



Brilliant Mathematics

7

Teacher's Manual

KANHA BOOKS INTERNATIONAL

New Delhi

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KANHA BOOKS INTERNATIONAL

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Exercise 1.1**1. Add :**

$$\begin{aligned} \text{(i)} \quad & 323 + (-125) \\ &= 323 - 125 \\ &= 198 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad & 983 + 451 \\ &= 1434 \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad & -323 + 79 \\ &= -244 \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad & -543 + 214 \\ &= -329 \end{aligned}$$

$$\begin{aligned} \text{(v)} \quad & -3050 + (-1978) \\ &= -3050 - 1978 \\ &= -5028 \end{aligned}$$

$$\begin{aligned} \text{(vi)} \quad & -4159 + (-1709) \\ &= -4159 - 1709 \\ &= -5868 \end{aligned}$$

2. Find the additive inverse of :

$$\text{(i)} \quad |37| = -37$$

$$\text{(ii)} \quad |-1| = 1$$

$$\text{(iii)} \quad |-143| = -143$$

$$\text{(iv)} \quad |-299| = 299$$

$$\text{(v)} \quad |-2978| = 2978$$

3. Subtract :

- (i) $579 - 343$
 $= 236$
- (ii) $4379 - 2003$
 $= 2376$
- (iii) $-289 - 367$
 $= -656$
- (iv) $893 - (-967)$
 $= 893 + 967$
 $= 1860$
- (v) $-1031 - (-7279)$
 $= -1031 + 7279$
 $= 6248$
- (vi) $-547 - (-349)$
 $= -547 + 349$
 $= -198$

4. Find the successor and predecessor of each of the following integers :

- (i) Successor $= 99 + 1 = 100$
Predecessor $= 99 - 1 = 98$
- (ii) Successor $= 80 + 1 = 81$
Predecessor $= 80 - 1 = 79$
- (iii) Successor $= -40 + 1 = -39$
Predecessor $= -40 - 1 = -41$
- (iv) Successor $= -100 + 1 = -99$
Predecessor $= -100 - 1 = -101$

5. Find the value of :

- (i) $75 - 100 + 125 + 37$
 $= -25 + 125 + 37$

$$= 137$$

$$(ii) \quad (-237) + (-183) + 299 + (-15)$$

$$= -237 - 183 + 299 - 15$$

$$= -420 + 299 - 15$$

$$= -121 - 15$$

$$= -136$$

$$(iii) \quad 437 - 817 + 370 - 139$$

$$= -380 + 370 - 139$$

$$= -10 - 139$$

$$= -149$$

$$(iv) \quad -4379 + 3784 - 1932 + 5279$$

$$= -595 - 1932 + 5279$$

$$= -2527 + 5279$$

$$= 2752$$

6. Sum

Sum

$$-199 + (-237)$$

$$= -843 + 379$$

$$= -199 - 237$$

$$= -464$$

$$= -436$$

Difference

$$-464 - (-436)$$

$$-464 + 436$$

$$= -28$$

7. Sum

Difference

$$= -437 + (-317)$$

$$= -437 - (-317)$$

$$= -437 - 317$$

$$= -437 + 317$$

$$= -754$$

$$= -120$$

Sum

$$= -754 + (-120)$$

$$= -754 - 120$$

$$= -874$$

8. Sum of two integers = -79

One integer = 23

Other = x

$$23 + x = -79$$

$$x = -79 - 23$$

$$= -102$$

9. Sum of two integers = -3491

One integer = -1897

Other = x

$$-1897 + x = -3491$$

$$x = -3491 + 1897$$

$$= -1594$$

10. Verify $a + (b + c) = (a + b) + c$ for each of the following :

$$(i) \quad -19 + (29 + (-15)) = (-19 + 29) + (-15)$$

$$-19 + (29 - 15) = (10) - 15$$

$$-19 + 14 = -5$$

$$-5 = -5$$

Hence verified

$$(ii) \quad 37 + (-17 + 47) = (37 + (-17)) + 47$$

$$37 + 30 = 2 + 47$$

$$67 = 67$$

Hence verified

11. Write down (various answer are possible)

$$(i) \quad -1, -7 \quad (ii) \quad -4, -3 \quad (iii) \quad -20, 3 \quad (iv) \quad 10, -9$$

12. Maximum temperature of a city = 28°C

Minimum temperature of a city = -5°C

Fall in temperature = $28^{\circ}\text{C} - (-5^{\circ}\text{C})$

$$= 28^{\circ}\text{C} + 5^{\circ}\text{C}$$

$$= 33^{\circ}\text{C}$$

13. Distance travelled by Mohit towards South = 59 km

Distance travelled by Mohit towards North = 70 km

Distance of Mohit from Delhi = 70 km – 59 km

$$= 11 \text{ km}$$

14. Amount in Amna account in 2023 = ₹4500

Amount deposited in April = ₹1700

Amount withdrawn in April = ₹1500

Balance = ₹(4500 + 1700 – 1500)

$$= ₹4700$$

Exercise 1.2

1. Multiply :

(i) $36 \times 7 = 252$

(ii) $18 \times -8 = -144$

(iii) $21 \times -3 = -63$

(iv) $-24 \times 4 = -96$

(v) $-16 \times 7 = -112$

(vi) $-32 \times -5 = 160$

(vii) $28 \times -2 = 56$

(viii) $99 \times -1 = -99$

(ix) $-317 \times 0 = 0$

2. Find each of the following product:

(i) $2 \times 3 \times (-8) = -48$

(ii) $-5 \times 7 \times (-4) = 140$

(iii) $-5 \times -7 \times -8 \times -12 = 3360$

(iv) $-11 \times -13 \times 0 \times 9 \times 12 = 0$

(v) $-60 \times -10 \times -5 \times -1 = 3000$

(vi) $30 \times -16 \times 5 \times -2 = 4800$

$$(vii) -3 \times -3 \times -3 \times -3 = 81$$

$$(viii) (-1)^{100} = 1$$

3. Simplify using suitable properties and also mention them:

$$(i) (-9) \times 7 + 3 \times (-9)$$

$$= -9[7 + 3]$$

Distributive property

$$= -9[10]$$

$$= -90$$

$$(ii) 8 \times (-25) \times 38$$

(Associative property)

$$= -200 \times 38$$

$$= -7600$$

$$(iii) (-47) \times (100 - 3)$$

$$= (-47 \times 100) - (-47 \times 3) \quad (\text{Distributive property})$$

$$= -4700 + 141$$

$$= -4559$$

$$(iv) 51 \times (-100 - 1)$$

(Distributive property)

$$= 51 \times (-100) - (51 \times 1)$$

$$= -5100 - 51$$

$$= -5151$$

$$(v) 83(-99 - 1)$$

(Distributive property)

$$= 83(-100)$$

$$= -8300$$

$$(vi) 725 \times [-35 + 35]$$

(Distributive property)

$$= 725 \times 0$$

$$= 0$$

4. Verify the following :

$$(i) 20 \times [8 - (-4)] = 20 \times 8 - 20 \times (-4)$$

$$20 \times (8 + 4) = 160 - (-80)$$

$$20 \times 12 = 160 + 80$$

$$240 = 240$$

Hence verified

$$(ii) \quad 38 \times [10 + (-7)] = 38 \times 10 + 38 \times (-7)$$

$$38 \times (10 - 7) = 380 + (-266)$$

$$38 \times 3 = 380 - 266$$

$$114 = 114$$

Hence verified

$$(iii) \quad -40 \times [136 - 36] = (-40) \times 136 - (-40) \times 36$$

$$-40 \times [100] = -5440 + 1440$$

$$-4000 = -4000$$

Hence verified

$$(iv) \quad -25 \times [(-9) - (-4)] = (-25) \times (-9) - (-25) \times (-4)$$

$$-25 \times [-9 + 4] = 225 - 100$$

$$-25 \times [-5] = 125$$

$$125 = 125$$

Hence verified

5. Divide :

$$(i) \quad \frac{147}{3} = 49$$

$$(ii) \quad \frac{255}{-15} = -17$$

$$(iii) \quad \frac{-348}{4} = -87$$

$$(iv) \quad \frac{-105}{7} = -15$$

$$(v) \quad \frac{-210}{-21} = 10$$

$$(vi) \quad \frac{-336}{-21} = 16$$

$$(vii) \quad \frac{98}{-14} = -7$$

$$(viii) \quad \frac{-37}{1} = -37$$

$$(ix) \quad \frac{43}{-1} = -43$$

$$(x) \quad \frac{0}{-321} = 0$$

6. Verify that $a \div (b + c) \neq (a \div b) + (a \div c)$ for each of the following values:

$$(i) \quad a = 12, b = 1, c = -2$$

$$\text{LHS} = 12 \div (1 + (-2))$$

$$= 12 \div (1 - 2)$$

$$= 12 \div (-1)$$

$$= -12$$

$$\text{RHS} = (12 \div 1) + (12 \div -2)$$

$$= 12 + (-6)$$

$$= 12 - 6$$

$$= 6$$

$$\text{LHS} \neq \text{RHS} \quad \text{Verified}$$

(ii) $a = 10, b = 1, c = 1$

$$\text{LHS} = 10 \div (1 + 1)$$

$$= 10 \div (2)$$

$$= 5$$

$$\text{RHS} = (10 \div 1) + (10 \div 1)$$

$$= 10 + 10$$

$$= 20$$

$$\text{LHS} \neq \text{RHS} \quad \text{Hence verified}$$

7. Find the value of the following :

(i) $[12 + 22] \times [5]$

$$= 34 \times 5$$

$$= 170$$

(ii) $4 \times 5 \times 7$

$$= 140$$

(iii) $[10 - 5] \times 2$

$$= 5 \times 2$$

$$= 10$$

8. Total no. of questions = 24

Marks given for every correct answer = 5

Marks given for every incorrect answer = -2

Marks given for not attempted question = 0

$$\begin{aligned}
 \text{(i) No. of correct answers} &= 8 \\
 \text{Marks for correct answers} &= 8 \times 5 \\
 &= 40 \\
 \text{No. of incorrect answers} &= 16 \\
 \text{Marks for incorrect answers} &= 16 \times -2 \\
 &= -32 \\
 \text{Rohit score} &= 40 - 32 \\
 &= 8
 \end{aligned}$$

$$\begin{aligned}
 \text{(ii) No. of correct answers} &= 16 \\
 \text{Marks for correct answers} &= 16 \times 5 \\
 &= 80 \\
 \text{No. of incorrect answers} &= 8 \times -2 \\
 &= -16 \\
 \text{Seema's score} &= 80 - 16 \\
 &= 64
 \end{aligned}$$

9. Amount gain by company on each bag of white cement = ₹132

Amount loses by company on each bag of grey cement = ₹68

No. of white cement bags sold = 3500

$$\begin{aligned}
 \text{Profit} &= 3500 \times ₹132 \\
 &= ₹4,62,000
 \end{aligned}$$

No. of grey cement bags sold = 4500

$$\begin{aligned}
 \text{Loss} &= 4500 \times ₹68 \\
 &= ₹3,06,000
 \end{aligned}$$

$$\begin{aligned}
 \text{Net Profit} &= ₹4,62,000 - ₹3,06,000 \\
 &= ₹1,56,000
 \end{aligned}$$

$$\begin{aligned}
 \text{10. Total distance covered by an elevator} &= 10 - (-350) \text{ m} \\
 &= (10 + 350) \text{ m} \\
 &= 360 \text{ m}
 \end{aligned}$$

Time taken to cover a distance of 6m = 1 min

Therefore, time taken to cover 360 m = $360 \div 6$

= 60 mins

= 1 hour

Thus, elevator will reach -350 m from 10 in 1 hours.

11. Fill in the blanks :

- (i) -1 (ii) 0 (iii) 8 (iv) -125 (v) -37 (vi) 1
 (vii) 0 (viii) Not define

12. True or False :

- (i) False (ii) False (iii) True (iv) False (v) True (vi) True

MCQs

1.	(b)	2.	(b)	3.	(a)	4.	(a)	5.	(c)	6.	(d)
7.	(b)	8.	(d)	9.	(c)	10.	(b)	11.	(a)	12.	(c)

2. $-7 + 3 > -5 - 3$

$-4 > -8$

9. $8 + x = -14$

$x = -14 - 8$

$= -22$

10. $6 \times x = -30$

$x = \frac{-30^5}{6}$

$x = 5$

Fill in the blanks

1. -1 2. 0, not defined 3. 0 4. 1 5. may or may not be
 6. neither, nor 7. $(a \times b) \pm (b \times c)$ 8. -1

Exercise 2.1

1. (i) $\frac{2\cancel{40}}{3\cancel{60}} = \frac{2}{3}$

(ii) 1 day = 24 hours

$$\frac{\cancel{6}^1}{24_4} = \frac{1}{4}$$

2. (i) Convert each of the following into a mixed fraction :

(a) $\frac{37}{5}$ $5 \overline{) \frac{37}{5}} = 7 \frac{2}{5}$

(b) $\frac{43}{9}$ $9 \overline{) \frac{43}{9}} = 4 \frac{7}{9}$

(c) $\frac{39}{8}$ $8 \overline{) \frac{39}{8}} = 4 \frac{7}{8}$

(d) $\frac{79}{11}$ $11 \overline{) \frac{79}{11}} = 7 \frac{2}{11}$

(ii) Convert each of the following into an improper fraction:

(a) $\frac{4 \times 3 + 2}{4} = \frac{14}{4}$

(b) $\frac{8 \times 7 + 1}{8} = \frac{57}{8}$

$$(c) \frac{11 \times 3 + 5}{11} = \frac{38}{11}$$

$$(d) \frac{15 \times 13 + 7}{15} = \frac{202}{15}$$

3. Reduce each of the following fractions to its simplest form :

$$(a) \frac{75}{125} \div \frac{5}{5} = \frac{15}{25} \div \frac{5}{5} = \frac{3}{5}$$

$$(b) \frac{150}{375} \div \frac{5}{5} = \frac{30}{75} \div \frac{5}{5} = \frac{6}{15} \div \frac{3}{3} = \frac{2}{5}$$

$$(c) \frac{1024}{3440} \div \frac{2}{2} = \frac{512}{1720} \div \frac{2}{2} = \frac{256}{860} \div \frac{2}{2} = \frac{128}{430} \div \frac{2}{2} = \frac{64}{215}$$

$$(d) \frac{172}{301} \div \frac{43}{43} = \frac{4}{7}$$

4. Arrange the following fractions in the ascending order :

$$(i) \frac{2}{5} \times \frac{4}{4} = \frac{8}{20}$$

$$\frac{3}{4} \times \frac{5}{5} = \frac{15}{20}$$

$$\frac{1}{2} \times \frac{10}{10} = \frac{10}{20}$$

$$\frac{3}{5} \times \frac{4}{4} = \frac{12}{20}$$

$$\frac{8}{20}, \frac{10}{20}, \frac{12}{20}, \frac{15}{20}$$

$$\frac{2}{5} < \frac{1}{2} < \frac{3}{5} < \frac{3}{4}$$

$$(ii) \frac{7}{25} < \frac{7}{18} < \frac{7}{11} < \frac{7}{10} < \frac{7}{8}$$

$$(iii) \frac{1}{5} < \frac{3}{5} < \frac{4}{5} < \frac{9}{5}$$

$$(iv) \frac{3}{8} \times \frac{6}{6} = \frac{18}{48}$$

$$\frac{6}{12} \times \frac{4}{4} = \frac{24}{48}$$

$$\frac{5}{16} \times \frac{3}{3} = \frac{15}{48}$$

$$\frac{4}{6} \times \frac{8}{8} = \frac{38}{48}$$

$$\frac{15}{48}, \frac{18}{48}, \frac{24}{48}, \frac{38}{48}$$

$$\frac{5}{16} < \frac{3}{8} < \frac{6}{12} < \frac{4}{6}$$

5. Arrange the following fractions in the descending order :

(i) $\frac{8}{5} > \frac{8}{9} > \frac{8}{13} > \frac{8}{17}$

(ii) $\frac{2}{7} \times \frac{20}{20} = \frac{40}{140}$

$$\frac{11}{35} \times \frac{4}{4} = \frac{44}{140}$$

$$\frac{9}{14} \times \frac{10}{10} = \frac{90}{140}$$

$$\frac{13}{28} \times \frac{5}{5} = \frac{65}{140}$$

$$\frac{90}{140}, \frac{65}{140}, \frac{44}{140}, \frac{40}{140}$$

$$\frac{9}{14} > \frac{13}{28} > \frac{11}{35} > \frac{2}{7}$$

(iii) $\frac{4}{5} \times \frac{6}{6} = \frac{24}{30}$

$$\frac{7}{10} \times \frac{3}{3} = \frac{21}{30}$$

$$\frac{8}{15} \times \frac{2}{2} = \frac{16}{30}$$

$$\frac{17}{30} \times \frac{1}{1} = \frac{17}{30}$$

$$\frac{24}{30}, \frac{21}{30}, \frac{17}{30}, \frac{16}{30}$$

$$\frac{4}{5} > \frac{7}{10} > \frac{17}{30} > \frac{8}{15}$$

$$(iv) \quad \frac{2}{3} \times \frac{10}{10} = \frac{20}{30}$$

$$\frac{3}{5} \times \frac{6}{6} = \frac{18}{30}$$

$$\frac{7}{10} \times \frac{3}{3} = \frac{21}{30}$$

$$\frac{8}{15} \times \frac{2}{2} = \frac{16}{30}$$

$$\frac{21}{30}, \frac{20}{30}, \frac{18}{30}, \frac{16}{30}$$

$$\frac{7}{10} > \frac{2}{3} > \frac{3}{5} > \frac{8}{15}$$

6. Simplify :

$$(i) \quad \frac{7}{3} + \frac{7}{2} - \frac{17}{4}$$

$$= \frac{7 \times 4 + 7 \times 6 - 17 \times 3}{12}$$

$$= \frac{28 + 42 - 51}{12} = \frac{19}{12}$$

$$(ii) \quad \frac{16}{53} + \frac{13}{3} - \frac{11}{5}$$

$$= \frac{16 \times 5 + 13 \times 5 - 11 \times 3}{15}$$

$$= \frac{80 + 65 - 33}{15}$$

$$= \frac{112}{15}$$

$$\begin{aligned} \text{(iii)} \quad & \frac{22}{7} + \frac{3}{5} - \frac{7}{3} \\ &= \frac{22 \times 15 + 3 \times 21 - 7 \times 35}{105} \\ &= \frac{330 + 63 - 245}{105} = \frac{148}{105} \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad & \frac{73}{9} - \frac{7}{2} - \frac{13}{3} \\ &= \frac{73 \times 2 - 7 \times 9 - 13 \times 6}{18} \\ &= \frac{146 - 63 - 78}{18} \\ &= \frac{5}{18} \end{aligned}$$

7. Part of exercise Reema solved $= \frac{2}{7}$

Part of exercise Seema solved $= \frac{4}{5}$

$$\begin{aligned} \text{Difference} &= \frac{4}{5} - \frac{2}{7} \\ &= \frac{4 \times 7 - 2 \times 5}{35} = \frac{28 - 10}{35} \\ &= \frac{18}{35} \end{aligned}$$

Reema solved lesser by $\frac{18}{35}$

8. Length of wire to fence $= 12\frac{4}{11}$

$$= \frac{11 \times 12 + 4}{11}$$

$$= \frac{136}{11} \text{ m}$$

$$\text{Length of wire used} = 10\frac{1}{7} = \frac{71}{7} \text{ m}$$

$$\begin{aligned} \text{Length of wire unused} &= \frac{136}{11} - \frac{17}{7} \\ &= \frac{136 \times 7 - 71 \times 11}{77} \\ &= \frac{952 - 781}{77} \\ &= \frac{171}{77} - 2\frac{17}{77} \text{ m} \end{aligned}$$

$2\frac{17}{77}$ m of wire remains unused.

9. Length of paper = $15\frac{1}{3}$ cm

Width of paper = $12\frac{1}{2}$ cm

$$\begin{aligned} \text{Perimeter} &= 2(l + b) \\ &= 2\left(15\frac{1}{3} + 12\frac{1}{2}\right) \text{ cm} \\ &= 2\left(\frac{46}{3} + \frac{25}{2}\right) \text{ cm} \\ &= 2\left(\frac{46 \times 2 + 25 \times 3}{6}\right) \text{ cm} \\ &= 2\left(\frac{92 + 75}{6}\right) \text{ cm} \\ &= \frac{167}{3} \text{ cm} \\ &= 55\frac{2}{3} \text{ cm} \end{aligned}$$

10. Quantity of oranges Vanya purchased $= 3\frac{1}{2}$ kg

$$= \frac{7}{2} \text{ kg}$$

Quantity of apples Vanya purchased $= 4\frac{3}{4}$ kg

$$= \frac{19}{4} \text{ kg}$$

Quantity of guava Vanya purchased $= 2\frac{1}{4}$ kg

$$= \frac{9}{4} \text{ kg}$$

Quantity of fruits purchased

$$= \frac{7}{2} \text{ kg} + \frac{19}{4} \text{ kg} + \frac{9}{4} \text{ kg}$$

$$= \frac{14 + 19 + 9}{4}$$

$$= \frac{42}{4} = \frac{21}{2}$$

$$= 10\frac{1}{2} \text{ kg}$$

$10\frac{1}{2}$ kg of fruits were purchased by her.

