}{12}$ of x. This means that the actual area of steel used = $\frac{12}{11} \times 87.12\,m^2$]

10. 2200 cm^2; Height of the cylinder should be treated as (30 + 2.5 + 2.5) cm

11. 7920 cm^2

EXERCISE 13.3

1. 165 cm^2 **2.** 1244.57 m^2 **3.** (i) 7 cm (ii) 462 cm^2

4. (i) 26 m (ii) ₹ 137280 **5.** 63 m **6.** ₹ 1155

7. 5500 cm^2 **8.** ₹ 384.34 (approx.)

EXERCISE 13.4

1. (i) 1386 cm^2 (ii) 394.24 cm^2 (iii) 2464 cm^2

2. (i) 616 cm^2 (ii) 1386 cm^2 (iii) 38.5 m^2

3. 942 cm^2 **4.** 1 : 4 **5.** ₹ 27.72

6. 3.5 cm **7.** 1 : 16 **8.** 173.25 cm^2

9. (i) $4\pi r^2$ (ii) $4\pi r^2$ (iii) 1 : 1

EXERCISE 13.5

1. 180 cm^3 **2.** 135000 litres **3.** 4.75 m **4.** ₹ 4320 **5.** 2 m

6. 3 days **7.** 16000 **8.** 6 cm, 4 : 1 **9.** 4000 m^3

EXERCISE 13.6

1. 34.65 litres

2. 3.432 kg [Volume of a pipe = $\pi h \times (R^2 - r^2)$, where R is the outer radius and r is the inner radius].

3. The cylinder has the greater capacity by 85 cm^3.

4. (i) 3 cm (ii) 141.3 cm^3

5. (i) 110 m^2 (ii) 1.75 m (iii) 96.25 *kl* **6.** 0.4708 m^2

7. Volume of wood = 5.28 cm^3, Volume of graphite = 0.11 cm^3.

8. 38500 cm^3 or 38.5*l* of soup

EXERCISE 13.7

1. (i) 264 cm^3 (ii) 154 cm^3 **2.** (i) 1.232 l (ii) $\frac{11}{35}l$

3. 10 cm **4.** 8 cm **5.** 38.5 kl

6. (i) 48 cm (ii) 50 cm (iii) 2200 cm^2 **7.** $100\pi\ cm^3$ **8.** $240\pi\ cm^3$; 5 : 12

9. 86.625x m^3, 99.825 m^2

EXERCISE 13.8

1. (i) $1437\frac{1}{3}\ cm^3$ (ii) 1.05 m^3 (approx.)

2. (i) $11498\frac{2}{3}\ cm^3$ (ii) 0.004851 m^3 **3.** 345.39 g (approx.) **4.** $\frac{1}{64}$

5. 0.303l (approx.) **6.** 0.06348 m^3 (approx.)

7. $179\frac{2}{3}\ cm^3$ **8.** (i) 249.48 m^2 (ii) 523.9 m^3 (approx.) **9.** (i) 3r (ii) 1 : 9

10. 22.46 mm^3 (approx.)

EXERCISE 13.9 (Optional)

1. ₹ 6275

2. ₹ 2784.32 (approx.) [Rememeber to subtract the part of the sphere that is resting on the support while calculating the cost of silver paint]. **3.** 43.75%

EXERCISE 14.1

1. Five examples of data that we can gather from our day-to-day life are :

(i) Number of students in our class.

(ii) Number of fans in our school.

(iii) Electricity bills of our house for last two years.

(iv) Election results obtained from television or newspapers.

(v) Literacy rate figures obtained from Educational Survey.

Of course, remember that there can be many more different answers.

2. Primary data; (i), (ii) and (iii)

Secondary data; (iv) and (v)

EXERCISE 14.2

1.

Blood group	Number of students
A	9
B	6
O	12
AB	3
Total	30

Most common – O , Rarest – AB

2.

Distances (in km)	Tally Marks	Frequency
0 - 5	𝍸	5
5 - 10	𝍸 𝍸 𝍷	11
10 - 15	𝍸 𝍸 𝍷	11
15 - 20	𝍸 𝍷𝍷𝍷𝍷	9
20 - 25	𝍷	1
25 - 30	𝍷	1
30 - 35	𝍷𝍷	2
Total		40

3. (i)

Relative humidity (in %)	Frequency
84 - 86	1
86 - 88	1
88 - 90	2
90 - 92	2
92 - 94	7
94 - 96	6
96 - 98	7
98 - 100	4
Total	30

(ii) The data appears to be taken in the rainy season as the relative humidity is high.

(iii) Range = 99.2 – 84.9 = 14.3

4. (i)

Heights (in cm)	Frequency
150 - 155	12
155 - 160	9
160 - 165	14
165 - 170	10
170 - 175	5
Total	50

(ii) One conclusion that we can draw from the above table is that more than 50% of students are shorter than 165 cm.