11. $x + 3\frac{5}{7} = 4$

$$x = 4 - \frac{26}{7}$$

$$= \frac{4 \times 7 - 26 \times 1}{7}$$

$$= \frac{28 - 26}{7}$$

$$= \frac{2}{7}$$

$$12. \quad 1\frac{4}{9} + x = 8\frac{2}{5}$$

$$\frac{13}{9} + x = \frac{42}{5}$$

$$x = \frac{42}{5} - \frac{13}{9}$$

$$= \frac{42 \times 9 - 13 \times 5}{45}$$

$$= \frac{378 - 65}{45}$$

$$= \frac{313}{45}$$

Exercise 2.2

1. Multiply :

$$(i) \quad \frac{3}{4} \times 16 = 12$$

$$(ii) \quad 12 \times \frac{9}{4} = 27$$

$$(iii) \quad 16\frac{3}{4} \times 20$$

$$= \frac{67}{4} \times 20$$

$$= 335$$

$$(iv) \quad \frac{5}{9} \times \frac{12}{25} = \frac{4}{15}$$

$$(v) \quad \frac{36}{11} \times \frac{44}{27} = \frac{16}{3} = 5\frac{1}{3}$$

$$(vi) \quad \frac{16}{5} \times \frac{9}{20} = \frac{36}{25} = 1\frac{11}{25}$$

$$(vii) \frac{22}{3} \times \frac{13}{4} = \frac{143}{6} = 23\frac{5}{6}$$

$$(viii) \frac{17}{2} \times \frac{18}{17} \\ = \frac{18}{2} = 9$$

$$(ix) \frac{32}{5} \times \frac{25}{8} = 20$$

2. Simplify :

$$(i) \frac{3}{5} \times \frac{4}{1} \times \frac{7}{8} \\ = \frac{21}{10} = 2\frac{1}{10}$$

$$(ii) \frac{12}{25} \times \frac{30}{28} \times \frac{21}{32} = \frac{27}{80}$$

$$(iii) \frac{49}{16} \times \frac{52}{7} \times \frac{2}{1} = \frac{91}{2} = 45\frac{1}{2}$$

$$(iv) \frac{11}{7} \times \frac{35}{22} \times \frac{16}{15} \\ = \frac{8}{3} = 2\frac{2}{3}$$

$$(v) \frac{141}{7} \times \frac{92}{5} \times \frac{10}{3} \times \frac{6}{1} \\ = \frac{5188}{7} = 741\frac{4}{7}$$

3. Find :

$$(i) \frac{1}{2} \times 48 = 24$$

$$(ii) \frac{2}{3} \times 24 = 16$$

$$(iii) \frac{5}{9} \times 63 = 35$$

$$(iv) \quad \frac{4}{7} \times \frac{11}{4} = \frac{11}{7} = 1\frac{4}{7}$$

$$(v) \quad \frac{2}{5} \times 100 = 40 \text{ paise}$$

$$(vi) \quad \frac{1}{20} \times 100 = 5 \text{ cm}$$

$$(vii) \quad \frac{2}{5} \times 60 = 24 \text{ minutes}$$

$$(viii) \quad \frac{2}{7} \times 7 = 2 \text{ days}$$

$$(ix) \quad \frac{6}{5} \times 365 = 438 \text{ days}$$

4. Evaluate :

$$\begin{aligned} (i) \quad & \left(\frac{45}{4} \times \frac{16}{5} \right) + \left(\frac{14}{3} \times \frac{41}{7} \right) \\ &= 36 + \frac{82}{3} \\ &= \frac{36 \times 3 + 82}{3} = \frac{108 + 82}{3} \\ &= \frac{190}{3} = 63\frac{1}{3} \end{aligned}$$

$$\begin{aligned} (ii) \quad & \left(\frac{32}{5} \times \frac{25}{8} \right) - \left(\frac{4}{3} \times \frac{9}{8} \right) \\ &= 20 - \frac{3}{2} = \frac{40 - 3}{2} = \frac{37}{2} \end{aligned}$$

$$\begin{aligned} (iii) \quad & \left(\frac{9}{2} \times \frac{11}{5} \times \frac{8}{3} \right) - \left(\frac{3}{5} \times \frac{8}{3} \times \frac{15}{4} \right) \\ &= \frac{132}{5} - 6 \\ &= \frac{132 - 30}{5} = \frac{102}{5} = 20\frac{2}{5} \end{aligned}$$

$$\begin{aligned}
 \text{(iv)} \quad & \left(\frac{6+5}{22} \right) \times \left(\frac{14 \times 2 + 5 \times 3}{18} \right) \\
 &= \frac{11}{22} \times \frac{28+15}{18} \\
 &= \frac{11}{22} \times \frac{43}{18} = \frac{43}{36} = 1 \frac{7}{36}
 \end{aligned}$$

5. Which is greater :

$$\begin{aligned}
 \text{(i)} \quad & \frac{6}{7} \times \frac{49}{5} = \frac{42}{5} \\
 &= \frac{7}{8} \times \frac{48}{5} = \frac{42}{5} \\
 \Rightarrow & \frac{42}{5} = \frac{42}{5}
 \end{aligned}$$

$$\begin{aligned}
 \text{(ii)} \quad & \frac{7}{3} \times \frac{3}{4} = \frac{7}{4} \\
 & \frac{1}{5} \times \frac{15}{4} = \frac{3}{4} \\
 & \frac{7}{4} > \frac{3}{4}
 \end{aligned}$$

$$\begin{aligned}
 \text{(iii)} \quad & \frac{1}{3} \times \frac{3}{4} = \frac{1}{4} \\
 & \frac{1}{2} \times \frac{4}{5} = \frac{2}{5} \\
 & \frac{1}{4} \times \frac{5}{5} = \frac{5}{20} \\
 & \frac{2}{5} \times \frac{4}{4} = \frac{8}{20} \\
 & \frac{5}{20} < \frac{8}{20}
 \end{aligned}$$

$$\frac{1}{4} < \frac{2}{5}$$

$$\text{(iv)} \quad \frac{2}{3} \times \frac{3}{1} = 2$$

$$\frac{1}{3} \times \frac{12}{7} = \frac{4}{7}$$

$$\frac{2}{1} \quad \frac{4}{7}$$

$$\frac{2}{1} \times \frac{7}{7} = \frac{14}{7}$$

$$\frac{4}{7} \times \frac{1}{1} = \frac{4}{7}$$

$$\frac{14}{7} > \frac{4}{7}$$

$$2 > \frac{4}{7}$$

6. No. of students in a class = 50

$$\begin{aligned} \text{No. of boys in a class} &= \frac{2}{5} \times 50 \\ &= 20 \end{aligned}$$

$$\begin{aligned} \text{No. of girls in a class} &= 50 - 20 \\ &= 30 \end{aligned}$$

There are 30 girls in the class.

7. Fabric needed to make a dress = $\frac{5}{6}$ yards

$$\begin{aligned} \text{Fabric needed to make 8 dresses} &= \frac{5}{6} \times 8 \\ &= \frac{20}{3} \text{ yards} \\ &= 6\frac{2}{3} \text{ yards} \end{aligned}$$

$6\frac{2}{3}$ yards fabric is needed to make 8 dresses.

8. Time Krishna spent on watching TV each day = $\frac{2}{5}$ hours

Total number of hours she spend on watching TV in the month of September = $\frac{2}{5} \times 30 = 12$

Krishna spends 12 hours watching TV in September.

9. Cost of 1 metre of cloth = ₹ $35\frac{1}{3}$

$$\begin{aligned}\text{Cost of } 22\frac{7}{9} \text{ metre of cloth} &= ₹ 35\frac{1}{3} \times 22\frac{7}{9} \\ &= \frac{106}{3} \times \frac{205}{9} \\ &= \frac{21730}{27} \\ &= ₹ 804\frac{22}{27}\end{aligned}$$

Cost of $22\frac{7}{9}$ m cloth is ₹ $804\frac{22}{27}$

10. Distance covered in 1 hour = 120 km

$$\begin{aligned}\text{Distance covered in } 4\frac{3}{5} \text{ hour} &= 120 \times \frac{23}{5} \text{ km} \\ &= 552 \text{ km}\end{aligned}$$

Car covers 552 km in $4\frac{3}{5}$ hours.

11. Total money Harry and Neena had = ₹ 3500

$$\begin{aligned}\text{Harry's share} &= \frac{3}{7} \times 3500 \\ &= ₹ 1500\end{aligned}$$

$$\begin{aligned}\text{Neera's share} &= ₹ 3500 - ₹ 1500 \\ &= ₹ 2000\end{aligned}$$

12. No. of chairs in a row = 15

$$\text{Distance between 2 chairs} = \frac{1}{4} \text{ of a metre}$$

$$\text{No. of gaps} = 15 - 1 = 14$$

$$\text{Total distance} = 14 \times \frac{1}{4}$$

$$= \frac{7}{2}$$

$$= 3\frac{1}{2} \text{ m}$$

Exercise 2.3

1. Write down the reciprocal of :

$$(i) \quad 1 \qquad (ii) \quad \frac{1}{20} \qquad (iii) \quad 9$$

$$(iv) \quad \frac{19}{13} \qquad (v) \quad \frac{7}{38} \qquad (vi) \quad \frac{5}{22}$$

2. Divide :

$$(i) \quad \frac{4 \times 3}{8} = \frac{3}{2} = 1\frac{1}{2}$$

$$(ii) \quad \frac{2}{5} \times \frac{1}{7} = \frac{2}{35}$$

$$(iii) \quad \frac{8}{9} \times \frac{1}{16} = \frac{1}{18}$$

$$(iv) \quad 24 \times \frac{7}{6} = 28$$

$$(v) \quad \frac{13}{7} \times \frac{14}{39} = \frac{2}{3}$$

$$(vi) \quad \frac{16}{7} \times \frac{42}{28} = \frac{24}{7} = 3\frac{3}{7}$$

$$(vii) \quad \frac{51}{2} \times \frac{13}{8}$$

$$\frac{663}{16} = 41\frac{7}{16}$$

$$(viii) \frac{34}{5} \times \frac{35}{7} = 34$$

$$(ix) \frac{16}{5} \times \frac{3}{5} = \frac{48}{25} = 1\frac{23}{25}$$

$$(x) \frac{108}{7} \times \frac{49}{72} \\ = \frac{63}{6} = 10\frac{1}{2}$$

3. Simplify :

$$(i) \frac{4}{15} \times \frac{6}{28} \times \frac{9}{2} = \frac{9}{35}$$

$$(ii) \frac{164}{9} \times \frac{9}{82} \times \frac{3}{4} \\ = \frac{3}{2} = 1\frac{1}{2}$$

$$(iii) \left(24 \times \frac{3}{8} \right) \times \frac{9}{28} \\ \frac{81}{28} = 2\frac{25}{28}$$

$$(iv) 7 \times \frac{5}{12} \times \frac{5}{9} \times \frac{9}{85} \\ = \frac{35}{204}$$

$$4. \frac{74}{9} \times x = 45$$

$$x = 45 \times \frac{9}{74} \\ = \frac{405}{74} \\ = 5\frac{35}{74}$$

$$5. 4\frac{1}{3} \times x = \frac{91}{6}$$

$$\frac{13}{3} \times x = \frac{91}{6}$$

$$x = \frac{91}{6} \times \frac{3}{13}$$

$$x = \frac{7}{2}$$

$$\text{Other number} = \frac{7}{2} = 3\frac{1}{2}$$

$$6. 6\frac{2}{9} \div x = 4\frac{2}{3}$$

$$\frac{56}{9} \div x = \frac{14}{3}$$

$$x = \frac{14}{3} \times \frac{9}{56}$$

$$= \frac{3}{4}$$

$$7. \text{Cost of } 6\frac{1}{2} \text{ m lace} = ₹115\frac{3}{8}$$

$$\text{Cost of 1 m lace} = ₹115\frac{3}{8} \times \frac{2}{13}$$

$$= ₹\frac{923}{8} \times \frac{2}{13}$$

$$= ₹\frac{71}{4}$$

$$\text{Last of 3 m lace} = ₹\frac{71}{4} \times 3$$

$$= ₹\frac{213}{4}$$

$$= ₹53\frac{1}{4}$$

Cost of 3m lace is ₹ $53\frac{1}{4}$

8. Length of tape warehouse has = $1\frac{3}{10}$ m

length of divided piece = $\frac{5}{8}$ m

No. of pieces = $\frac{13}{10} \times \frac{8}{5}$

$$= \frac{104}{50}$$

$$= 2\frac{2}{25}$$

They had 2 and $\frac{2}{25}$ pieces.

9. Area of rectangular plot = $68\frac{3}{4}$ m²

Length of rectangular plot = $12\frac{1}{2}$ m

Width of rectangular plot = $68\frac{3}{4} \times \frac{2}{25}$

$$= \frac{275}{4} \times \frac{2}{25}$$

$$= \frac{11}{2} = 5\frac{1}{2} \text{ m}$$

Width of rectangular plot = $5\frac{1}{2}$ m

10. Volume of water in bucket = $20\frac{1}{4}$ l

Capacity of small jug = $\frac{3}{4}$ l

No. of times jug has to be filled = $\frac{81}{4} \times \frac{4}{3}$

$$= 27$$

27 times jug need to be filled from the bucket to get empty.

11. (i) Distance travelled by Vivek in $9\frac{1}{2}$ hrs = $432\frac{1}{4}$ km

$$\begin{aligned}\text{Distance travelled by Vivek in 1 hour} &= \frac{1729}{4} \times \frac{2}{19} \\ &= \frac{91}{2} \text{ km}\end{aligned}$$

$$\begin{aligned}\text{Distance travelled by Vivek in } 6\frac{1}{2} \text{ hrs} &= \frac{13}{2} \times \frac{91}{2} \\ &= \frac{1183}{4} \text{ km} \\ &= 295\frac{3}{4} \text{ km}\end{aligned}$$

(ii) Time taken to cover $\frac{91}{2}$ km = 1 hour

$$\text{Time taken to cover 1 km} = 1 \times \frac{2}{91} \text{ hour}$$

$$\begin{aligned}\text{Time taken to cover } 256\frac{31}{50} \text{ km} \\ &= \frac{12831}{50} \times \frac{2}{91} \\ &= \frac{141}{25} \\ &= 5\frac{16}{25} \text{ hrs}\end{aligned}$$

12. Total length of rope = $58\frac{13}{20}$ m

No. of ropes cut = 17

$$\text{Length of each piece} = 58\frac{13}{20} \times \frac{1}{17}$$

$$= \frac{1173}{20} \times \frac{1}{17}$$

$$\frac{69}{20} = 3\frac{9}{20} \text{ m}$$

Length of each piece is $3\frac{9}{20}$ m

MCQs

1.	(a)	2.	(c)	3.	(b)	4.	(d)	5.	(c)	6.	(d)
7.	(a)	8.	(b)	9.	(d)	10.	(d)				

3. $\frac{3}{8} \times 56 = 21$

4. $\frac{11}{17} \div x = 1$

$$x = 1 \times \frac{17}{11}$$

$$= \frac{17}{11}$$

7. $9\frac{4}{5} \times x = 42$

$$x = 42 \times \frac{5}{49}$$

$$= \frac{30}{7}$$

Fill in the blanks

1. less 2. greater 3. decimal fraction
4. less, greater 5. zero 6. 1

True or False

1. False 2. True 3. False

4. False 5. True 6. True

3

Decimals

Exercise 3.1

1. Write the following decimals in digit:

- (i) 405.23
- (ii) 7080.052
- (iii) 57.25

2. Write each as a fraction or in a mixed form :

- (i) $\frac{003}{100}$
- (ii) $\frac{105}{10} = \frac{21}{2} = 10\frac{1}{2}$
- (iii) $\frac{0705}{1000} = \frac{141}{200}$
- (iv) $\frac{125}{100} = \frac{25}{20} = 1\frac{1}{4}$
- (v) $\frac{065}{100} = \frac{13}{20}$
- (vi) $\frac{0008}{1000} = \frac{1}{125}$

3. Write the place value chart and find the place value of each digit :

	Hundr eds (100)	Tens (10)	Ones (1)	Tenths $\left(\frac{1}{10}\right)$	Hundr edths $\left(\frac{1}{100}\right)$	Thous andths $\left(\frac{1}{1000}\right)$
(i)			7	3	1	
(ii)		5	6	1	3	5
(iii)			7	0	8	5
(iv)	1	3	5	4	8	1

(i) 7.31

Place value of 7 = 7

Place value of 3 = $\frac{3}{10}$

Place value of 1 = $\frac{1}{100}$

(ii) 56.135

Place value of 5 = 50

Place value of 6 = 6

Place value of 1 = $\frac{1}{10}$

Place value of 3 = $\frac{3}{100}$

Place value of 5 = $\frac{5}{1000}$

(iii) Place value of 7 = 7

Place value of 0 = $\frac{0}{10}$

Place value of 8 = $\frac{8}{100}$

$$\text{Place value of } 5 = \frac{5}{1000}$$

$$(iv) \text{ Place value of } 1 = 1000$$

$$\text{Place value of } 3 = 30$$

$$\text{Place value of } 5 = 5$$

$$\text{Place value of } 4 = \frac{4}{10}$$

$$\text{Place value of } 8 = \frac{8}{100}$$

$$\text{Place value of } 1 = \frac{1}{1000}$$

4. Write each of the following in expanded form :

$$(i) \quad 60 + 5 + \frac{8}{10} + \frac{1}{100}$$

$$(ii) \quad 20 + 7 + \frac{6}{10} + \frac{3}{100} + \frac{9}{1000}$$

$$(iii) \quad 7 + \frac{7}{10} + \frac{5}{100}$$

$$(iv) \quad 600 + 80 + 5 + \frac{1}{10} + \frac{3}{100} + \frac{2}{1000}$$

5. Write each of the following in expanded form :

$$(i) \quad 6.357 \quad (ii) \quad 37.053 \quad (iii) \quad 453.089 \quad (iv) \quad 137.843$$

6. Write the following fractions in ascending order :

$$(i) \quad 1.79 < 8.07 < 8.18 < 8.6 < 9.003$$

$$(ii) \quad 1.07 < 1.8 < 1.84 < 1.98 < 2.7 < 6.67 < 9.08$$

$$(iii) \quad 0.552 < 5.52 < 55.20 < 522.1$$

$$(iv) \quad 0.033 < 0.303 < 30.03 < 30.3$$

7. Write the following fractions in descending order :

$$(i) \quad 85.004 > 43.8 > 7.997 > 6.07 > 3.6$$

$$(ii) \quad 25.7 > 4.614 > 3.06 > 2.39 > 1.67 > 1.37$$

$$(iii) \quad 6.78 > 3.45 > 3.24 > 2.35 > 1.67 > 1.45$$

$$(iv) \quad 64.7 > 8.31 > 0.647 > 0.064$$

8. Write next three numbers in the sequence :

$$(i) \quad 4.5, 4.6, 4.7 \qquad (ii) \quad 9.004, 9.005, 9.006$$

$$(iii) \quad 22.1, 22.2, 22.3 \qquad (iv) \quad 8.126, 8.127, 8.128$$

9. Add the following decimals :

$$(i) \quad \begin{array}{r} 1 \ 2 \ 1 \ 1 \ 1 \\ 2 \ 3 \ 4 \ . \ 7 \ 0 \ 0 \\ 3 \ 2 \ 5 \ . \ 8 \ 6 \ 0 \\ 2 \ 5 \ . \ 3 \ 6 \ 0 \\ 2 \ 1 \ . \ 0 \ 1 \ 5 \\ 4 \ . \ 0 \ 0 \ 7 \\ \hline 6 \ 1 \ 0 \ . \ 9 \ 4 \ 2 \end{array} \qquad (ii) \quad \begin{array}{r} 1 \ 1 \ 2 \ 3 \ 2 \\ 1 \ 2 \ 1 \ . \ 2 \ 1 \ 0 \\ 1 \ 2 \ 5 \ . \ 7 \ 6 \ 0 \\ 1 \ 6 \ 3 \ . \ 0 \ 9 \ 0 \\ 1 \ 0 \ . \ 1 \ 4 \ 8 \\ 1 \ 5 \ . \ 7 \ 0 \ 6 \\ 2 \ 1 \ 3 \ . \ 7 \ 9 \ 8 \\ \hline 6 \ 4 \ 9 \ . \ 7 \ 1 \ 2 \end{array}$$

$$(iii) \quad \begin{array}{r} 1 \ 3 \ 2 \ 1 \\ 7 \ 8 \ . \ 3 \ 5 \ 0 \\ 3 \ 9 \ 7 \ . \ 0 \ 0 \ 0 \\ 9 \ . \ 6 \ 7 \ 5 \\ 8 \ . \ 9 \ 0 \ 0 \\ 0 \ . \ 4 \ 5 \ 0 \\ \hline 4 \ 9 \ 4 \ . \ 3 \ 7 \ 5 \end{array} \qquad (iv) \quad \begin{array}{r} 2 \ 2 \ 2 \ 2 \ 1 \\ 1 \ 7 \ 8 \ . \ 3 \ 0 \ 4 \\ 1 \ 5 \ 5 \ . \ 5 \ 5 \ 5 \\ 1 \ 6 \ 6 \ . \ 6 \ 6 \ 0 \\ 1 \ 8 \ 1 \ . \ 9 \ 1 \ 0 \\ 1 \ 5 \ . \ 0 \ 7 \ 6 \\ \hline 6 \ 9 \ 7 \ . \ 5 \ 0 \ 5 \end{array}$$

10. Subtract :

$$(i) \quad \begin{array}{r} 5 \ 10 \\ 9 \ 8 \ . \ 8 \ 0 \\ - 9 \ 3 \ . \ 1 \ 9 \\ \hline 5 \ . \ 4 \ 1 \end{array} \qquad (ii) \quad \begin{array}{r} 3 \ 9 \ 9 \ 10 \\ 2 \ 4 \ 0 \ . \ 0 \ 0 \\ - 2 \ 0 \ 2 \ . \ 4 \ 5 \\ \hline 3 \ 7 \ . \ 5 \ 5 \end{array}$$

$$(iii) \quad \begin{array}{r} 0 \ 9 \ 15 \ 3 \ 18 \\ 1 \ 0 \ 8 \ . \ 4 \ 8 \\ - 8 \ 7 \ . \ 2 \ 9 \\ \hline 1 \ 8 \ . \ 1 \ 9 \end{array} \qquad (iv) \quad \begin{array}{r} 1 \ 11 \ 6 \ 10 \\ 2 \ . \ 1 \ 7 \ 0 \\ - 0 \ . \ 3 \ 4 \ 1 \\ \hline 1 \ . \ 8 \ 2 \ 9 \end{array}$$

11. Simplify :

$$(i) \quad \begin{array}{r} 5 \ 12 \ 13 \ 9 \ 10 \\ 8 \ 3 \ . \ 4 \ 0 \ 0 \\ - 8 \ . \ 5 \ 4 \ 5 \\ \hline 5 \ 4 \ . \ 8 \ 5 \ 5 \end{array} \qquad \begin{array}{r} 1 \ 1 \\ 5 \ 4 \ . \ 8 \ 5 \ 5 \\ + 6 \ . \ 3 \ 3 \ 0 \\ \hline 6 \ 1 \ . \ 1 \ 8 \ 5 \end{array}$$

$$\begin{array}{r} \text{(ii)} \quad \begin{array}{r} 8 \text{ } 11 \text{ } 10 \quad 3 \text{ } 10 \\ \cancel{8} \cancel{2} \cancel{0} . \cancel{4} \cancel{0} \\ - 4 \text{ } 7 . \text{ } 2 \text{ } 4 \\ \hline 8 \text{ } 7 \text{ } 3 . \text{ } 1 \text{ } 6 \end{array} \end{array}$$

$$\begin{array}{r} \begin{array}{r} 1 \text{ } 1 \\ 7 \text{ } 5 \text{ } 6 . \text{ } 4 \text{ } 8 \\ + 1 \text{ } 1 \text{ } 8 . \text{ } 9 \text{ } 0 \\ \hline 8 \text{ } 7 \text{ } 5 . \text{ } 3 \text{ } 8 \end{array} \end{array}$$

$$\begin{array}{r} \begin{array}{r} 6 \text{ } 12 \text{ } 10 \text{ } 16 \\ 8 \cancel{7} \cancel{3} . \cancel{1} \cancel{6} \\ - 1 \text{ } 1 \text{ } 6 . \text{ } 6 \text{ } 8 \\ \hline 7 \text{ } 5 \text{ } 6 . \text{ } 4 \text{ } 8 \end{array} \end{array}$$

$$\begin{array}{r} \text{(iii)} \quad \begin{array}{r} 1 \text{ } 1 \text{ } 1 \\ 1 \text{ } 0 \text{ } 3 \text{ } 2 . \text{ } 6 \text{ } 0 \\ + 7 \text{ } 7 . \text{ } 4 \text{ } 8 \\ \hline 1 \text{ } 1 \text{ } 1 \text{ } 0 . \text{ } 0 \text{ } 8 \end{array} \end{array}$$

$$\begin{array}{r} \begin{array}{r} 0 \text{ } 1 \text{ } 0 \text{ } 9 \quad 10 \text{ } 7 \text{ } 10 \\ \cancel{1} \cancel{1} \cancel{1} \cancel{0} . \cancel{0} \cancel{8} \cancel{0} \\ - 6 \text{ } 5 . \text{ } 3 \text{ } 7 \text{ } 2 \\ \hline 1 \text{ } 0 \text{ } 4 \text{ } 4 . \text{ } 7 \text{ } 0 \text{ } 8 \end{array} \end{array}$$

$$\begin{array}{r} \begin{array}{r} 0 \text{ } 10 \text{ } 3 \text{ } 14 \\ \cancel{1} \cancel{0} \cancel{4} \cancel{4} . \text{ } 7 \text{ } 0 \text{ } 8 \\ - 8 \text{ } 0 \text{ } 9 . \text{ } 0 \text{ } 0 \text{ } 0 \\ \hline 2 \text{ } 3 \text{ } 5 . \text{ } 7 \text{ } 0 \text{ } 8 \end{array} \end{array}$$

$$\begin{array}{r} \text{(iv)} \quad \begin{array}{r} 1 \text{ } 1 \\ 3 \text{ } 1 \text{ } 2 . \text{ } 6 \text{ } 7 \\ + 5 \text{ } 8 . \text{ } 4 \\ \hline 3 \text{ } 7 \text{ } 1 . \text{ } 0 \text{ } 7 \end{array} \end{array}$$

$$\begin{array}{r} \begin{array}{r} 6 \text{ } 10 \quad 10 \text{ } 6 \text{ } 10 \\ 3 \cancel{7} \cancel{1} . \cancel{0} \cancel{7} \cancel{0} \\ - 1 \text{ } 0 \text{ } 5 . \text{ } 7 \text{ } 6 \text{ } 5 \\ \hline 2 \text{ } 6 \text{ } 5 . \text{ } 3 \text{ } 0 \text{ } 5 \end{array} \end{array}$$

$$\begin{array}{r} \begin{array}{r} 5 \text{ } 14 \quad 13 \\ 2 \cancel{8} \cancel{8} . \cancel{3} \text{ } 0 \text{ } 5 \\ - 1 \text{ } 1 \text{ } 8 . \text{ } 9 \text{ } 0 \text{ } 0 \\ \hline 1 \text{ } 4 \text{ } 6 . \text{ } 4 \text{ } 0 \text{ } 5 \end{array} \end{array}$$

12. Fill in the blanks :

(i) integral, decimal

(ii) 4

(iii) like

(iv) like

Exercise 3.2

1. Multiply :

(i) 35.3

(ii) 0.37

(iii) 7.3

(iv) 197 (v) 8.1

(vi) 0.3

(vii) 6230

(viii) 760

(ix) 18.2

2. Multiply :

$$\begin{array}{r} ^2 \\ (i) \quad 3.7 \\ \times 1.4 \\ \hline 148 \\ 37 \times \\ \hline 51.8 \end{array}$$

$$\begin{array}{r} (ii) \quad 26.81 \\ \times 21 \\ \hline 11 \\ 2681 \\ 5362 \times \\ \hline 563.01 \end{array}$$

$$\begin{array}{r} (iii) \quad 198.37 \\ \times 11 \\ \hline 1111 \\ 19837 \\ 19837 \times \\ \hline 2182.07 \end{array}$$

$$\begin{array}{r} ^{11} \\ (iv) \quad 6.032 \\ \times 125 \\ \hline 11 \\ 30160 \\ 12064 \times \\ 6032 \times \times \\ \hline 754.000 \end{array}$$

$$\begin{array}{r} (v) \quad 0.03 \\ \times 63 \\ \hline 009 \\ 018 \times \\ \hline 01.89 \end{array}$$

$$\begin{array}{r} ^4 \\ (vi) \quad 0.006 \\ \times 327 \\ \hline 0042 \\ 0012 \times \\ 0018 \times \times \\ \hline 001.962 \end{array}$$

$$\begin{array}{r} (vii) \quad 0.854 \\ \times 12 \\ \hline 1708 \\ 0854 \times \\ \hline 10.248 \end{array}$$

$$\begin{array}{r} (viii) \quad 0.000125 \\ \times 137 \\ \hline 0000875 \\ 0000375 \times \\ 0000125 \times \times \\ \hline 000.017125 \end{array}$$

$$\begin{array}{r} (ix) \quad 312.15 \\ \times 50 \\ \hline 00000 \\ 156075 \times \\ \hline 15607.50 \end{array}$$

3. Multiply :

$$\begin{array}{r} (i) \quad 6.6 \\ \times 3.4 \\ \hline 264 \\ 198 \times \\ \hline 22.44 \end{array}$$

$$\begin{array}{r} (ii) \quad 3.24 \\ \times 5.3 \\ \hline 1972 \\ 1620 \times \\ \hline 17.172 \end{array}$$

$$\begin{array}{r} (iii) \quad 3.87 \\ \times 1.25 \\ \hline 1935 \\ 774 \times \\ 387 \times \times \\ \hline 4.8375 \end{array}$$

$$\begin{array}{r}
 \text{(iv)} \quad 54.5 \\
 \times 1.76 \\
 \hline
 13270 \\
 3815 \times \\
 545 \times \times \\
 \hline
 95.920
 \end{array}$$

$$\begin{array}{r}
 \text{(v)} \quad 264.72 \\
 \times 15.25 \\
 \hline
 132360 \\
 52944 \times \\
 132360 \times \times \\
 26472 \times \times \times \\
 \hline
 4036.9800
 \end{array}$$

$$\begin{array}{r}
 \text{(vi)} \quad 0.013 \\
 \times 3.7 \\
 \hline
 0091 \\
 0039 \times \\
 \hline
 0.0481
 \end{array}$$

$$\begin{array}{r}
 \text{(vii)} \quad 0.062 \\
 \times 0.46 \\
 \hline
 0372 \\
 0248 \times \\
 0000 \times \times \\
 \hline
 0.02852
 \end{array}$$

$$\begin{array}{r}
 \text{(viii)} \quad 0.623 \\
 \times 0.38 \\
 \hline
 4984 \\
 1869 \times \\
 0000 \times \times \\
 \hline
 0.023674
 \end{array}$$

$$\begin{array}{r}
 \text{(ix)} \quad 6.45 \\
 \times 0.09 \\
 \hline
 5805 \\
 000 \times \\
 000 \times \times \\
 \hline
 0.5805
 \end{array}$$

4. Divide :

$$\text{(i)} \quad 1.67$$

$$\text{(ii)} \quad 3.721$$

$$\text{(iii)} \quad 0.0037$$

$$\text{(iv)} \quad 1.374$$

5. Divide :

$$\begin{array}{r}
 \text{(i)} \quad 6 \overline{) 24.3} (4.05 \\
 \underline{-24} \downarrow \\
 030 \\
 \underline{-30} \\
 0
 \end{array}$$

$$= 4.05$$

$$\begin{array}{r}
 \text{(ii)} \quad 8 \overline{) 3.28} (0.41 \\
 \underline{-32} \downarrow \\
 08 \\
 \underline{-8} \\
 0
 \end{array}$$

$$= 0.41$$

$$\begin{array}{r}
 \text{(iii)} \quad 12 \overline{) 584.292} \quad (48.691 \\
 \underline{-48} \downarrow \\
 104 \\
 \underline{-96} \downarrow \\
 082 \\
 \underline{-72} \downarrow \\
 109 \\
 \underline{-108} \downarrow \\
 12 \\
 \underline{-12} \\
 0
 \end{array}
 \quad = 48.691$$

$$\begin{array}{r}
 \text{(iv)} \quad 25 \overline{) 2.575} \quad (.103 \\
 \underline{-25} \downarrow \\
 07 \\
 \underline{-0} \downarrow \\
 75 \\
 \underline{-75} \\
 0
 \end{array}
 \quad = .103$$

$$\begin{array}{r}
 \text{(v)} \quad 20 \overline{) 0.175} \quad (0.00875 \\
 \underline{-0} \downarrow \downarrow \downarrow \\
 17 \\
 \underline{-0} \downarrow \\
 175 \\
 \underline{-160} \\
 150 \\
 \underline{-140} \\
 100 \\
 \underline{-100} \\
 0
 \end{array}
 \quad = 0.00875$$

$$\begin{array}{r}
 \text{(vi)} \quad 18 \overline{) 0.477} \quad (0.0265 \\
 \underline{-0} \downarrow \\
 4 \\
 \underline{-0} \downarrow \\
 47 \\
 \underline{-36} \downarrow \\
 117 \\
 \underline{-108} \\
 90 \\
 \underline{-90} \\
 0
 \end{array}
 \quad = 0.0265$$

$$\begin{array}{r}
 \text{(vii)} \quad 16 \overline{) 1.104} \quad (0.069 \\
 \underline{-96} \downarrow \\
 144 \\
 \underline{-144} \\
 0
 \end{array}
 \quad = 0.069$$

$$\begin{array}{r}
 \text{(viii)} \quad 22 \overline{) 142.868} \quad (6.494 \\
 \underline{-132} \downarrow \\
 108 \\
 \underline{-88} \downarrow \\
 206 \\
 \underline{-198} \downarrow \\
 088 \\
 \underline{-88} \\
 0
 \end{array}
 \quad = 6.494$$

$$\begin{array}{r}
 \text{(ix)} \quad 40 \overline{) 2.024} \quad (0.0506 \\
 \underline{-0} \downarrow \\
 20 \\
 \underline{-0} \downarrow \\
 202 \\
 \underline{-200} \downarrow \\
 240 \\
 \underline{-240} \\
 0
 \end{array}
 \quad = 0.0506$$

6. Divide :

$$(i) \quad \frac{0.288}{0.9} \times \frac{10}{1000}$$

$$= \frac{288}{900}$$

$$900 \overline{) 2880} \quad (0.32$$

$$\quad \underline{-2700}$$

$$\quad \quad 1800$$

$$\quad \quad \underline{-1800}$$

$$\quad \quad \quad 0$$

$$(ii) \quad \frac{25.395 \times 10}{1.5 \times 1000}$$

$$1500 \overline{) 25395} \quad (16.93$$

$$\quad \underline{-1500} \downarrow$$

$$\quad \quad 10395$$

$$\quad \quad \underline{-9000}$$

$$\quad \quad \quad 13950$$

$$\quad \quad \quad \underline{-13500}$$

$$\quad \quad \quad \quad 4500$$

$$\quad \quad \quad \quad \underline{-4500}$$

$$\quad \quad \quad \quad \quad 0$$

$$(iii) \quad \frac{497.8}{0.19} \times \frac{100}{10}$$

$$19 \overline{) 49780} \quad (2620$$

$$\quad \underline{-38} \downarrow$$

$$\quad \quad 117$$

$$\quad \quad \underline{-114} \downarrow$$

$$\quad \quad \quad 38$$

$$\quad \quad \quad \underline{-38} \downarrow$$

$$\quad \quad \quad \quad 00$$

$$\quad \quad \quad \quad \underline{-00}$$

$$\quad \quad \quad \quad \quad 0$$

$$(iv) \frac{1.5008}{0.56} \times \frac{100}{10000}$$

$$\begin{array}{r} 5600 \overline{) 15008} \quad (2.68 \\ -11200 \\ \hline 38080 \\ -33600 \\ \hline 44800 \\ -44800 \\ \hline 0 \end{array}$$

$$(v) \frac{1143.1}{49.7}$$

$$\begin{array}{r} 497 \overline{) 11431} \quad (23 \\ -994 \downarrow \\ \hline 1491 \\ -1491 \\ \hline 0 \end{array}$$

$$(vi) \frac{345.676 \times 10}{17.8 \times 1000}$$

$$\begin{array}{r} 17800 \overline{) 345676} \quad (19.42 \\ -17800 \downarrow \\ \hline 177676 \\ -160200 \\ \hline 174760 \\ -171200 \\ \hline 35600 \\ -35600 \\ \hline 0 \end{array}$$

$$(vii) \frac{37.91991 \times 1000}{0.021 \times 100000}$$

$$\begin{array}{r}
 2100 \overline{) 379199} \quad (1805.71 \\
 \underline{-2100} \downarrow \\
 16919 \downarrow \\
 \underline{-16800} \downarrow \\
 1199 \\
 \underline{-0000} \\
 11991 \\
 \underline{-10500} \\
 14910 \\
 \underline{-14700} \\
 2100 \\
 \underline{-2100} \\
 0
 \end{array}$$

$$\text{(viii)} \quad \frac{0.8085 \times 100}{3.5 \times 10000}$$

$$\begin{array}{r}
 35000 \overline{) 80850} \quad (0.231 \\
 \underline{-70000} \\
 108500 \\
 \underline{-105000} \\
 35000 \\
 \underline{-35000} \\
 0
 \end{array}$$

$$\text{(ix)} \quad \frac{0.196 \times 100}{0.14 \times 1000}$$

$$\begin{array}{r}
 140 \overline{) 196} \quad (1.4 \\
 \underline{-140} \\
 560 \\
 \underline{-560} \\
 0
 \end{array}$$

7. Divide :

$$\begin{array}{r} \text{(i) } 8 \overline{) 14} \quad (1.75 \\ \underline{-8} \\ 60 \\ \underline{-56} \\ 40 \\ \underline{-40} \\ 0 \end{array}$$

$$\begin{array}{r} \text{(ii) } 25 \overline{) 478} \quad (19.12 \\ \underline{-25} \downarrow \\ 228 \\ \underline{-225} \\ 30 \\ \underline{-25} \\ 50 \\ \underline{-50} \\ 0 \end{array}$$

$$\begin{array}{r} \text{(iii) } 80 \overline{) 250} \quad (0.3125 \\ \underline{-240} \\ 100 \\ \underline{-80} \\ 200 \\ \underline{-160} \\ 400 \\ \underline{-400} \\ 0 \end{array}$$

$$\begin{array}{r} \text{(iv) } 40 \overline{) 110} \quad (0.275 \\ \underline{-80} \\ 300 \\ \underline{-280} \\ 200 \\ \underline{-200} \\ 0 \end{array}$$

$$\begin{array}{r} \text{(v) } 120 \overline{) 210} \quad (0.175 \\ \underline{-120} \\ 900 \\ \underline{-840} \\ 600 \\ \underline{-600} \\ 0 \end{array}$$

$$\begin{array}{r} \text{(vi) } 25 \overline{) 101} \quad (4.04 \\ \underline{-100} \\ 100 \\ \underline{-100} \\ 0 \end{array}$$

Exercise 3.3

1. Convert the following units as described :

- (i) $1 \text{ g} = 1000 \text{ mg}$
 $0.79 \text{ g} = 0.79 \times 1000 \text{ mg}$
 $= 790 \text{ mg}$
- (ii) $1 \text{ km} = 1000 \text{ m}$

$$8.73 \text{ km} = 8.73 \times 1000 \text{ m}$$

$$= 8730 \text{ m}$$

(iii) $1 \text{ kg} = 1000 \text{ g}$

$$4.165 \text{ kg} = 4.165 \times 1000 \text{ g}$$

$$= 4165 \text{ g}$$

(iv) $1 \text{ l} = 1000 \text{ ml}$

$$25 \text{ l} = 25 \times 1000 \text{ ml}$$

$$= 25000 \text{ ml}$$

(v) $1000 \text{ m} = 1 \text{ km}$

$$1 \text{ m} = \frac{1}{1000} \text{ km}$$

$$520 \text{ m} = \frac{1}{1000} \times 520 \text{ km}$$

$$= \frac{520}{1000} = 0.520 \text{ km}$$

(vi) $10 \text{ mm} = 1 \text{ cm}$

$$1 \text{ mm} = \frac{1}{10} \text{ cm}$$

$$54 \text{ mm} = \frac{54}{10} \text{ cm}$$

$$= 5.4 \text{ cm}$$

(vii) $1000 \text{ ml} = 1 \text{ l}$

$$1 \text{ ml} = \frac{1}{1000} \text{ l}$$

$$137 \text{ ml} = \frac{1}{1000} \times 137 \text{ l}$$

$$= 0.137 \text{ l}$$

(viii) $1000 \text{ g} = 1 \text{ kg}$

$$1 \text{ g} = \frac{1}{1000} \text{ kg}$$

$$7843 \text{ g} = \frac{1}{1000} \times 7843 \text{ kg}$$

$$= 7.843 \text{ kg}$$

(ix) $1 \text{ g} = 1000 \text{ mg}$
 $16 \text{ g} = 16 \times 1000 \text{ mg}$
 $= 16000 \text{ mg} + 240 \text{ mg}$
 $= 16240 \text{ mg}$

(x) $1 \text{ m} = 100 \text{ cm}$
 $4 \text{ m} = 4 \times 100 \text{ cm} + 37 \text{ cm}$
 $= 400 \text{ cm} + 37 \text{ cm}$
 $= 437 \text{ cm}$

2. Cost of milk per litre = ₹ 49.75

Quantity of milk sold = 42 l

Money milkman get = 49.75×42

$$\begin{array}{r} 49.75 \\ \times 42 \\ \hline 11950 \\ 19900 \times \\ \hline 2089.50 \end{array}$$

He got ₹ 2089.50

3. Cost of one banana = ₹ 7.45

Cost of twelve bananas = 7.45×12

$$\begin{array}{r} 7.45 \\ \times 12 \\ \hline 1490 \\ 745 \times \\ \hline 89.40 \end{array}$$

Cost of 1 dozen bananas is ₹ 89.40

4. Length of rectangular playground = 352.85 m

Breadth of rectangular playground = 155.25 m

Area of rectangular playground = $l \times b$

$$= 352.85 \times 155.25$$

$$\begin{array}{r}
 352.85 \\
 \times 155.25 \\
 \hline
 176425 \\
 70570 \times \\
 176425 \times \times \\
 176425 \times \times \times \\
 35285 \times \times \times \times \\
 \hline
 54779.9625
 \end{array}$$

Area of rectangular field is 54779.9625 m^2 .