5. (i)

Concentration of Sulphur dioxide (in ppm)	Frequency
0.00 - 0.04	4
0.04 - 0.08	9
0.08 - 0.12	9
0.12 - 0.16	2
0.16 - 0.20	4
0.20 - 0.24	2
Total	30

(ii) The concentration of sulphur dioxide was more than 0.11 ppm for 8 days.

6.

Number of heads	Frequency
0	6
1	10
2	9
3	5
Total	30

7. (i)

Digits	Frequency
0	2
1	5
2	5
3	8
4	4
5	5
6	4
7	4
8	5
9	8
Total	50

(ii) The most frequently occurring digits are 3 and 9. The least occurring is 0.

8. (i)

Number of hours	Frequency
0 - 5	10
5 - 10	13
10 - 15	5
15 - 20	2
Total	30

(ii) 2 children.

9.

Life of batteries (in years)	Frequency
2.0 - 2.5	2
2.5 - 3.0	6
3.0 - 3.5	14
3.5 - 4.0	11
4.0 - 4.5	4
4.5 - 5.0	3
Total	40

EXERCISE 14.3

1. (ii) Reproductive health conditions.

3. (ii) Party A **4.** (ii) Frequency polygon (iii) No **5.** (ii) 184

8.

Age (in years)	Frequency	Width	Length of the rectangle
1 - 2	5	1	$\frac{5}{1} \times 1 = 5$
2 - 3	3	1	$\frac{3}{1} \times 1 = 3$
3 - 5	6	2	$\frac{6}{2} \times 1 = 3$
5 - 7	12	2	$\frac{12}{2} \times 1 = 6$
7 - 10	9	3	$\frac{9}{3} \times 1 = 3$
10 - 15	10	5	$\frac{10}{5} \times 1 = 2$
15 - 17	4	2	$\frac{4}{2} \times 1 = 2$

Now, you can draw the histogram, using these lengths.

9. (i)

Number of letters	Frequency	Width of interval	Length of rectangle
1 - 4	6	3	$\frac{6}{3} \times 2 = 4$
4 - 6	30	2	$\frac{30}{2} \times 2 = 30$
6 - 8	44	2	$\frac{44}{2} \times 2 = 44$
8 - 12	16	4	$\frac{16}{4} \times 2 = 8$
12 - 20	4	8	$\frac{4}{8} \times 2 = 1$

Now, draw the histogram.

(ii) 6 - 8

EXERCISE 14.4

1. Mean = 2.8; Median = 3; Mode = 3
2. Mean = 54.8; Median = 52; Mode = 52
3. $x = 62$ **4.** 14
5. Mean salary of 60 workers is Rs 5083.33.

EXERCISE 15.1

1. $\frac{24}{30}$, i.e., $\frac{4}{5}$ **2.** (i) $\frac{19}{60}$ (ii) $\frac{407}{750}$ (iii) $\frac{211}{1500}$ **3.** $\frac{3}{20}$ **4.** $\frac{9}{25}$

5. (i) $\frac{29}{2400}$ (ii) $\frac{579}{2400}$ (iii) $\frac{1}{240}$ (iv) $\frac{1}{96}$ (v) $\frac{1031}{1200}$ **6.** (i) $\frac{7}{90}$ (ii) $\frac{23}{90}$

7. (i) $\frac{27}{40}$ (ii) $\frac{13}{40}$ **8.** (i) $\frac{9}{40}$ (ii) $\frac{31}{40}$ (iii) 0 **11.** $\frac{7}{11}$ **12.** $\frac{1}{15}$ **13.** $\frac{1}{10}$

EXERCISE A1.1

1. (i) False. There are 12 months in a year.
 (ii) Ambiguous. In a given year, Diwali may or may not fall on a Friday.
 (iii) Ambiguous. At some time in the year, the temperature in Magadi, may be 26° C.
 (iv) Always true.
 (v) False. Dogs cannot fly.
 (vi) Ambiguous. In a leap year, February has 29 days.

2. (i) False. The sum of the interior angles of a quadrilateral is 360°.
 (ii) True (iii) True (iv) True
 (v) False, for example, $7 + 5 = 12$, which is not an odd number.

3. (i) All prime numbers greater than 2 are odd. (ii) Two times a natural number is always even. (iii) For any $x > 1$, $3x + 1 > 4$. (iv) For any $x \geq 0$, $x^3 \geq 0$.
 (v) In an equilateral triangle, a median is also an angle bisector.

EXERCISE A1.2

1. (i) Humans are vertebrates. (ii) No. Dinesh could have got his hair cut by anybody else. (iii) Gulag has a red tongue. (iv) We conclude that the gutters will have to be cleaned tomorrow. (v) All animals having tails need not be dogs. For example, animals such as buffaloes, monkeys, cats, etc. have tails but are not dogs.

2. You need to turn over B and 8. If B has an even number on the other side, then the rule has been broken. Similarly, if 8 has a consonant on the other side, then the rule has been broken.

EXERCISE A1.3

1. Three possible conjectures are:

(i) The product of any three consecutive even numbers is even. (ii) The product of any three consecutive even numbers is divisible by 4. (iii) The product of any three consecutive even numbers is divisible by 6.