5. Wages of a labourer per hr = ₹24.60

He works for = 7.5 hr per day

He earns in a week = ₹ $24.60 \times 7.5 \times 7$

$$\begin{array}{r}
 24.60 \qquad \qquad \qquad 184.5 \\
 \times 7.5 \qquad \qquad \qquad \times 7 \\
 \hline
 12300 \qquad \qquad \qquad 1291.5 \\
 17220 \times \\
 \hline
 184.500
 \end{array}$$

He earns ₹1291.5

6. Cost of 1 kg of tomatoes = ₹49.75

Cost of 4 kg of tomatoes = ₹ 49.75×4

$$\begin{array}{r}
 49.75 \\
 \times 4 \\
 \hline
 199.00
 \end{array}$$

Cost of 1 kg of potatoes = ₹19.25

Cost of 5 kg of potatoes = ₹ 19.25×5

$$\begin{array}{r}
 19.25 \\
 \times 5 \\
 \hline
 96.25
 \end{array}$$

Total money she spent = ₹ $(199 + 96.25)$

$$\begin{array}{r}
 199.00 \\
 +96.25 \\
 \hline
 295.25
 \end{array}$$

She spent ₹ 295.25

7. Product of two decimals = 131.58

One of them = 2.15

Other = x

$$x \times 2.15 = 131.58$$

$$x = \frac{131.58}{2.15}$$

$$\begin{array}{r} 215 \overline{) 13158} \quad (61.2 \\ \underline{-1290} \downarrow \\ 258 \\ \underline{-215} \\ 430 \\ \underline{-430} \\ 0 \end{array}$$

Other number = 61.2

8. Weight of 75 bags of cement = 4106.25 kg

$$\text{Weight of 1 bag of cement} = \frac{4106.25}{75} \text{ kg}$$

$$\begin{array}{r} 75 \overline{) 4106.25} \quad (54.75 \\ \underline{-375} \downarrow \\ 356 \\ \underline{-300} \downarrow \\ 562 \\ \underline{-525} \downarrow \\ 375 \\ \underline{-375} \\ 0 \end{array}$$

$$\begin{aligned} \text{Weight of 100 bags of cement} &= 54.75 \times 100 \\ &= 5475 \text{ kg} \end{aligned}$$

9. Ravindra Jadeja took 15 wicket making runs = 321

$$\text{Ravindra Jadeja took 1 wicket making runs} = \frac{321}{15}$$

$$\begin{array}{r}
 15 \overline{) 321} \quad (21.4 \\
 \underline{-30} \downarrow \\
 21 \\
 \underline{-15} \\
 60 \\
 \underline{-60} \\
 0
 \end{array}$$

His average score is 21.4.

10. Total length of cloth = 46 m

Length of piece Raveena cut = 1.15 m

$$\text{No. of pieces she get} = \frac{46 \times 100}{115}$$

$$\begin{array}{r}
 115 \overline{) 4600} \quad (40 \\
 \underline{-460} \downarrow \\
 00 \\
 \underline{-0} \\
 0
 \end{array}$$

40 pieces she get from 46 m cloth.

11. Distance covered = 180 km

Time taken = 4.5 hrs

$$s = \frac{d}{t}$$

$$s = \frac{180 \times 10}{4.5}$$

$$\begin{array}{r}
 45 \overline{) 1800} \quad (40 \\
 \underline{-180} \downarrow \\
 00 \\
 \underline{-0} \\
 0
 \end{array}$$

$$s = 40 \text{ km/hr}$$

Time taken to cover 280 km

= 7 hours

12. Weight of 25 tins of oil = 412.5 kg

$$\begin{array}{r} 25 \overline{) 412.5} \quad (16.5 \\ -25 \downarrow \\ \hline 162 \downarrow \\ -150 \downarrow \\ \hline 125 \\ -125 \\ \hline 0 \end{array}$$

$$\begin{array}{r} 16.5 \\ \times 6 \\ \hline 99.0 \end{array}$$

MCQs

1.	(c)	2.	(b)	3.	(b)	4.	(c)	5.	(d)	6.	(c)
7.	(a)	8.	(a)	9.	(b)	10.	(c)	11.	(d)	12.	(b)

$$\begin{array}{r} 25 \overline{) 52} \quad (2.08 \\ \underline{-50} \\ 200 \\ \underline{-200} \\ 0 \end{array}$$

5. $1 \text{ kg} = 1000 \text{ g}$

$$2 \text{ kg} = 2 \times 1000 \text{ g} + 10 \text{ g}$$

$$= 2010 \text{ g}$$

$$= \frac{2010}{1000} \text{ kg}$$

$$= 2.010 \text{ kg}$$

7. $\frac{2.73}{1.3} \times \frac{10}{100}$

$$\begin{array}{r} 130 \overline{) 273} \quad (2.1 \\ \underline{-260} \\ 130 \\ \underline{-130} \\ 0 \end{array}$$

8.
$$\begin{array}{r} 11.1 \\ \times 0.1 \\ \hline 111 \\ 000 \times \\ \hline 01.11 \end{array}$$

$$\begin{array}{r} 1.11 \\ \times 1.11 \\ \hline 111 \\ 111 \times \\ 111 \times \times \\ \hline 1.2321 \end{array}$$

9. Cost of a toffee = ₹2.45

$$\text{Cost of 50 toffees} = ₹2.45 \times 50$$

$$\begin{array}{r} 2.45 \\ \times 50 \\ \hline 000 \\ 1225 \times \\ \hline 122.50 \end{array}$$

10.
$$\begin{array}{r} 0.3 \\ \times 4.4 \\ \hline 12 \\ 12 \times \\ \hline 1.32 \end{array}$$

12. $36.48 \times x = 711.36$

$$x = \frac{711.36}{36.48}$$

$$\begin{array}{r} 3648 \overline{) 71136} \quad (19.5 \\ \underline{-3648} \downarrow \\ 34656 \\ \underline{-32832} \\ 18240 \\ \underline{-18240} \\ 0 \end{array}$$

Fill in the blanks

1. Decimals 2. like 3. right, one 4. right, three
5. left, two 6. 2.03 7. 2.003 8. 0.10935

6. $4.669 \div 23$

$$\begin{array}{r} 23 \overline{) 4.669} \quad (0.203 \\ \underline{-46} \downarrow \downarrow \\ 069 \\ \underline{-69} \\ 0 \end{array}$$

8.

$$\begin{array}{r} 4.05 \\ \times 0.45 \\ \hline 2025 \\ 1620 \times \\ 000 \times \times \\ \hline 1.8225 \end{array}$$

$$\begin{array}{r} 1.8225 \\ \times 0.6 \\ \hline 109350 \\ 00000 \times \\ \hline 1.09350 \end{array}$$

4

Rational Numbers

Exercise 4.1

1. Which of the following are rational numbers and which are fractions?

Rational number : i, ii, iii, iv, v, vi, viii; Fractions : i

2. Identify the positive and negative rational numbers from the following :

Positive integers : $\frac{-3}{-7}, \frac{17}{18}, \frac{243}{125}, \frac{-81}{-64},$

Negative integers : $\frac{13}{-17}, \frac{15}{-21}, \frac{-8}{19}$

3. Express $\frac{-3}{11}$ as a rational number with :

$$(i) \quad \frac{-3 \times 7}{11 \times 7} = \frac{-21}{77}$$

$$(ii) \quad \frac{-3}{11} \times \frac{5}{5} = \frac{-15}{55}$$

$$(iii) \quad \frac{-3}{11} \times \frac{11}{11} = \frac{-33}{121}$$

$$(iv) \quad \frac{-3}{11} \times \frac{-4}{-4} = \frac{12}{-44}$$

4. Express $\frac{17}{18}$ as a rational number with :

$$(i) \quad \frac{17}{18} \times \frac{3}{3} = \frac{51}{54}$$

$$(ii) \quad \frac{17}{18} \times \frac{-5}{-5} = \frac{-85}{-90}$$

$$(iii) \quad \frac{17}{18} \times \frac{7}{7} = \frac{119}{126}$$

$$(iv) \quad \frac{17}{18} \times \frac{-18}{-18} = \frac{-306}{-324}$$

5. Form the equivalent rational number of the following rational number by multiplying the numerator and denominator by $-2, 5, 11, -13$

$$(i) \quad \frac{3}{7} \times \frac{-2}{-2} = \frac{-6}{-14}$$

$$\frac{3}{7} \times \frac{5}{5} = \frac{15}{35}$$

$$\frac{3}{7} \times \frac{11}{11} = \frac{33}{77}$$

$$\frac{3}{7} \times \frac{-13}{-13} = \frac{-39}{-91}$$

$$(ii) \quad \frac{5}{-11} \times \frac{-2}{-2} = \frac{-10}{22}$$

$$\frac{5}{-11} \times \frac{5}{5} = \frac{25}{-55}$$

$$\frac{5}{-11} \times \frac{11}{11} = \frac{55}{-121}$$

$$\frac{5}{-11} \times \frac{-13}{-13} = \frac{-65}{143}$$

$$(iii) \quad \frac{-6}{-19} \times \frac{-2}{-2} = \frac{12}{38}$$

$$\frac{-6}{-19} \times \frac{5}{5} = \frac{-30}{-95}$$

$$\frac{-6}{-11} \times \frac{11}{11} = \frac{-66}{209}$$

$$\frac{-6}{-19} \times \frac{-13}{-13} = \frac{78}{247}$$

$$(iv) \quad \frac{-36}{17} \times \frac{-2}{-2} = \frac{72}{-34}$$

$$\frac{-36}{17} \times \frac{5}{5} = \frac{-180}{85}$$

$$\frac{-36}{17} \times \frac{11}{11} = \frac{-396}{187}$$

$$\frac{-36}{17} \times \frac{-13}{-13} = \frac{468}{-221}$$

6. Write each of the following rational number with positive denominator :

$$(i) \quad \frac{5}{-11} \times \frac{-1}{-1} = \frac{-5}{11}$$

$$(ii) \quad \frac{13}{-17} \times \frac{-1}{-1} = \frac{-13}{17}$$

$$(iii) \quad \frac{-625}{-343} \times \frac{-1}{-1} = \frac{625}{343}$$

$$(iv) \quad \frac{-14}{-19} \times \frac{-1}{-1} = \frac{14}{19}$$

7. Write four rational numbers equivalent to each of the following :

$$(i) \quad \frac{1}{5} \times \frac{2}{2} = \frac{2}{10}$$

$$\frac{1}{5} \times \frac{3}{3} = \frac{3}{15}$$

$$\frac{1}{5} \times \frac{4}{4} = \frac{4}{20}$$

$$\frac{1}{5} \times \frac{5}{5} = \frac{5}{25}$$

$$(ii) \quad \frac{-7}{13} \times \frac{2}{2} = \frac{-14}{26}$$

$$\frac{-7}{13} \times \frac{3}{3} = \frac{-21}{39}$$

$$\frac{-7}{13} \times \frac{4}{4} = \frac{-28}{52}$$

$$\frac{-7}{13} \times \frac{5}{5} = \frac{-35}{65}$$

$$(iii) \quad \frac{-29}{-21} \times \frac{2}{2} = \frac{-58}{-42}$$

$$\frac{-29}{-21} \times \frac{3}{3} = \frac{-87}{-63}$$

$$\frac{-29}{-21} \times \frac{4}{4} = \frac{-116}{-84}$$

$$\frac{-29}{-21} \times \frac{5}{5} = \frac{145}{-105}$$

$$(iv) \frac{19}{-6} \times \frac{2}{2} = \frac{38}{-12}$$

$$\frac{19}{-6} \times \frac{3}{3} = \frac{57}{-18}$$

$$\frac{19}{-6} \times \frac{4}{4} = \frac{76}{-24}$$

$$\frac{19}{-6} \times \frac{5}{5} = \frac{95}{-30}$$

8. Fill in the blanks :

$$(i) \frac{70}{25} \div \frac{5}{5} = \frac{\boxed{14}}{5}$$

$$= \frac{70}{25} \times \frac{4}{4} = \frac{\boxed{280}}{100}$$

$$= \frac{70}{25} \times \frac{-3}{-3} = \frac{-210}{\boxed{-75}}$$

$$(ii) \frac{-3}{\boxed{2}} \times \frac{27}{27} = \frac{-81}{54}$$

$$\frac{-3}{2} \times \frac{6}{6} = \frac{\boxed{-18}}{12}$$

$$\frac{-3}{2} \times \frac{12}{12} = \frac{-36}{\boxed{24}}$$

$$(iii) \frac{9}{-5} \times \frac{-4}{-4} = \frac{\boxed{-36}}{20}$$

$$\frac{9}{-5} \times \frac{3}{3} = \frac{\boxed{27}}{-15}$$

$$\frac{9}{-5} \times \frac{-5}{-5} = \frac{-45}{\boxed{25}}$$

$$(iv) \frac{-2}{-11} \times \frac{-3}{-3} = \frac{\boxed{6}}{33}$$

$$\frac{-2}{-11} \times \frac{4}{4} = \frac{-8}{-44}$$

$$\frac{-2}{-11} \times \frac{-9}{-9} = \frac{18}{99}$$

9. Find the value of x such that :

$$(i) \quad \frac{2}{3} = \frac{x}{6}$$

$$3x = 12$$

$$x = \frac{12}{3} \quad x = 4$$

$$(ii) \quad -48 = 2x$$

$$\frac{-48}{2} = x \quad x = -24$$

$$(iii) \quad \frac{-7}{5} = \frac{28}{x}$$

$$-7x = 28 \times 5$$

$$x = \frac{28 \times 5}{-7}$$

$$= -20$$

$$(iv) \quad \frac{3}{-5} = \frac{x}{-25}$$

$$-25 \times 3 = -5x$$

$$\frac{-25 \times 3}{-5} = x$$

$$15 = x$$

10. Check whether each pair has equal rational numbers :

$$(i) \quad \frac{3}{7} \quad \frac{39}{91}$$

$$91 \times 3 = 7 \times 39$$

$$273 = 273$$

Yes

$$(ii) \quad \frac{5}{12} \quad \frac{60}{25}$$

$$5 \times 25 = 12 \times 60$$

$$125 \neq 720 \quad \text{No}$$

$$(iii) \quad \frac{-4}{9} \quad \frac{20}{-45}$$

$$-4 \times -45 = 9 \times 20$$

$$180 = 180 \quad \text{Yes}$$

$$(iv) \quad \frac{-21}{-71} \quad \frac{84}{284}$$

$$-21 \times 284 = -71 \times 84$$

$$-5964 = -5964 \quad \text{Yes}$$

$$(v) \quad \frac{-5}{-8} \quad \frac{-65}{-117}$$

$$-5 \times -117 = -65 \times -8$$

$$585 \neq 520 \quad \text{No}$$

$$(vi) \quad \frac{4}{5} \quad \frac{48}{-60}$$

$$4 \times -60 = 5 \times 48$$

$$-240 \neq 240 \quad \text{No}$$

11. Write the following rational numbers in standard form :

$$(i) \quad \frac{28}{70} \div \frac{2}{2} = \frac{14}{35} \div \frac{7}{7} = \frac{2}{5}$$

$$(ii) \quad \frac{216}{-432} \div \frac{2}{2} = \frac{108}{-216} \div \frac{2}{2} = \frac{54}{-108} \div \frac{2}{2} = \frac{27}{-54} \div \frac{3}{3} \\ = \frac{9}{-18} \div \frac{9}{9} = \frac{1}{-2}$$

$$(iii) \quad \frac{-299}{-161} \div \frac{23}{23} = \frac{13}{7}$$

$$(iv) \quad \frac{-588}{2205} \div \frac{7}{7} = \frac{-84}{315} \div \frac{7}{7} = \frac{-12}{45} \div \frac{3}{3} = \frac{-4}{15}$$

$$\begin{aligned}
 \text{(v)} \quad & \frac{1792}{-1456} \div \frac{2}{2} = \frac{896}{-728} \div \frac{2}{2} = \frac{448}{-364} \div \frac{2}{2} = \frac{224}{-182} \\
 & \frac{224}{-182} \div \frac{2}{2} = \frac{112}{-91} \div \frac{7}{7} = \frac{-16}{13} \\
 \text{(vi)} \quad & \frac{-56}{-336} \div \frac{2}{2} = \frac{-28}{-168} \div \frac{2}{2} = \frac{-14}{-84} \div \frac{2}{2} = \frac{-7}{-42} \div \frac{7}{7} = \frac{1}{6} \\
 \text{(vii)} \quad & \frac{49}{91} \div \frac{7}{7} = \frac{7}{13} \\
 \text{(viii)} \quad & \frac{54}{-216} \div \frac{2}{2} = \frac{27}{-108} \div \frac{3}{3} = \frac{9}{-36} \div \frac{9}{9} = \frac{1}{-4}
 \end{aligned}$$

12. State 'True' or 'False' against the given statements :

- | | | |
|------------|------------|------------|
| (i) True | (ii) False | (iii) True |
| (iv) False | (v) True | (vi) True |

Exercise 4.2

1. Which of the following pairs of rational numbers is smaller?

- | | |
|---|---------------------------------------|
| (i) $\frac{-7}{3} < \frac{7}{3}$ | (ii) $\frac{-11}{13} < 0$ |
| (iii) $\frac{3}{14} > 0$ | (iv) $\frac{-6}{-11} > \frac{-6}{11}$ |
| (v) $\frac{3}{-8}, \frac{-8}{12}$ | |
| $\frac{3}{-8} \times \frac{3}{3} = \frac{-9}{24}$ | |
| $\frac{-8}{12} \times \frac{2}{2} = \frac{-16}{24}$ | |
| $\frac{-9}{24} > \frac{-16}{24}$ | |
| $\frac{-3}{8} > \frac{-8}{12}$ | |
| (vi) $\frac{-5}{6}, \frac{-4}{5}$ | |

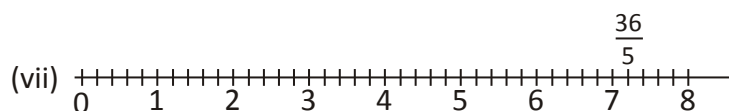
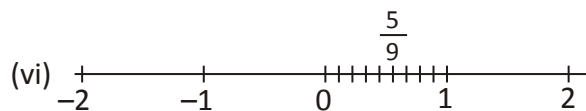
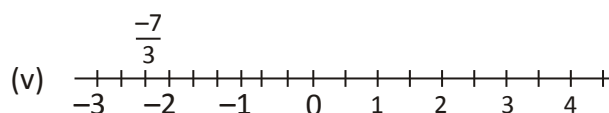
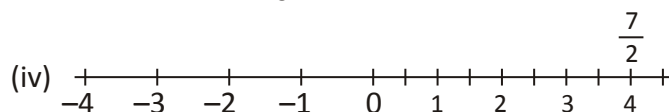
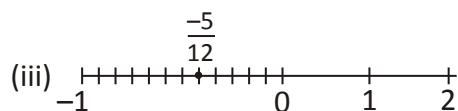
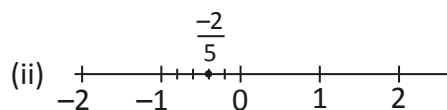
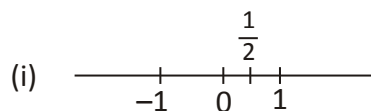
$$\frac{-5}{6} \times \frac{5}{5} = \frac{-25}{30}$$

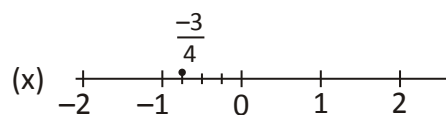
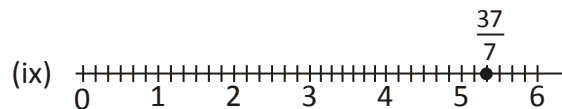
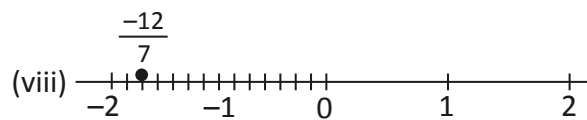
$$\frac{-4}{5} \times \frac{6}{6} = \frac{-24}{30}$$

$$\frac{-25}{30} < \frac{-24}{30}$$

$$\frac{-5}{6} < \frac{-4}{5}$$

2. Represent each of the following rational numbers on the number line :





3. Arrange the following rational numbers in ascending order :

(i) $\frac{-3}{5}, \frac{7}{-10}, \frac{-5}{6}$

$$\frac{-3}{5} \times \frac{6}{6} = \frac{-18}{30}$$

$$\frac{-7}{10} \times \frac{3}{3} = \frac{-21}{30}$$

$$\frac{-5}{6} \times \frac{5}{5} = \frac{-25}{30}$$

$$\frac{-25}{30} < \frac{-21}{30} < \frac{-18}{30}$$

$$\frac{-5}{6} < \frac{-7}{10} < \frac{-3}{5}$$

(ii) $\frac{2}{5}, \frac{7}{10}, \frac{8}{15}, \frac{13}{30}$

$$\frac{2}{5} \times \frac{6}{6} = \frac{12}{30}$$

$$\frac{7}{10} \times \frac{3}{3} = \frac{21}{30}$$

$$\frac{8}{15} \times \frac{2}{2} = \frac{16}{30}$$

$$\frac{13}{30} \times \frac{1}{1} = \frac{13}{30}$$

$$\frac{12}{30} < \frac{13}{30} < \frac{16}{30} < \frac{21}{30}$$

$$\frac{2}{5} < \frac{13}{30} < \frac{8}{15} < \frac{7}{10}$$

$$(iii) \quad 1, \frac{4}{15}, \frac{3}{20}, \frac{13}{25}$$

$$\frac{1}{1} \times \frac{300}{300} = \frac{300}{300}$$

$$\frac{4}{15} \times \frac{20}{20} = \frac{80}{300}$$

$$\frac{3}{20} \times \frac{15}{15} = \frac{45}{300}$$

$$\frac{13}{25} \times \frac{12}{12} = \frac{156}{300}$$

$$\frac{45}{300} < \frac{80}{300} < \frac{156}{300} < \frac{300}{300}$$

$$\frac{3}{20} < \frac{4}{15} < \frac{13}{25} < \frac{-5}{-5}$$

$$(iv) \quad \frac{9}{13}, \frac{2}{26}, \frac{7}{78}, \frac{4}{-39}$$

$$\frac{9}{13} \times \frac{6}{6} = \frac{54}{78}$$

$$\frac{2}{26} \times \frac{3}{3} = \frac{6}{78}$$

$$\frac{7}{78} \times \frac{1}{1} = \frac{7}{78}$$

$$\frac{-4}{39} \times \frac{2}{2} = \frac{-8}{78}$$

$$\frac{-8}{78} < \frac{6}{78} < \frac{7}{78} < \frac{54}{78}$$

$$\frac{-4}{39} < \frac{2}{26} < \frac{7}{78} < \frac{9}{13}$$

4. Arrange the following rational numbers in descending order :

$$(i) \quad \frac{-3}{10}, \frac{7}{-15}, \frac{-11}{20}, \frac{17}{-30}$$

$$\frac{-3}{10} \times \frac{6}{6} = \frac{-18}{60}$$

$$\frac{-7}{15} \times \frac{4}{4} = \frac{-28}{60}$$

$$\frac{-11}{20} \times \frac{3}{3} = \frac{-33}{60}$$

$$\frac{-17}{30} \times \frac{2}{2} = \frac{-34}{60}$$

$$\frac{-18}{60} > \frac{-28}{60} > \frac{-33}{60} > \frac{-34}{60}$$

$$\frac{-3}{10} > \frac{-7}{15} > \frac{-11}{20} > \frac{-17}{30}$$

$$(ii) \quad \frac{17}{-30}, \frac{11}{-15}, \frac{-7}{10}, \frac{3}{5}$$

$$\frac{-17}{30} \times \frac{1}{1} = \frac{-17}{30}$$

$$\frac{-11}{15} \times \frac{2}{2} = \frac{-22}{30}$$

$$\frac{-7}{10} \times \frac{3}{3} = \frac{-21}{30}$$

$$\frac{3}{5} \times \frac{6}{6} = \frac{18}{30}$$

$$\frac{18}{30} > \frac{-17}{30} > \frac{-21}{30} > \frac{-22}{30}$$

$$\frac{3}{5} > \frac{-17}{30} > \frac{-7}{10} > \frac{-11}{15}$$

$$(iii) \quad -2, \frac{-13}{6}, \frac{8}{-3}, \frac{1}{3}$$

$$\frac{-2}{1} \times \frac{6}{6} = \frac{-12}{6}$$

$$\frac{-13}{6} \times \frac{1}{1} = \frac{-13}{6}$$

$$\frac{-8}{3} \times \frac{2}{2} = \frac{-16}{6}$$

$$\frac{1}{3} \times \frac{2}{2} = \frac{2}{6}$$

$$\frac{2}{6} > \frac{-12}{6} > \frac{-13}{6} > \frac{-16}{6}$$

$$\frac{1}{3} > -2 > \frac{-13}{6} > \frac{-8}{3}$$

$$(iv) \frac{7}{8}, \frac{17}{24}, \frac{4}{-12}, \frac{1}{32}$$

$$\frac{7}{8} \times \frac{12}{12} = \frac{84}{96}$$

$$\frac{17}{24} \times \frac{4}{4} = \frac{68}{96}$$

$$\frac{-4}{12} \times \frac{8}{8} = \frac{-32}{96}$$

$$\frac{1}{32} \times \frac{3}{3} = \frac{3}{96}$$

$$\frac{84}{96} > \frac{68}{96} > \frac{3}{96} > \frac{-32}{96}$$

$$\frac{7}{8} > \frac{17}{24} > \frac{1}{32} > \frac{-4}{12}$$

$$5. \frac{-1}{2} \times \frac{2}{2} = \frac{-2}{4}$$

$$\frac{1}{2} \times \frac{2}{2} = \frac{2}{4}$$

two rational $-\frac{1}{2}$ and $\frac{1}{2}$

NO's between $-\frac{1}{4}, 0$

$$6. \quad \frac{-3}{5} \times \frac{2}{2} = \frac{-6}{10} \qquad \frac{-6}{10} \times \frac{4}{4} = \frac{-24}{40}$$

$$\frac{-1}{2} \times \frac{5}{5} = \frac{-5}{10} \qquad \frac{-5}{10} \times \frac{4}{4} = \frac{-20}{40}$$

Three rational no's between $\frac{-3}{5}$ and $\frac{-1}{2}$

$$\frac{-21}{40}, \frac{-11}{20}, \frac{-23}{40}$$

$$7. \quad \frac{-3}{1} \times \frac{5}{5} = \frac{-15}{5}$$

$$\frac{-2}{1} \times \frac{5}{5} = \frac{-10}{5}$$

four rational no's between -2 and -3

$$\frac{-11}{5}, \frac{-12}{5}, \frac{-13}{5}, \frac{-14}{5}$$

$$8. \quad \frac{-3}{11} \times \frac{6}{6} = \frac{-18}{66}$$

$$\frac{1}{11} \times \frac{6}{6} = \frac{6}{66}$$

Five rational no's between $\frac{-3}{11}$ and $\frac{1}{11}$

$$\frac{5}{66}, \frac{4}{66}, \frac{3}{66}, \frac{2}{66}, \frac{1}{66}$$

$$\frac{5}{66}, \frac{2}{33}, \frac{1}{22}, \frac{1}{33}, \frac{1}{66}$$

$$9. \quad \frac{-4}{5} \times \frac{4}{4} = \frac{-16}{20}$$

$$\frac{-3}{4} \times \frac{5}{5} = \frac{-15}{20}$$

$$\frac{-16}{20} \times \frac{6}{6} = \frac{-96}{120}$$

$$\frac{-15}{20} \times \frac{6}{6} = \frac{-90}{120}$$

$$\frac{-91}{120}, \frac{-92}{120}, \frac{-93}{120}, \frac{-94}{120}, \frac{-95}{120}$$

$$\frac{-91}{120}, \frac{-23}{30}, \frac{-31}{40}, \frac{-47}{60}, \frac{-19}{24}$$

10. Fill in the blanks with $>$, $<$ or $=$ in the following :

(i) $\frac{4}{5} > \frac{2}{5}$

(ii) $\frac{3}{7} \times \frac{8}{8} = \frac{24}{56}$

$$\frac{5}{8} \times \frac{7}{7} = \frac{35}{56}$$

$$\frac{24}{56} < \frac{35}{56}$$

$$\frac{3}{7} < \frac{5}{8}$$

(iii) $\frac{-7}{10} \times \frac{1}{1} = \frac{-7}{10}$

$$\frac{-4}{5} \times \frac{2}{2} = \frac{-8}{10}$$

$$\frac{-7}{10} > \frac{-8}{10}$$

$$\frac{-7}{10} > \frac{4}{-5}$$

(iv) $\frac{12}{18} \times \frac{1}{1} = \frac{12}{18}$

$$\frac{2}{3} \times \frac{6}{6} = \frac{12}{18}$$

$$\frac{12}{18} = \frac{2}{3}$$

$$(v) \quad \frac{-2}{1} \times \frac{5}{5} = \frac{-10}{5}$$

$$\frac{-13}{5} \times \frac{1}{1} = \frac{-13}{5}$$

$$\frac{-10}{5} > \frac{-13}{5}$$

$$-2 > \frac{-13}{5}$$

$$(vi) \quad 0 < \frac{5}{3}$$

11. State 'True' or 'False' against the given statements :

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

Exercise 4.3

1. Add the following rational numbers :

$$(i) \quad \frac{3}{5} + \frac{4}{5} = \frac{7}{5}$$

$$(ii) \quad \frac{-4+3}{7} = \frac{-1}{7}$$

$$(iii) \quad \frac{11}{13} - \frac{9}{13} = \frac{2}{13}$$

$$(iv) \quad \frac{-17}{27} + \frac{(-19)}{27} = \frac{-36}{27} = \frac{4}{3}$$

$$(v) \quad \frac{13}{4} + \frac{11}{3} = \frac{13 \times 3 + 11 \times 4}{12} = \frac{39 + 44}{12} = \frac{83}{12}$$

$$(vi) \quad -2 + \frac{5}{13} = \frac{-2 \times 13 + 5 \times 1}{13} = \frac{-26 + 5}{13} = \frac{-21}{13}$$

$$(vii) \quad \frac{-7}{27} + \frac{11}{18} = \frac{-7 \times 12 + 11 \times 3}{54} = \frac{-14 + 33}{54} = \frac{19}{54}$$

$$(viii) \frac{-13}{8} + \frac{1}{-4}$$

$$\frac{-13 + -1 \times 2}{8} = \frac{-13 - 2}{8} = \frac{-15}{8}$$

$$(ix) \frac{-9}{11} + \frac{-3}{4} = \frac{-9 \times 4 - 33}{44} = \frac{-36 - 33}{44} = \frac{-69}{44}$$

2. Write the additive inverse of the following :

$$(i) \frac{3}{4}$$

$$(ii) \frac{13}{11}$$

$$(iii) \frac{-15}{14}$$

$$(iv) \frac{-19}{29}$$

3. Subtract :

$$(i) 2 - \left(\frac{-15}{7} \right) = 2 + \frac{15}{7} = \frac{14 + 15}{7} = \frac{29}{7}$$

$$(ii) 1 - \left(\frac{-8}{11} \right) = 1 + \frac{8}{11} = \frac{11 + 8}{11} = \frac{19}{11}$$

$$(iii) \frac{11}{13} - (-3) = \frac{11}{13} + 3 = \frac{11 + 39}{13} = \frac{50}{13}$$

$$(iv) \frac{-3}{7} - \left(\frac{-4}{5} \right) \\ = \frac{-3}{7} + \frac{4}{5} = \frac{-15 + 28}{35} = \frac{13}{35}$$

$$(v) \frac{11}{13} - \frac{2}{5} = \frac{55 - 26}{65} = \frac{29}{65}$$

$$(vi) \frac{-6}{5} - \left(\frac{-32}{13} \right) = \frac{-6}{5} + \frac{32}{13} = \frac{-78 + 160}{65} = \frac{82}{65}$$

$$(vii) \frac{9}{5} - \left(\frac{-3}{5} \right) = \frac{9 + 3}{5} = \frac{12}{5}$$

$$(viii) \frac{13}{11} - \frac{1}{11} = \frac{12}{11}$$

$$(ix) \frac{-9}{7} - \frac{2}{7} = \frac{-11}{7}$$

4. Simplify :

$$\begin{aligned} \text{(i)} \quad & \frac{2}{5} + \left(\frac{-3}{4} \right) + \frac{1}{2} \\ &= \frac{2 \times 4 + (-3) \times 5 + 1 \times 10}{20} = \frac{8 - 15 + 10}{20} \\ &= \frac{3}{20} \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad & \frac{-5}{4} + \frac{7}{4} + \frac{8}{3} \\ &= \frac{-5 \times 3 + 7 \times 3 + 8 \times 4}{12} = \frac{15 + 21 + 32}{12} = \frac{38}{12} = \frac{19}{6} \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad & 1 + \left(\frac{-2}{5} \right) + \left(\frac{1}{-3} \right) \\ &= \frac{15 + (-2) \times 3 + (-1) \times 5}{15} = \frac{15 - 6 - 5}{15} = \frac{4}{15} \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad & \frac{-2}{5} + \frac{5}{7} + \left(\frac{-4}{35} \right) \\ &= \frac{-2 \times 7 + 5 \times 5 + (-4) \times 1}{35} = \frac{-14 + 25 - 4}{35} \\ &= \frac{7}{35} = \frac{1}{5} \end{aligned}$$

$$\begin{aligned} \text{(v)} \quad & \frac{3}{4} - \frac{1}{2} + \frac{1}{3} \\ &= \frac{9 - 6 + 4}{12} = \frac{7}{12} \end{aligned}$$

$$\begin{aligned} \text{(vi)} \quad & \frac{3}{4} - \frac{1}{2} - \frac{1}{3} \\ &= \frac{9 - 6 - 4}{12} = \frac{-1}{12} \end{aligned}$$

$$\text{(vii)} \quad \frac{5}{7} - \left(\frac{1}{2} - \frac{1}{3} \right)$$

$$\begin{aligned}
 &= \frac{5}{7} - \left(\frac{3-2}{6} \right) \\
 &= \frac{5}{7} - \frac{1}{6} \\
 &= \frac{30-7}{42} = \frac{23}{42}
 \end{aligned}$$

$$\begin{aligned}
 \text{(viii)} \quad &\left(\frac{4}{5} - \frac{1}{3} \right) - \frac{1}{2} \\
 &= \left(\frac{12-5}{15} \right) - \frac{1}{2} \\
 &= \frac{7}{15} - \frac{1}{2} \\
 &= \frac{14-15}{30} = \frac{-1}{30}
 \end{aligned}$$

$$\begin{aligned}
 \text{(ix)} \quad &\left(\frac{3}{5} + \frac{1}{2} \right) - \frac{3}{2} \\
 &= \left(\frac{6+5}{10} \right) - \frac{3}{2} \\
 &= \frac{11}{10} - \frac{3}{2} \\
 &= \frac{11-15}{10} = \frac{-4}{10} = \frac{2}{5}
 \end{aligned}$$

5. Let other rational number be x

$$\begin{aligned}
 \frac{21}{17} + x &= \frac{49}{17} \\
 x &= \frac{49}{17} - \frac{21}{17} \\
 &= \frac{28}{17}
 \end{aligned}$$

6. Let other rational number be x

$$-5 + x = \frac{-4}{3}$$

$$x = \frac{-4}{3} + \frac{5}{1}$$

$$x = \frac{-4 + 15}{3} = \frac{11}{3}$$

$$7. \frac{-7}{9} + x = 2$$

$$x = 2 + \frac{7}{9}$$

$$x = \frac{18 + 7}{9} = \frac{25}{9}$$

$$8. \frac{-3}{4} + x = \frac{-5}{6}$$

$$x = \frac{-5}{6} + \frac{3}{4}$$

$$= \frac{-10 + 9}{12} = \frac{-1}{12}$$

$$9. \frac{-12}{5} - x = 3$$

$$x = \frac{-12}{5} - 3$$

$$= \frac{-12 - 15}{5} = \frac{-27}{5}$$

$$10. \frac{-13}{11} - x = \frac{4}{5}$$

$$x = \frac{-13}{11} - \frac{4}{5}$$

$$= \frac{-13 \times 5 - 44}{44}$$

$$= \frac{-65 - 44}{55} = \frac{-109}{55}$$

11. Sum of $\frac{17}{11}$ and $\frac{3}{22}$

$$\begin{aligned}\frac{17}{11} + \frac{3}{22} &= \frac{17 \times 2 + 3 \times 1}{22} \\ &= \frac{34 + 3}{22} = \frac{37}{22}\end{aligned}$$

Sum of $\frac{33}{8} + \left(\frac{-19}{4}\right)$

$$\begin{aligned}&= \frac{33 - 38}{8} = \frac{-5}{8} \\ &= \frac{-5}{8} - \frac{37}{22} \\ &= \frac{-5 \times 11 - 37 \times 4}{88} = \frac{-55 - 148}{88} = \frac{-203}{88}\end{aligned}$$