2. Line 4: 1 3 3 1 $=11^3$; Line 5: 1 4 6 4 1$=11^4$; the conjecture holds for Line 4 and Line 5; No, because $11^5 \neq 15101051$.

3. $T_4 + T_5 = 25 = 5^2$; $T_{n-1} + T_n = n^2$.

4. $111111^2 = 12345654321$; $1111111^2 = 1234567654321$

5. Student's own answer. For example, Euclid's postulates.

EXERCISE A1.4

1. (i) You can give any two triangles with the same angles but of different sides.

(ii) A rhombus has equal sides but may not be a square.

(iii) A rectangle has equal angles but may not be a square.

(iv) For $a = 3$ and $b = 4$, the statement is not true.

(v) For $n = 11$, $2n^2 + 11 = 253$ which is not a prime.

(vi) For $n = 41$, $n^2 - n + 41$ is not a prime.

2. Student's own answer.

3. Let x and y be two odd numbers. Then $x = 2m + 1$ for some natural number m and $y = 2n + 1$ for some natural number n.

$x + y = 2\,(m + n + 1)$. Therefore, $x + y$ is divisible by 2 and is even.

4. See Q.3. $xy = (2m + 1)(2n + 1) = 2\,(2mn + m + n) + 1$.

Therefore, $x\,y$ is not divisible by 2, and so it is odd.

5. Let $2n$, $2n + 2$ and $2n + 4$ be three consecutive even numbers. Then their sum is $6(n + 1)$, which is divisible by 6.

7. (i) Let your original number be n. Then we are doing the following operations:

$$n \rightarrow 2n \rightarrow 2n + 9 \rightarrow 2n + 9 + n = 3n + 9 \rightarrow \frac{3n + 9}{3} = n + 3 \rightarrow n + 3 + 4 = n + 7 \rightarrow n + 7 - n = 7.$$

(ii) Note that $7 \times 11 \times 13 = 1001$. Take any three digit number say, abc. Then $abc \times 1001 = abcabc$. Therefore, the six digit number $abcabc$ is divisible by 7, 11 and 13.

EXERCISE A2.1

1. **Step 1: Formulation :**

   The relevant factors are the time period for hiring a computer, and the two costs given to us. We assume that there is no significant change in the cost of purchasing or hiring the computer. So, we treat any such change as irrelevant. We also treat all brands and generations of computers as the same, i.e. these differences are also irrelevant.

   The expense of hiring the computer for x months is ₹ $2000x$. If this becomes more than the cost of purchasing a computer, we will be better off buying a computer. So, the equation is

   $$2000\,x = 25000 \qquad (1)$$

   Step 2 : Solution : Solving (1), $x = \frac{25000}{2000} = 12.5$

   Step 3 : Interpretation : Since the cost of hiring a computer becomes more **after** 12.5 months, it is cheaper to buy a computer, if you have to use it for more than 12 months.

2. **Step1 : Formulation :** We will assume that cars travel at a constant speed. So, any change of speed will be treated as irrelevant. If the cars meet after x hours, the first car would have travelled a distance of $40x$ km from A and the second car would have travelled $30x$ km, so that it will be at a distance of $(100 - 30x)$ km from A. So the equation will be $40x = 100 - 30x$, i.e., $70x = 100$.

   Step 2 : Solution : Solving the equation, we get $x = \frac{100}{70}$.

   Step 3 : Interpretation : $\frac{100}{70}$ is approximately 1.4 hours. So, the cars will meet after 1.4 hours.

3. **Step1: Formulation :** The speed at which the moon orbits the earth is

   $$\frac{\text{Length of the orbit}}{\text{Time taken}}.$$

   Step 2 : Solution : Since the orbit is nearly circular, the length is $2 \times \pi \times 384000$ km $= 2411520$ km

   The moon takes 24 hours to complete one orbit.

   So, speed $= \frac{2411520}{24} = 100480$ km/hour.

   Step 3 : Interpretation : The speed is 100480 km/h.

4. **Formulation :** An assumption is that the difference in the bill is only because of using the water heater.

Let the average number of hours for which the water heater is used = x

Difference per month due to using water heater = ₹ 1240 – ₹ 1000 = ₹ 240

Cost of using water heater for one hour = ₹ 8

So, the cost of using the water heater for 30 days = $8 \times 30 \times x$

Also, the cost of using the water heater for 30 days = Difference in bill due to using water heater

So, $240x = 240$

Solution : From this equation, we get $x = 1$.

Interpretation : Since $x = 1$, the water heater is used for an average of 1 hour in a day.

EXERCISE A2.2

1. We will not discuss any particular solution here. You can use the same method as we used in last example, or any other method you think is suitable.

EXERCISE A2.3

1. We have already mentioned that the formulation part could be very detailed in real-life situations. Also, we do not validate the answer in word problems. Apart from this word problem have a 'correct answer'. This need not be the case in real-life situations.

2. The important factors are (ii) and (iii). Here (i) is not an important factor although it can have an effect on the number of vehicles sold.