12. Multiply the following :

(i) $\frac{3}{7} \times \frac{-2}{5} = \frac{-6}{35}$

(ii) $\frac{2}{15} \times \frac{5}{8} = \frac{1}{12}$

(iii) $\frac{-7}{30} \times \frac{6}{-11} = \frac{7}{55}$

(iv) $\frac{4}{15} \times \frac{-3}{20} = \frac{-1}{25}$

(v) $\frac{-36}{5} \times \frac{-25}{26} = \frac{-90}{13}$

(vi) $-3 \times \frac{2}{9} = \frac{-6}{9} = \frac{-2}{3}$

(vii) $\frac{-11}{5_1} \times \frac{-15}{22} = \frac{33}{22} = \frac{3}{2}$

(viii) $\frac{13}{7} \times \frac{49}{65} = \frac{7}{5}$

$$(ix) \quad \frac{7}{24} \times (-48) = -14$$

13. Divide

$$(i) \quad \frac{6}{7} \div \frac{-3}{14}$$

$$\frac{6}{7} \times \frac{14}{-3} = -4$$

$$(ii) \quad \frac{-3}{17} \div \frac{5}{34}$$

$$\frac{-3}{17} \times \frac{34}{5} = \frac{-6}{5}$$

$$(iii) \quad \frac{-28}{7} \div \frac{-5}{9}$$

$$\frac{-28}{7} \times \frac{9}{-5} = \frac{36}{5}$$

$$(iv) \quad \frac{-1}{10} \div \frac{-8}{5}$$

$$\frac{-1}{10} \times \frac{5}{-8} = \frac{1}{16}$$

14. Write the multiplicative inverse (reciprocal) of the following rational numbers :

$$(i) \quad \frac{3}{-2} \quad (ii) \quad \frac{15}{-14}$$

$$(iii) \quad \frac{1}{-5} \quad (iv) \quad \frac{3}{7}$$

$$(v) \quad 1 \quad (vi) \quad \frac{10}{3}$$

$$(vii) \quad 40 \quad (viii) \quad \frac{-8}{3}$$

15. Simplify :

$$(i) \quad \left(\frac{-16}{7} \times \frac{3}{9} \right) + \frac{1}{2}$$

$$= \frac{-16}{21} + \frac{1}{2}$$

$$= \frac{-16 \times 2 + 21}{42} = \frac{-32 + 21}{42} = \frac{-11}{42}$$

$$(ii) \left(\frac{15}{8} \times \frac{2}{5} \right) + \left[\frac{3}{5} \times \frac{-10}{9} \right]$$

$$= \frac{3}{4} + \left(\frac{-2}{3} \right)$$

$$= \frac{3}{4} - \frac{2}{3} = \frac{9-8}{12} = \frac{1}{12}$$

$$(iii) \frac{-8}{5} \times \frac{-10}{3} \times \frac{21}{-4} \times (-6) = 168$$

$$(iv) \left(\frac{25}{8} \times \frac{2}{5} \right) - \left(\frac{3}{5} \times \frac{-10}{9} \right)$$

$$= \frac{5}{4} - \left(\frac{-2}{3} \right)$$

$$= \frac{5}{4} + \frac{2}{3} = \frac{15+8}{12} = \frac{23}{12}$$

16. Sum of $\frac{23}{12}$ and $\frac{9}{6}$

$$\frac{23}{12} + \frac{9}{6}$$

$$\frac{23+18}{12} = \frac{41}{12}$$

Difference of $\frac{23}{12}$ and $\frac{9}{6}$

$$\frac{23}{12} - \frac{9}{6}$$

$$\frac{23-18}{12} = \frac{5}{12}$$

$$\frac{41}{12} \times \frac{12}{5} = \frac{41}{5}$$

17. Sum of $\frac{17}{7}$ and $\frac{-3}{5}$

$$= \frac{17 \times 5 + (-3) \times 7}{35} = \frac{85 - 21}{35} = \frac{64}{35}$$

Product of $\frac{-31}{7}$ and $\frac{1}{-2}$

$$= \frac{-31}{7} \times \frac{1}{-2}$$

$$= \frac{-31}{-14}$$

$$= \frac{64}{35} \times \frac{-14}{-31}$$

$$= \frac{896}{1085} = \frac{128}{155}$$

18. Cost of one pen = ₹ $9\frac{1}{2} = \frac{19}{2}$

Cost of 15 pens = $\frac{19}{2} \times 15 = \frac{285}{2}$

$$= ₹ \frac{285}{2} = ₹ 142\frac{1}{2}$$

19. Length of tape = 72 m

Length of pice to be cut = $\frac{9}{4}$ m

No. of pieces to be cut = $72 \times \frac{4}{9}$

$$= 32$$

32 piece's can be cut off.

20. No. of apples = $\frac{1}{3} \times 240 = 80$

No. of oranges = $\frac{1}{4} \times 240 = 60$

$$\text{No. of bananas} = \frac{1}{5} \times 240 = 48$$

$$\begin{aligned}\text{Part of mangoes} &= 1 - \left(\frac{1}{3} + \frac{1}{4} + \frac{1}{5} \right) \\ &= 1 - \left(\frac{20 + 15 + 12}{60} \right) \\ &= 1 - \frac{47}{60} \\ &= \frac{60 - 47}{60} = \frac{13}{60}\end{aligned}$$

$$\text{No. of mangoes} = \frac{13}{60} \times 240 = 52$$

21. Let the no. be x

$$\begin{aligned}\frac{-8}{39} \times x &= \frac{5}{26} \\ x &= \frac{5}{26} \times \frac{39}{-8} \\ &= \frac{195}{-208} = \frac{-15}{16}\end{aligned}$$

22. Product of two rational no's = $\frac{-19}{8}$

$$\text{One no.} = \frac{5}{12}$$

Other no. = x

$$\begin{aligned}\frac{5}{12} \times x &= \frac{-19}{8} \\ x &= \frac{-19}{8} \times \frac{12}{5} \\ &= \frac{-228}{40} = \frac{-114}{20} = \frac{-57}{10}\end{aligned}$$

MCQs

1.	(b)	2.	(d)	3.	(a)	4.	(b)	5.	(a)	6.	(c)
7.	(a)	8.	(a)	9.	(c)	10.	(d)				

$$5. \frac{-42}{35} \div \frac{7}{7} = \frac{-6}{5}$$

$$7. \frac{5}{-6} \times \frac{2}{2} = \frac{-10}{12}$$

$$\frac{7}{-12} \times \frac{1}{1} = \frac{-7}{12}$$

$$\frac{-10}{12} < \frac{-7}{12}$$

$$8. \frac{2}{3} + \frac{12}{7} = \frac{14 + 36}{21} = \frac{50}{21}$$

$$= 2\frac{8}{21}$$

$$9. 0$$

$$10. 1 \times 3 = 3$$

Fill in the blanks

1. zero 2. rational number 3. 1 4. rational number itself
5. greater 6. its additive inverse 7. countless
8. Positive, negative

5 Exponents and Powers

Exercise 5.1

1. Write each of the following in exponent form :

$$(i) \quad 3^8$$

$$(ii) \quad \left(\frac{1}{2}\right)^{10}$$

$$(iii) \left(\frac{-1}{2}\right)^5 \quad (iv) (-4)^5$$

$$(v) (3)^3 \times (x)^4 \times (y)^2 \times (z)^1 = 3^3 x^4 y^2 z$$

$$(vi) (-2)^3 \times (a)^4 \times (b)^2 = (-2)^3 a^4 b^2$$

$$(vii) \left(\frac{-2}{7}\right)^{11}$$

2. Express each of the following in exponent form :

$$(i) \frac{16}{169} = \frac{4 \times 4}{13 \times 13} = \left(\frac{4}{13}\right)^2$$

$$(ii) \frac{-8}{1331} = \frac{-2 \times -2 \times -2}{11 \times 11 \times 11} = \left(\frac{-2}{11}\right)^3$$

$$(iii) \frac{1}{3125} = \frac{1 \times 1 \times 1 \times 1 \times 1}{5 \times 5 \times 5 \times 5 \times 5} = \left(\frac{1}{5}\right)^5$$

$$(iv) \frac{16}{729} = \frac{4 \times 4}{27 \times 27} = \left(\frac{4}{27}\right)^2$$

$$(v) \frac{-1}{128} = \frac{-1 \times -1 \times -1 \times -1 \times -1 \times -1 \times -1}{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2} = \left(\frac{-1}{2}\right)^7$$

$$(vi) \frac{-243}{100000} = \frac{-3 \times -3 \times -3 \times -3 \times -3}{10 \times 10 \times 10 \times 10 \times 10} = \left(\frac{-3}{10}\right)^5$$

3. Express each of the following as a rational number :

$$(i) \frac{3 \times 3 \times 3 \times 3 \times 3}{2 \times 2 \times 2 \times 2 \times 2} = \frac{243}{32}$$

$$(ii) \frac{-8 \times -8 \times -8}{7 \times 7 \times 7} = \frac{-512}{343}$$

$$(iii) \frac{11 \times 11}{15 \times 15} = \frac{121}{225}$$

$$(iv) \frac{-1 \times -1 \times -1 \times -1}{7 \times 7 \times 7 \times 7} = \frac{1}{2401}$$

$$(v) \quad 1$$

$$(vi) \quad -1 \times -1 \times -1 \times -1 \times -1 \times -1 \times -1 \times -1 \times -1 = -1$$

$$(vii) \quad \frac{-13 \times -13 \times -13}{17 \times 17 \times 17} = \frac{-2197}{4913}$$

$$(viii) \quad \frac{-1 \times -1 \times -1 \times -1}{10 \times 10 \times 10 \times 10} = \frac{1}{10000}$$

4. Find the reciprocal of the following and express each in exponent form :

$$(i) \quad \left(\frac{1}{-4} \right)^3$$

$$(ii) \quad \left(\frac{4}{5} \right)^3$$

$$(iii) \quad \left(\frac{12}{-2} \right)^3$$

$$(iv) \quad \left(\frac{15}{-14} \right)^3$$

$$(v) \quad \left(\frac{1}{8^5} \right)$$

5. Express each of the following as a rational number :

$$(i) \quad \frac{1}{3 \times 3 \times 3} = \frac{1}{27}$$

$$(ii) \quad \frac{1}{-2} = \frac{1}{-2}$$

$$(iii) \quad \frac{1}{(-1)^4} = \frac{1}{-1 \times -1 \times -1 \times -1} = 1$$

$$(iv) \quad \left(\frac{-5}{6} \right)^{-4} = \frac{6 \times 6 \times 6 \times 6}{-5 \times -5 \times -5 \times -5} = \frac{1296}{625}$$

$$(v) \quad \left(\frac{5}{-2} \right)^6 = \frac{5 \times 5 \times 5 \times 5 \times 5 \times 5}{-2 \times -2 \times -2 \times -2 \times -2 \times -2} = \frac{15625}{64}$$

$$(vi) \quad \left(\frac{12}{-11} \right)^3 = \frac{12 \times 12 \times 12}{-11 \times -11 \times -11} = \frac{-1728}{1331}$$

$$(vii) \quad \left(\frac{4}{1} \right)^4 = \frac{4 \times 4 \times 4 \times 4}{1 \times 1 \times 1 \times 1} = \frac{256}{1}$$

$$(viii) \frac{1}{(-3)^4} = \frac{1}{-3 \times -3 \times -3 \times -3} = \frac{1}{81}$$

6. Find the value of each of the following :

$$(i) \quad 1 \qquad (ii) \quad 1 + 1 = 2$$

$$(iii) \quad 1 + 1 = 2 \qquad (iv) \quad 1 \times 1 = 1$$

$$(v) \quad 1 \div 1 = 1 \qquad (vi) \quad 1 - 1 = 0$$

Exercise 5.2

1. Using the laws of exponents, simplify in the exponential form :

$$(i) \quad 2^{12+4} = 2^{16}$$

$$(ii) \quad -3^{7+2} = (-3)^9$$

$$(iii) \quad \left(\frac{1}{4}\right)^{5+3+4} = \left(\frac{1}{4}\right)^{12}$$

$$(iv) \quad \left(\frac{-13}{11}\right)^{3+4+8} = \left(\frac{-13}{11}\right)^{15}$$

$$(v) \quad -6^{2+5+4} = (-6)^{11}$$

$$(vi) \quad a^{3+10+5} = a^{18}$$

$$(vii) \quad \left(\frac{5}{6}\right)^{13-8-4} = \left(\frac{5}{6}\right)^1$$

$$(viii) \quad a^{m-n+2m+2n+2} = a^{3m+n+2}$$

$$(ix) \quad \left(\frac{21}{17}\right)^{8-5+4} = \left(\frac{21}{17}\right)^7$$

$$(x) \quad \left(\frac{-3}{4}\right)^{4+3+4} = \left(\frac{-3}{4}\right)^{11}$$

2. Simplify and express the result in exponential form :

$$(i) \quad \left(\frac{5}{7}\right)^{11-8} = \left(\frac{5}{7}\right)^3$$

$$\begin{aligned}
\text{(ii)} \quad & \left(\frac{-7}{8}\right)^{12-10} = \left(\frac{-7}{8}\right)^2 \\
\text{(iii)} \quad & \left(\frac{6}{7}\right)^{12-(-4)} = \left(\frac{6}{7}\right)^{12+4} = \left(\frac{6}{7}\right)^{16} \\
\text{(iv)} \quad & \left(\frac{31}{43}\right)^{8-(-4)} = \left(\frac{31}{43}\right)^{8+4} = \left(\frac{31}{43}\right)^{12} \\
\text{(v)} \quad & \left(\frac{x}{y}\right)^{-7-(-3)} = \left(\frac{x}{y}\right)^{-4} \\
\text{(vi)} \quad & \left(\frac{a}{b}\right)^{8-(-4)} = \left(\frac{a}{b}\right)^{12} \\
\text{(vii)} \quad & (6.8)^{10-6} = (6.8)^4 \\
\text{(viii)} \quad & \left(\frac{-4}{7}\right)^{11-5} = \left(\frac{-4}{7}\right)^6 \\
\text{(ix)} \quad & \left(\frac{x}{y}\right)^6 \div \left(\frac{x}{y}\right)^{-4} = \left(\frac{x}{y}\right)^{6-(-4)} = \left(\frac{x}{y}\right)^{10} \\
\text{(x)} \quad & (7.2)^{8-(-2)} = (7.2)^{10}
\end{aligned}$$

3. Simplify and write the answer in exponential form :

$$\begin{aligned}
\text{(i)} \quad & (2)^{20} & \text{(ii)} \quad & (-7)^{12} \\
\text{(iii)} \quad & (8)^{-8} = \frac{1}{(8)^8} & \text{(iv)} \quad & \frac{1}{(4)^8} \\
\text{(v)} \quad & \left(\frac{-3}{4}\right)^8 & \text{(vi)} \quad & \left(\frac{-1}{4}\right)^4 \\
\text{(vii)} \quad & \left(\frac{-3}{4}\right)^{-6} = \left(\frac{4}{-3}\right)^6 & \text{(viii)} \quad & \left(\frac{4}{5}\right)^4 \\
\text{(ix)} \quad & \left(\frac{-1}{5}\right)^{-6} = (-5)^6 & \text{(x)} \quad & \left(\frac{-1}{4}\right)^{-4} = \left(\frac{4}{-1}\right)^4
\end{aligned}$$

4. Express the following with a single exponent :

(i) $(3)^{10} \times 3^8 = 3^{18}$

(ii) $(7)^{12} \times 7^{10} = 7^{22}$

(iii) $(10)^8 \times 10^{-12} = 10^{8-12} = 10^{-4} = \left(\frac{1}{10}\right)^4$

(iv) $(2)^{30} \times 2^{-20} = 2^{30-20} = 2^{10}$

(v) $(-3)^4 \times (-3)^8 \times (-3)^{-5} = (-3)^{4+8-5} = (-3)^7$

(vi) $\left(\frac{-1}{2}\right)^8 \times \left(\frac{-1}{2}\right)^6 \times \left(\frac{-1}{2}\right)^{-9} = \left(\frac{-1}{2}\right)^{8+6-9} = \left(\frac{-1}{2}\right)^5$

(vii) $(3)^{12} \times (3)^9 \times (3)^{-12} = 3^{12+9-12} = (3)^9$

(viii) $x^{18} \times x^{-16} \times x^4 = x^{18-16+4} = x^6$

5. Simplify :

(i) $\left(\frac{11}{9}\right)^{3+4-5} = \left(\frac{11}{9}\right)^2 = \frac{11 \times 11}{9 \times 9} = \frac{121}{81}$

(ii) $3^{7-2} \times 3^5 = 3^5 \times 3^5 = 3^{10}$

(iii) $\left(\frac{2}{9}\right)^3 \times \left(\frac{2}{9}\right)^{-8} = \left(\frac{2}{9}\right)^{3-8} = \left(\frac{2}{9}\right)^{-5} = \left(\frac{9}{2}\right)^5$

(iv)
$$\begin{aligned} \frac{3^8 \times 3^2}{3^4 \times 3^3} &= \frac{3^4 \cdot 3^4 \times 3^2}{3^4 \times 3^3} \\ &= \frac{3^3 \cdot 3^1 \times 3^2}{3^3} \\ &= 3^3 = 27 \end{aligned}$$

(v) $(1+1) \times [1+1]$
 $= 2 \times 2 = 4$

(vi) $(1-1) \times (1) \div 1$
 $= 0 \times 1 = 0$

(vii) $1-1+1=1$

$$\begin{aligned} \text{(viii)} \quad & [1 + 1] + [1 + 1] \\ & = 4 \end{aligned}$$

6. Simplify :

$$\begin{aligned} \text{(i)} \quad & \left[2^{-1} + \left(\frac{2}{3} \right)^{-1} \right]^2 \\ & = \frac{1}{2} + \frac{3}{2} \\ & = \frac{1+3}{2} = \frac{4}{2} \\ & = (2)^2 = 4 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad & \left[(-2)^4 + \left(\frac{1}{3} \right)^{-2} \right]^{-1} \\ & = [16 + 9]^{-1} \\ & = \left(\frac{1}{25} \right) \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad & \left(\frac{1}{2} \right)^{-2} + \left(\frac{1}{3} \right)^{-1} + \left(\frac{1}{4} \right)^{-2} \\ & = (2)^2 + (3)^1 + (4)^2 \\ & = 4 + 3 + 16 \\ & = 23 \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad & (2^{-1} + 5^{-1})^2 \times \left(\frac{-5}{8} \right)^{-1} \\ & = \left(\frac{1}{2} + \frac{1}{5} \right)^2 \times \left(\frac{8}{-5} \right)^1 \\ & = \left(\frac{5+2}{10} \right)^2 \times \frac{8}{-5} \end{aligned}$$

$$\begin{aligned}
&= \frac{7 \times 7}{10 \times 10} \times \frac{8}{-5} \\
&= \frac{49}{100} \times \frac{8}{-5} = \frac{-392}{500} = \frac{-196}{250} = \frac{-98}{125}
\end{aligned}$$

$$\begin{aligned}
\text{(v)} \quad &\left[6^{-1} + \left(\frac{3}{2} \right)^{-2} \right]^{-1} \times \left(\frac{3}{2} \right)^{-1} \\
&= \left(\frac{1}{6} + \left(\frac{2}{3} \right)^2 \right)^{-1} \times \left(\frac{2}{3} \right) \\
&= \left(\frac{1}{6} + \frac{4}{9} \right)^{-1} \times \left(\frac{2}{3} \right) \\
&= \left(\frac{11}{18} \right)^{-1} \times \frac{2}{3} \\
&= \frac{18}{11} \times \frac{2}{3} = \frac{12}{11}
\end{aligned}$$

$$\begin{aligned}
\text{(vi)} \quad &(5^{-1} - 7^{-1})^{-2} \\
&= \left(\frac{1}{5} - \frac{1}{7} \right)^{-2} \\
&= \left(\frac{7-5}{35} \right)^{-2} \\
&= \left(\frac{2}{35} \right)^{-2} = \left(\frac{35}{2} \right)^2 = \frac{1225}{4}
\end{aligned}$$

$$\begin{aligned}
\text{(vii)} \quad &\left[\left(\frac{1}{2} \right)^{-2} + \left(\frac{1}{3} \right)^{-1} \right]^{-1} \times \left(\frac{1}{7} \right)^{-2} \\
&= [(2)^2 + (3)^1]^{-1} \times (7)^2 \\
&= [4 + 3]^{-1} \times 49 \\
&= (7)^{-1} \times 49
\end{aligned}$$

$$= \frac{1}{7} \times 49 = 7$$

$$\begin{aligned} \text{(viii)} \quad & \left[5^0 + \left(\frac{1}{2} \right)^{-1} \right]^{-4} \times 3^3 \\ &= \left[1 + \left(\frac{2}{1} \right)^1 \right]^{-4} \times 27 \\ &= [3]^{-4} \times 27 \\ &= \frac{1}{(3)^4} \times (3)^3 \\ &= \frac{3^3}{3^4} = 3^{3-4} = 3^{-1} = \frac{1}{3} \end{aligned}$$

7. Find the value of x

$$\begin{aligned} \text{(i)} \quad & 64 \times 4^{2x} = 4^7 \\ & 4^3 \times 4^{2x} = 4^7 \\ & 3 + 2x = 7 \\ & 2x = 7 - 3 \\ & 2x = 4 \\ & x = \frac{4^2}{2^1} = \frac{2}{1} = 2 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad & 3^2 \times 3^x = 3^6 \\ & 2 + x = 6 \\ & x = 6 - 2 \\ & x = 4 \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad & 2^3 \cdot 2^{x+2} = 2^5 \\ & 3 + x + 2 = 5 \\ & x = 5 - 5 \\ & = 0 \end{aligned}$$

$$(iv) \quad 6^{2x+1} \div 6^2 = 6^3$$

$$2x + 1 - 2 = 3$$

$$2x - 1 = 3$$

$$2x = 3 + 1$$

$$x = \frac{4}{2}$$

$$(v) \quad 2^{x-7} \times 5^{x-4} = 2^1 \times 5^4$$

$$x - 7 = 1$$

$$x - 4 = 4$$

$$x = 1 + 7$$

$$x = 4 + 4$$

$$x = 8$$

$$x = 8$$

$$(vi) \quad \left(\frac{216}{343}\right)^5 \times \left(\frac{216}{343}\right)^x = \left(\frac{6}{7}\right)^{18}$$

$$\left(\frac{216}{343}\right)^{5+x} = \left(\frac{6}{7}\right)^{18}$$

$$\left(\frac{6^3}{7^3}\right)^{5+x} = \left(\frac{6}{7}\right)^{18}$$

$$15 + 3x = 18$$

$$3x = 18 - 15$$

$$x = \frac{3}{3} = 1$$

8. Which one is greater?

$$(i) \quad 3^8 \text{ or } 9 \times 4$$

$$6561 > 36$$

$$(ii) \quad (4)^{15} \text{ or } 64 \times 5$$

$$4^{15} > 64 \times 5$$

$$(iii) \quad (-6)^8 \text{ or } (-6)^2 \times 4$$

$$(-6)^8 > (-6)^2 \times 4$$

$$(iv) \quad 2^{15} \text{ or } 2^5 \times 8$$

$$2^{15} > 2^5 \cdot 2^3$$

$$2^{15} > 2^8$$

$$9. \frac{a}{b} = \left(\frac{2}{3}\right)^2 \div \left(\frac{2}{3}\right)^{-3}$$

$$\left(\frac{a}{b}\right) = \left(\frac{2}{3}\right)^{2-(-3)}$$

$$\left(\frac{a}{b}\right) = \left(\frac{2}{3}\right)^5$$

$$\left(\frac{a}{b}\right)^3 = \left(\left(\frac{2}{3}\right)^5\right)^3$$

$$= \left(\frac{2}{3}\right)^{15}$$

10. Let the no. be x

$$\left(\frac{2}{5}\right)^{-2} \div x = 5$$

$$\left(\frac{5}{2}\right)^2 \div x = 5$$

$$\frac{25}{4} \div x = 5$$

$$\frac{\frac{25}{4}}{\frac{x}{1}} = 5$$

$$\frac{25}{45} = x$$

$$= \frac{25}{20} = \frac{5}{4}$$

11. Let the no. be x

$$(-8)^{-1} \times x = 10^{-1}$$

$$\frac{1}{-8} \times x = \frac{1}{10}$$

$$x = \frac{1}{10} \times -8$$

$$= \frac{-8}{10} = \frac{-4}{5}$$

12. Let the no. be x

$$(-3)^{-1} \times x = (8)^{-1}$$

$$\frac{1}{-3} \times x = \frac{1}{8}$$

$$x = \frac{1}{8} \times -3$$

$$= \frac{-3}{8}$$

Exercise 5.3

1. Express the following in standard form :

(i) 1.379×10^7

(ii) 2.08×10^{10}

(iii) 1.5×10^{11}

(iv) 3.7418×10^{11}

(v) 3.15×10^{-7}

(vi) 1.547×10^{-5}

(vii) 4.9×10^{-11}

(viii) 1.25×10^{-5}

2. Express the following in usual form :

(i) 24000

(ii) 315000000

(iii) 7250000

(iv) 2900000000000

(v) 0.000000023

(vi) 0.0000001

(vii) 0.0000000000752

(viii) 0.0000000013124

MCQs

1.	(c)	2.	(a)	3.	(d)	4.	(b)	5.	(c)	6.	(a)
7.	(d)	8.	(b)	9.	(a)	10.	(d)	11.	(a)	12.	(b)

$$\begin{array}{r|l}
 2 & 432 \\
 \hline
 2 & 216 \\
 \hline
 2 & 108 \\
 \hline
 2 & 54 \\
 \hline
 3 & 27 \\
 \hline
 3 & 9 \\
 \hline
 3 & 3 \\
 \hline
 & 1
 \end{array}
 \quad = 2^4 \times 3^3$$

5. $8 + 1 + 4 = 13$

6. $[(3)^3 - (2)^3] \div (4)^3$
 $= [27 - 8] \div 64$
 $= 19 \div 64 = \frac{19}{64}$

7. 2^{12}

8. $\frac{1}{4} \times 4 = 1$

9. $\left(\frac{3}{5}\right)^x \times \left(\frac{3}{5}\right)^4 = \left(\frac{3}{5}\right)^9$

$$x + 4 = 9$$

$$x = 9 - 4$$

$$x = 5$$

11. $\frac{16 \times 2^{n+1} - 4 \times 2^n}{16 \times 2^{n+2} - 2 \times 2^{n+2}}$
 $= \frac{16 \times 2^n \cdot 2 - 2^2 \times 2^n}{16 \times 2^n \cdot 2^2 - 2 \times 2^n \cdot 2^2}$
 $= \frac{2^n \cdot 2(16 - 2)}{2^n \cdot 2^2(16 - 2)} = \frac{1}{2}$

12. $(-15)^{-1} \div x = (-5)^{-1}$
 $\frac{-1}{-15} \div x = \frac{1}{-5}$

$$\frac{\frac{1}{-15}}{x} = \frac{1}{-5}$$

$$\frac{1}{-15} \times \frac{-5^1}{1} = x$$

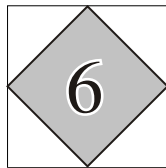
$$x = \frac{1}{3}$$

Fill in the blanks

1. $\left(\frac{3}{-2}\right)^4$
2. a^{-n}
3. positive
4. negative
5. 4
6. 1
7. 1.35×10^7
8. 1×10^7
5. $3^2 \times 3^n = 3^6$
 $3^{2+n} = 3^6$
 $2+n=6$
 $n=6-2=4$
6. $(1+1) \div 2 = 1$

True or False

1. False
2. False
3. True
4. True
5. False
6. True



Algebraic Expressions

Exercise 6.1

1. Write an algebraic expression for each of the following :

- (i) $4x$
- (ii) $\frac{1}{3}xy$
- (iii) $x^2 + y^2$

(iv) $2x - y$ (v) $xyz - 7$ (vi) $xy^2 + 5$

2. Write the coefficient of

(i) $3y$ (ii) $\frac{-7}{2}$ (iii) $9x$

(iv) 1 (v) 3 (vi) $\frac{-5}{7}y^2$

3. Identify the following expressions as monomials, binomials and trinomials :

- (i) Monomial (ii) Binomial (iii) Binomial
(iv) Monomial (v) Trinomial (vi) Binomial
(vii) Trinomial (viii) Trinomial (ix) Trinomial
(x) Monomial

4. Identify the like terms from each of the following expressions:

(i) $3a^2, -2a^2, 4b^2, b^2$ (ii) $3xy, -\frac{7}{2}xy, 8xz, xz$

(iii) $a^2b^2c, -9a^2cb^2$ (iv) $-xy^2, 2xy^2$

(v) $3(x + y), 7(x + y)$ (vi) $xyz, -32xyz$

5. Write the numerical coefficient of each of the following expressions :

(i) $9, 1, 10, -11$ (ii) $-\frac{4}{5}, 8, 9$

(iii) $-1, -2, 15, -18$ (iv) $-15, -30, 6, 4$

6. Write the coefficient of y^2 in the following :

(i) $10z$ (ii) $-8xyz$ (iii) -6

(iv) $\frac{6}{5}x^2yz$ (v) $\frac{-7}{9}x$ (vi) $32x^4y^2z$

7. Write the factors of each term of the following :

(i) $-16, x, y, z; 4, y, z$ (ii) $x, x, y, y, z; -1, x, y; 9$

(iii) $32; y, y, z; -8, x, y; -4$ (iv) $x, x, y; -1, y, y, z$

8. What is the degree of each term of the following expressions. Hence, state the degree of the expression.

- (i) $2, 0; 2$ (ii) $3, 2, 1; 3$ (iii) $0, 3; 3$
 (iv) $0, 4, 5; 5$ (v) $3, 3, 4, 5, 0; 5$ (vi) $3, 3, 2, 0; 3$
 (vii) $3, 2, 1, 0; 3$ (viii) $3, 3, 3, 0; 3$

9. Identify which of the following expressions are polynomials. If so, write their degrees :

- (i) Polynomial, degree = 4 (ii) Not a polynomial
 (iii) Not a polynomial (iv) Polynomial, degree = 7

Exercise 6.2

1. Find the values of the following expressions when $x = 3$

- (i) $3x - 7$
 $= 3(3) - 7 = 9 - 7$
 $= 2$
 (ii) $\frac{1}{3}x + 4$
 $= \frac{1}{3} \times 3 + 4$
 $= 1 + 4 = 5$
 (iii) $-x + 5$
 $= -3 + 5 = 2$
 (iv) $4x + 5$
 $= 4(3) + 5 = 12 + 5 = 17$

2. Find the values of the following expressions when

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

- (i) $2x + y$
 $= 2(-1) + 2 = -2 + 2 = 0$
 (ii) $3x - y$
 $= 3(-1) - 2 = -3 - 2 = -5$
 (iii) $x^2 + y^2 + 2$

$$= (-1)^2 + (2)^2 + 2$$

$$= 1 + 4 + 2$$

$$= 7$$

$$(iv) \quad x^2 + 5 - 2y^2$$

$$= (-1)^2 + 5 - 2(2)^2$$

$$= 1 + 5 - 8$$

$$= 6 - 8 = -2$$

3. Simplify the expressions and find their values, if $x = 4$

$$(i) \quad x + 9 + 2(x - 3)$$

$$x + 9 + 2x - 6$$

$$x + 2x + 3$$

$$4 + 2(4) + 3$$

$$4 + 8 + 3$$

$$12 + 3 = 15$$

$$(ii) \quad 4(x - 2) + 5x + 7$$

$$4x - 8 + 5x + 7$$

$$9x - 1$$

$$9(4) - 1$$

$$36 - 1 = 35$$

$$(iii) \quad 6x + 5(x - 2)$$

$$6x + 5x - 10$$

$$11x - 10$$

$$11(4) - 10$$

$$44 - 10 = 34$$

$$(iv) \quad 4(2x - 1) - 3(x + 1)$$

$$8x - 4 - 3x - 3$$

$$5x - 7$$

$$5(4) - 7$$

$$20 - 7 = 13$$

4. Find the values of the following expressions, if

$$a = 2, b = -1, c = 3$$

$$\begin{aligned} \text{(i)} \quad & a^2 + b^2 + c^2 + 1 \\ &= (2)^2 + (-1)^2 + (3)^2 + 1 \\ &= 4 + 1 + 9 + 1 \\ &= 5 + 10 \\ &= 15 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad & a^2b - ab^2 \\ &= (2)^2(-1) - 2(-1)^2 \\ &= 4(-1) - 2(1) \\ &= -4 - 2 \\ &= -6 \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad & -ab^2c + a^2bc - abc^2 \\ &= -2(-1)^2(3) + (2)^2(-1)(3) - (2)(-1)(3)^2 \\ &= -2(1)3 + 4(-1)(3) - (-2)(9) \\ &= -6 - 12 + 18 \\ &= -18 + 18 \\ &= 0 \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad & a^2 - b^2 - c^2 - 2ab - 2bc - 2ac \\ &= (2)^2 - (-1)^2 - (3)^2 - 2(-2)(-1) - 2(-1)(3) - 2(2)(3) \\ &= 4 - 1 - 9 + 4 + 6 - 12 \\ &= -6 + 4 + 6 - 12 \\ &= -2 + 6 - 12 \\ &= -8 \end{aligned}$$

$$\begin{aligned} \text{(v)} \quad & a^3 + b^3 + c^3 - 3abc \\ &= (2)^3 + (-1)^3 + (3)^3 - 3(2)(-1)(3) \\ &= 8 + 1 + 27 + 18 \\ &= 54 \end{aligned}$$

$$\begin{aligned}
 \text{(vi)} \quad & a^2b + b^2c + c^2a \\
 &= (2)^2(-1) + (-1)^2(3) + (3)^3(2) \\
 &= -4 + 3 + 18 \\
 &= -1 + 18 \\
 &= +17
 \end{aligned}$$

5. Simplify the expressions and find their values if
 $p = -1, q = 1, r = 2$

$$\begin{aligned}
 \text{(i)} \quad & 10pq - 2qr - 6pr + 4pq \\
 &= 14pq - 2qr - 6pr \\
 &= 14(-1)(1) - 2(1)(2) - 6(-1)(2) \\
 &= -14 - 4 + 12 \\
 &= -18 + 12 \\
 &= -6
 \end{aligned}$$

$$\begin{aligned}
 \text{(ii)} \quad & pqr - 6pqr + 7q^2 - 4p^2 \\
 &= -5pqr + 7q^2 - 4p^2 \\
 &= -5(-1)(1)(2) + 7(1)^2 - 4(-1)^2 \\
 &= 10 + 7 - 4 \\
 &= 13
 \end{aligned}$$

$$\begin{aligned}
 \text{(iii)} \quad & 5p^2 - 6q^2 - 7r^2 + 6p^2 - 5q^2 + 2r^2 \\
 &= 11p^2 - 11q^2 - 5r^2 \\
 &= 11(-1)^2 - 11(1)^2 - 5(2)^2 \\
 &= 11 - 11 - 20 \\
 &= 0 - 20 \\
 &= -20
 \end{aligned}$$

$$\begin{aligned}
 \text{(iv)} \quad & 5(p + q) - 3p - 2q \\
 &= 5p + 5q - 3p - 2q \\
 &= 2p + 3q \\
 &= 2(-1) + 3(1)
 \end{aligned}$$

$$= -2 + 3 = 1$$

$$\begin{aligned} \text{(v)} \quad & p^2q + pqr - qr^2 + 2pqr - 3p^2q \\ &= (-1)^2(1) + (-1)(1)(2) - (1)(2)^2 + 2(-1)(1)(2) - 3(-1)^2(1) \\ &= (1)(1) + (-2)(-1)(4) + (-4) - 3 \\ &= 1 - 2 - 4 - 4 - 3 \\ &= -12 \end{aligned}$$

Exercise 6.3

1. Add the following expressions :

$$\begin{aligned} \text{(i)} \quad & 24xy + 19xy + (-4xy) \\ &= 24xy + 19xy - 4xy \\ &= xy(24 + 19 - 4) \\ &= 39xy \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad & 8x^2y + (-11x^2y) + (-8x^2y) \\ &= 8x^2y - 11x^2y - 8x^2y \\ &= -3x^2y - 8x^2y \\ &= -11x^2y \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad & 5a^2b^2 + (-8a^2b^2) + 7a^2b^2 + 2a^2b^2 \\ &= 5a^2b^2 - 8a^2b^2 + 7a^2b^2 + 2a^2b^2 \\ &= -3a^2b^2 + 7a^2b^2 + 2a^2b^2 \\ &= a^2b^2(-3 + 7 + 2) \\ &= a^2b^2(6) \\ &= 6a^2b^2 \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad & \frac{2}{3}a + \frac{5}{3}a + \frac{-3}{2}a \\ &= \frac{4a + 10a + (-9)a}{6} \end{aligned}$$

$$= \frac{14a - 9a}{6}$$

$$= \frac{5a}{6}$$

$$\begin{aligned} \text{(v)} \quad & x + 3y + 7x - 8y \\ &= 8x - 5y \end{aligned}$$

$$\begin{aligned} \text{(vi)} \quad & x + y - 7 + 3x + 8y - 4 \\ &= 4x + 9y - 11 \end{aligned}$$

$$\begin{aligned} \text{(vii)} \quad & \frac{1}{2}x^2 - \frac{4}{3}y^2 + 2xy + \frac{3}{2}y^2 - \frac{1}{4}x^2 + 9x^2 - 5y^2 + 3xy \\ &= x^2 \left(\frac{1}{2} - \frac{1}{4} + 9 \right) + y^2 \left(\frac{-4}{3} + \frac{3}{2} - 5 \right) + 2xy + 3xy \\ &= x^2 \left(\frac{2 - 1 + 36}{4} \right) + y^2 \left(\frac{-8 + 9 - 30}{6} \right) + 5xy \\ &= \frac{37x^2}{4} - \frac{29y^2}{6} + 5xy \end{aligned}$$

$$\begin{aligned} \text{(viii)} \quad & 5ax - 3by + 7cz + 7by + (-11ax) + (-3cz) + 12cz + (-ax) \\ & \quad \quad \quad + (-3by) \end{aligned}$$

$$\begin{aligned} &= 5ax - 11ax - ax - 3by + 7by - 3by + 7cz - 3cz + 12cz \\ &= -7ax + by + 16cz \end{aligned}$$

$$\begin{aligned} \text{(ix)} \quad & \frac{3}{2}x^3 - \frac{1}{4}x^2 + \frac{5}{3} + \left(\frac{-5}{4}x^3 \right) + \frac{3}{5}x^2 - x + \frac{1}{5} + (-x^2) + \frac{3}{8}x \\ & \quad \quad \quad - \frac{8}{15} \end{aligned}$$

$$\begin{aligned} &= x^3 \left(\frac{3}{2} - \frac{5}{4} \right) + x^2 \left(\frac{-1}{4} + \frac{3}{5} - 1 \right) + x \left(-1 + \frac{3}{8} \right) \\ & \quad \quad \quad + \left(\frac{5}{3} + \frac{1}{5} - \frac{8}{15} \right) \\ &= x^3 \left(\frac{6 - 5}{4} \right) + x^2 \left(\frac{-5 + 12 - 20}{20} \right) + x \left(\frac{-8 + 3}{8} \right) \end{aligned}$$

$$+\left(\frac{25+3-8}{15}\right)$$

$$= \frac{1}{4}x^3 - \frac{13}{20}x^2 - \frac{5}{8}x + \frac{20}{15}$$

$$= \frac{1}{4}x^3 - \frac{13}{20}x^2 - \frac{5}{8}x + \frac{4}{3}$$

$$(x) \quad 3x^2 - 5xy + 4y^2 - 1 + 7y^2 - 9xy + 5 + 7xy - 4x^2 + y^2 - 13$$

$$= x^2(3-4) + xy(-5-9+7) + y^2(4+7+1) + (-1+5-13)$$

$$= x^2(-1) + xy(-7) + y^2(12) + (-9)$$

$$= x^2 - 7xy + 12y^2 - 9$$

$$(xi) \quad \frac{8}{5}x + \frac{11}{7}y + \frac{9}{4}xy - \frac{3}{2}x - \frac{9}{5}xy - \frac{5}{3}y + \frac{1}{2}x - \frac{4}{5}xy + y$$

$$= x\left(\frac{8}{5} - \frac{3}{2} + \frac{1}{2}\right) + y\left(\frac{11}{7} - \frac{5}{3} + 1\right) + xy\left(\frac{9}{4} - \frac{9}{5} - \frac{4}{5}\right)$$

$$= x\left(\frac{16-15+5}{10}\right) + y\left(\frac{33-35+21}{21}\right) + xy\left(\frac{45-36-16}{20}\right)$$

$$= x\left(\frac{6}{10}\right) + y\left(\frac{19}{21}\right) + xy\left(\frac{-7}{20}\right)$$

$$= \frac{6x}{10} + \frac{19}{21}y - \frac{7}{20}xy$$

$$= \frac{3}{5}x + \frac{19}{21}y - \frac{7}{20}xy$$

2. Subtract :

$$(i) \quad -6xy - 18xy \\ = xy(-6-18) \\ = -24xy$$

$$(ii) \quad 7a^2b - (-a^2b) \\ = 7a^2b + a^2b$$

$$= 8a^2b$$

$$\begin{aligned} \text{(iii)} \quad & -15ab - 9ab \\ & = ab(-15 - 9) \\ & = -24ab \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad & (4y - 5x) - (x + y) \\ & = 4y - 5x - x - y \\ & = 3y - 6x \\ & = 3(y - 2x) \end{aligned}$$

$$\begin{aligned} \text{(v)} \quad & (4x + 3y) - (-2x + 3y) \\ & = 4x + 3y + 2x - 3y \\ & = 6x \end{aligned}$$

$$\begin{aligned} \text{(vi)} \quad & \left(2x^2 - \frac{1}{2}y^2 + 3 \right) - (x^2 + y^2) \\ & = 2x^2 - \frac{1}{2}y^2 + 3 - x^2 - y^2 \\ & = x^2 - \frac{1y^2 - 2y^2}{2} + 3 \\ & = x^2 - \frac{3y^2}{2} + 3 \end{aligned}$$

$$\begin{aligned} \text{(vii)} \quad & 0 - (2a^2 + 3b^2 - 4c^2) \\ & = 0 - 2a^2 - 3b^2 + 4c^2 \\ & = -2a^2 - 3b^2 + 4c^2 \end{aligned}$$

$$\begin{aligned} \text{(viii)} \quad & (6xy - 4x^2 - y^2 + 5) - (x^2 - 3xy + 7y^2 - 2) \\ & = 6xy - 4x^2 - y^2 + 5 - x^2 + 3xy - 7y^2 + 2 \\ & = 9xy - 5x^2 - 8y^2 + 7 \end{aligned}$$

$$\begin{aligned} \text{(ix)} \quad & 8b^2 - 5a^2 - 7c^2 - 2a^2b^2c^2 - (a^2 + 5b^2 - 4c^2 + 9abc) \\ & = 8b^2 - 5a^2 - 7c^2 - 2a^2b^2c^2 - a^2 - 5b^2 + 4c^2 - 9abc \\ & = 3b^2 - 6a^2 - 3c^2 - 2a^2b^2c^2 - 9abc \end{aligned}$$

$$\begin{aligned}
 (x) \quad & 6p^3 - 4p - (4p^3 + 3p^2 - 2p) \\
 & = 6p^3 - 4p^3 - 4p - 3p^2 + 2p \\
 & = 2p^3 - 2p - 3p^2
 \end{aligned}$$

$$\begin{aligned}
 3. \quad & 5x^3 - 11x^2 - 4 - (10x^3 - 4x^2 + 6) \\
 & = 5x^3 - 11x^2 - 4 - 10x^3 + 4x^2 - 6 \\
 & = -5x^3 - 7x^2 - 10 \\
 & 5x^3 - 11x^2 - 4 \text{ is greater by } -5x^3 - 7x^2 - 10
 \end{aligned}$$

$$\begin{aligned}
 4. \quad & \text{Let } a \text{ be the number subtracted} \\
 & 14xyz + 6xy - a = -xyz + 7xy \\
 & a = 14xyz + xyz + 6xy - 7xy \\
 & a = 15xyz - xy
 \end{aligned}$$

$$\begin{aligned}
 5. \quad & \text{Let } a \text{ be the number added} \\
 & 5x^2 - 3x + 1 + a = 3x^3 - 7x^2 + 8 \\
 & a = 3x^3 - 5x^2 - 7x^2 + 3x + 8 - 1 \\
 & = 3x^3 - 12x^2 + 3x + 7
 \end{aligned}$$

$$\begin{aligned}
 6. \quad & 9x^2 - 10y^2 - z^2 - (x^2 - 4y^2 - z^2) \\
 & = 9x^2 - 10y^2 - z^2 - x^2 + 4y^2 + z^2 \\
 & = 8x^2 - 6y^2
 \end{aligned}$$

$$\begin{aligned}
 7. \quad & 11xy - x^2 - 4 + (-14xy + 5x^2) \\
 & = 11xy - 14xy - x^2 + 5x^2 - 4 \\
 & = -3xy + 4x^2 - 4 \\
 & = -3xy + 4x^2 - 4 + 15xy + x^2 + 2 \\
 & = 12xy + 5x^2 - 2
 \end{aligned}$$

$$\begin{aligned}
 8. \quad & P = 2x^2 + 3xy - 5y^2 \\
 & Q = -5x^2 + 2xy + 3y^2
 \end{aligned}$$

$$R = -3x^2 + 5xy - 2y^2$$

$$P + Q - R = 0$$

$$= 2x^2 + 3xy - 5y^2 + (-5x^2 + 2xy + 3y^2) - (-3x^2 + 5xy - 2y^2)$$

$$= 2x^2 + 3xy - 5y^2 - 5x^2 + 2xy + 3y^2 + 3x^2 - 5xy + 2y^2$$

$$= x^2(2 - 5 + 3) + y^2(-5 + 3 + 2) + xy(3 + 2 - 5)$$

$$= x^2(0) + y^2(0) + xy(0)$$

$$= 0$$

Hence Proved

$$9. 2y^2 + 2x - y - 10 + () = x^2 - y^2 + 3y - 5$$

$$(.) = x^2 - y^2 + 3y - 5 - (2y^2 + 2x - y - 10)$$

$$= x^2 - y^2 + 3y - 5 - 2y^2 - 2x + y + 10$$

$$= x^2 - 3y^2 + 4y + 5$$

$$10. (a + 3b - 4c) + (4a - b + 9c) + (-2b + 3c - a)$$

$$a + 3b - 4c + 4a - b + 9c - 2b + 3c - a$$

$$a(1 + 4 - 1) + b(3 - 1 - 2) + c(-4 + 9 + 3)$$

$$4a + b(0) + 8c$$

$$4a + 8c - (2a - 3b + 4c)$$

$$2a + 3b + 4c$$

MCQs

1.	(c)	2.	(b)	3.	(c)	4.	(a)	5.	(b)	6.	(c)
7.	(b)	8.	(c)	9.	(b)	10.	(b)	11.	(d)	12.	(d)

$$2. p^2 + 2q$$

$$= (-1)^2 + 2(2)$$

$$= 1 + 4 = 5$$

$$4. 3a^2b - (-8a^2b)$$

$$= 3a^2b + 8a^2b$$

$$= 11a^2b$$

$$7. \quad 3x^2 - 2x^2 + 5x + x + 4y - 2y$$

$$= x^2 + 6x + 2y$$

$$11. \quad a^2 + b^2 + 2ab + a^2 + b^2 - 2ab + 2a^2 - 2b^2 + 3ab$$

$$= 4a^2 + 3ab$$

$$12. \quad a^3 + b^3 - 3ab - (a^3 + b^3 + 3ab)$$

$$a^3 + b^3 - 3ab - a^3 - b^3 - 3ab$$

$$= -6ab$$

Fill in the blanks

1. algebraic factors

2. constant

3. zero

4. coefficient

5. $-\frac{3}{2}y$

6. Trinomial

7. -1

8. like

$$7. \quad 2(-1)^2(1) + 3(-1)(1)^2$$

$$= 2 - 3 = -1$$

True or False

1. True

2. False

3. False

4. False

5. True

6. True

7

Simple Equations

Exercise 7.1

❖ Solve the following equations and check your result:

$$1. \quad 11x + 24 = 46$$

$$11x = 46 - 24$$

$$11x = 22$$

$$x = \frac{22}{11}$$

Check

$$11(2) + 24 = 46$$

$$22 + 24 = 46$$

$$46 = 46$$

2. $5x - 8 = 4x - 6$

$$5x - 4x = -6 + 8$$

$$x = 2$$

Check

$$5(2) - 8 = 4(2) - 6$$

$$2 = 2$$

3. $5x + \frac{1}{2} = 8$

$$5x = 8 - \frac{1}{2}$$

$$5x = \frac{16-1}{2}$$

$$5x = \frac{15}{2}$$

$$x = \frac{15}{2 \times 5}$$

Check

$$5\left(\frac{3}{2}\right) + \frac{1}{2} = 8$$

$$\frac{15}{2} + \frac{1}{2} = 8$$

$$\frac{16}{2} = 8$$

4. $8x - 3 = 9 - 2x$

$$8x + 2x = 9 + 3$$

$$10x = 12$$

$$x = \frac{12}{10}$$

Check

$$8\left(\frac{6}{5}\right) - 3 = 9 - 2\left(\frac{6}{5}\right)$$

$$\frac{48}{5} - 3 = 9 - \frac{12}{5}$$

$$\frac{48 - 15}{5} = \frac{45 - 12}{5}$$

$$\frac{33}{5} = \frac{33}{5}$$

$$5. \quad \frac{2x + 5}{3x + 4} = 3$$

$$2x + 5 = 3(3x + 4)$$

$$2x + 5 = 9x + 12$$

$$2x - 9x = 12 - 5$$

$$-7x = 7$$

$$x = \frac{7}{-7} \quad x = -1$$

Check

$$\frac{2(-1) + 5}{3(-1) + 4} = 3$$

$$\frac{-2 + 5}{-3 + 4}$$

$$\frac{3}{1} = 3$$

$$6. \quad \frac{x + 2}{x - 2} = \frac{7}{3}$$

$$3(x + 2) = 7(x - 2)$$

$$3x + 6 = 7x - 14$$

$$6 + 14 = 7x - 3x$$

$$20 = 4x$$

$$\frac{20}{4} = x \quad x = 5$$

Check

$$\frac{5+2}{5-2} = \frac{7}{3}$$

$$\frac{7}{3} = \frac{7}{3}$$

7. $3(x + 2) - 2(x - 2) = -8(x + 1)$

$$3x + 6 - 2x + 4 = -8x - 8$$

$$3x - 2x + 8x = -8 - 6 - 4$$

$$9x = -18$$

$$x = \frac{-18}{9} \quad x = -2$$

Check

$$3(-2 + 2) - 2(-2 - 2) = -8(-2 + 1)$$

$$-2(-4) = -8(-1)$$

$$8 = 8$$

8. $3x + 2(x + 2) = 20 - (2x - 5)$

$$3x + 2x + 4 = 20 - 2x + 5$$

$$5x + 4 = 25 - 2x$$

$$5x + 2x = 25 - 4$$

$$7x = 21$$

$$x = \frac{21}{7}$$

Check

$$3(3) + 2(3 + 2) = 20 - (2(3) - 5)$$

$$9 + 10 = (20 - 1)$$

$$19 = 19$$

$$\begin{aligned} 9. \quad \frac{x}{5} - \frac{x}{6} &= \frac{1}{30} \\ \frac{6x - 5x}{30} &= \frac{1}{30} \\ \frac{x}{30} &= \frac{1}{30} \\ x \times 30 &= 30 \\ x &= \frac{30}{30} = 1 \end{aligned}$$

Check

$$\begin{aligned} \frac{1}{5} - \frac{1}{6} &= \frac{1}{30} \\ \frac{6 - 5}{30} &= \frac{1}{30} \\ \frac{1}{30} &= \frac{1}{30} \end{aligned}$$

$$\begin{aligned} 10. \quad \frac{2x}{3} - \frac{x}{2} &= 30 \\ \frac{4x - 3x}{6} &= 30 \end{aligned}$$

$$x = 30 \times 6$$

$$x = 180$$

Check

$$\frac{2(180)}{3} - \frac{180}{2} = 30$$

$$120 - 90 = 30$$

$$30 = 30$$

$$\begin{aligned} 11. \quad 34 - 5(x - 1) &= 4 \\ 34 - 5x + 5 &= 4 \\ 34 - 5x &= 4 - 5 \end{aligned}$$

$$-5x = 4 - 5 - 34$$

$$-5x = -35$$

$$x = \frac{-35}{-5} = 7$$

Check

$$34 - 5(7 - 1) = 4$$

$$34 - 5(6) = 4$$

$$34 - 30 = 4$$

$$4 = 4$$

$$12. \quad 3x - 2(2x - 5) = 2(x + 3) - 8$$

$$3x - 4x + 10 = 2x + 6 - 8$$

$$3x - 4x - 2x = 6 - 8 - 10$$

$$-3x = -12$$

$$x = \frac{-12}{-3} = 4$$

Check

$$3(4) - 2(2(4) - 5) = 2(4 + 3) - 8$$

$$12 - 2(8 - 5) = 14 - 8$$

$$12 - 2(3) = 14 - 8$$

$$12 - 6 = 6$$

$$6 = 6$$

$$13. \quad \frac{x}{23} - 1 = \frac{x}{3} + 4$$

$$\frac{x}{23} - \frac{x}{3} = 4 + 1$$

$$\frac{3x - 23x}{69} = 5$$

$$-20x = 5 \times 69$$

$$x = \frac{5 \times 69}{-20} = \frac{-69}{4}$$

Check

$$\frac{-69}{4 \times 23} - \left(\frac{-69}{4 \times 3} \right) = 5$$

$$\frac{-69}{92} + \frac{69}{12} = 5$$

$$\frac{-207 + 1587}{276} = 5$$

$$\frac{1380}{276} = 5$$

$$5 = 5$$

$$14. \quad \frac{3x-1}{5} - \frac{x}{7} = 3$$

$$\frac{7(3x-1) - 5x}{35} = 3$$

$$21x - 7 - 5x = 3 \times 35$$

$$16x - 7 = 105$$

$$16x = 105 + 7$$

$$x = \frac{112}{16}$$

$$x = 7$$

Check

$$\frac{3(7)-1}{5} - \frac{7}{7} = 3$$

$$\frac{21-1}{5} - 1 = 3$$

$$4 - 1 = 3$$

$$3 = 3$$

$$15. \quad 0.16(5x-2) = 0.4x + 7$$

$$0.8x - 0.32 = 0.4x + 7$$

$$0.8x - 0.4x = 7 + 0.32$$

$$0.4x = 7.32$$

$$x = \frac{732 \times 10}{04 \times 100}$$

$$= 18.3$$

Check

$$0.16(5(18.3) - 2) = 0.4(18.3) + 7$$

$$14.32 = 14.32$$

16. $0.3x + 0.4 = 0.28x + 1.16$

$$0.3x - 0.28x = 1.16 - 0.4$$

$$0.02x = 0.76$$

$$x = \frac{0.76}{0.02}$$

Check

$$0.3(38) + 0.4 = 0.28(38) + 1.16$$

$$11.4 + 0.4 = 10.64 + 1.16$$

$$11.8 = 11.8$$

17. $0.5x - (0.8 - 0.2x) = 0.2 - 0.3x$

$$0.5x - 0.8 + 0.2x = 0.2 - 0.3x$$

$$0.7x + 0.3x = 0.2 + 0.8$$

$$1.0x = 1.0$$

$$x = \frac{1.0}{1.0} = 1$$

Check

$$0.5(1) - (0.8 - 0.2(1)) = 0.2 - 0.3(1)$$

$$0.5 - 0.8 + 0.2 = 0.2 - 0.3$$

$$-0.1 = -0.1$$

$$18. \quad \frac{x+7}{3} = 1 + \frac{3x-2}{5}$$

$$\frac{x+7}{3} = \frac{5+3x-2}{5}$$

$$5(x+7) = 3(3x+3)$$

$$5x+35 = 9x+9$$

$$35-9 = 9x-5x$$

$$26 = 4x$$

$$\frac{26}{4} = x$$

$$x = \frac{13}{2}$$

Check

$$5\left(\frac{13}{2} + 7\right) = 3\left(3\left(\frac{13}{2}\right) + 3\right)$$

$$5\left(\frac{13+14}{2}\right) = 3\left(\frac{39}{2} + 3\right)$$

$$5\left(\frac{27}{2}\right) = 3\left(\frac{39+6}{2}\right)$$

$$5\left(\frac{27}{2}\right) = 3\left(\frac{45}{2}\right)$$

$$\frac{27}{2} = \frac{3}{5}\left(\frac{45}{2}\right)$$

$$\frac{27}{2} = \frac{27}{2}$$

$$19. \quad 4(3x+2) - 5(6x-1) = 2(x-8) - 6(7x-4) + 4x$$

$$12x+8-30x+5 = 2x-16-42x+24+4x$$

$$-18x+13 = -36x+8$$

$$-18x+36x = 8-13$$

$$18x = -5$$

$$x = \frac{-5}{18}$$

Check

$$-18\left(\frac{-5}{18}\right) + 13 = -36\left(\frac{-5}{18}\right) + 8$$

$$5 + 13 = 10 + 8$$

$$18 = 18$$

$$20. \quad x - \left(2x - \frac{3x - 4}{7}\right) = \frac{4x - 27}{3}$$

$$x - \left[\frac{14x - 3x + 4}{7}\right] = \frac{4x - 27}{3}$$

$$\left(x - \frac{11x + 4}{7}\right) = \frac{4x - 27}{3}$$

$$\frac{7x - 11x - 4}{7} = \frac{4x - 27}{3}$$

$$3(-4x - 4) = 7(4x - 27)$$

$$-12x - 12 = 28x - 189$$

$$-12x - 28x = -189 + 12$$

$$-40x = -177$$

$$x = \frac{-177}{-40}$$

Check

$$\frac{-4x - 4}{7} = \frac{4x - 27}{3}$$

$$\frac{-4\left(\frac{177}{40}\right) - 4}{7} = \frac{4\left(\frac{177}{40}\right) - 27}{3}$$

$$\frac{\frac{-177}{10} - 4}{7} = \frac{\frac{177}{10} - 27}{3}$$

$$\frac{-177-40}{10} = \frac{177-270}{10}$$

$$\frac{-217}{10} = \frac{-93}{10}$$

$$\frac{-217}{10} = \frac{-93}{10}$$

$$\frac{-217}{10 \times 7} = \frac{-93}{10 \times 3}$$

$$\frac{-31}{10} = \frac{-31}{10}$$

$$21. \quad x - \frac{x}{4} - \frac{1}{2} = 3 + \frac{x}{4}$$

$$x - \frac{x}{4} - \frac{x}{4} = 3 + \frac{1}{2}$$

$$\frac{4x - x - x}{4} = \frac{6 + 1}{2}$$

$$\frac{2x}{4} = \frac{7}{2}$$

$$2x \times 2 = 7 \times 4$$

$$4x = 28$$

$$x = \frac{28}{4} = 7$$

Check

$$7 - \frac{7}{4} - \frac{1}{2} = 3 + \frac{7}{4}$$

$$\frac{28 - 7 - 2}{4} = \frac{12 + 7}{4}$$

$$\frac{19}{4} = \frac{19}{4}$$

$$22. \quad \frac{3x-2}{3} + \frac{2x+3}{3} = x + \frac{7}{6}$$

$$\frac{3x - 2 + 2x + 3}{3} = \frac{6x + 7}{6}$$

$$\frac{5x + 1}{3} = \frac{6x + 7}{6}$$

$$6(5x + 1) = 3(6x + 7)$$

$$30x + 6 = 18x + 21$$

$$30x - 18x = 21 - 6$$

$$12x = 15$$

$$x = \frac{15}{12} = \frac{5}{4}$$

Check

$$6\left(5\left(\frac{5}{4}\right) + 1\right) = 3\left(6\left(\frac{5}{4}\right) + 7\right)$$

$$6\left(\frac{25}{4} + 1\right) = 3\left(\frac{30}{4} + 7\right)$$

$$6\left(\frac{25 + 4}{4}\right) = 3\left(\frac{15 + 14}{2}\right)$$

$$6\left(\frac{29}{4}\right) = 3\left(\frac{29}{2}\right)$$

23. $\frac{1}{4}x + \frac{1}{6}x = \frac{1}{2}x + \frac{3}{4}$

$$\frac{3x + 2x}{12} = \frac{2x + 3}{4}$$

$$4(3x + 2x) = 12(2x + 3)$$

$$12x + 8x = 24x + 36$$

$$24x - 20x = -36$$

$$4x = -36$$

$$x = \frac{-36}{4} = -9$$

Check

$$4(3(-9) + 2(-9)) = 12(2(-9) + 3)$$

$$4(-27 - 18) = 12(-18 + 3)$$

$$4(-45) = 12(-15)$$

$$-180 = -180$$

$$\begin{aligned} 24. \quad & \frac{x+2}{6} - \left(\frac{11-x}{3} - \frac{1}{4} \right) = \frac{3x-4}{12} \\ & \frac{x+2}{6} - \left(\frac{4(11-x)-3}{12} \right) = \frac{3x-4}{12} \\ & \frac{2(x+2) - (4(11-x)-3)}{12} = \frac{3x-4}{12} \\ & \frac{2x+4-44+4x+12}{12} = \frac{3x-4}{12} \\ & 2x+4-44+4x+12 = 3x-4 \\ & -28+6x = 3x-4 \\ & -28+4 = 3x-6x \\ & -24 = -3x \\ & \frac{-24}{-3} = x \quad x = 8 \end{aligned}$$

Check

$$2(8) + 4 - 44 + 4(8) + 12 = 3(8) - 4$$

$$16 + 4 - 44 + 32 + 12 = 24 - 4$$

$$20 = 20$$

$$\begin{aligned} 25. \quad & \frac{3}{4}(7x-1) - \left(2x - \frac{1-x}{2} \right) = x + \frac{3}{2} \\ & \frac{21}{4}x - \frac{3}{4} - \left(2x - \frac{1-x}{2} \right) = x + \frac{3}{2} \\ & \frac{21x}{4} - \frac{3}{4} - 2x - \frac{1-x}{2} = x + \frac{3}{2} \\ & \frac{21x}{4} - 2x + \frac{x}{2} - x = \frac{3}{2} + \frac{3}{4} + \frac{1}{2} \end{aligned}$$

$$\frac{21x - 8x + 2x - 4x}{4} = \frac{6 + 3 + 2}{4}$$

$$\frac{11x}{4} = \frac{11}{4}$$

$$x = \frac{11 \times 4}{11 \times 4} = 1$$

Check

$$\frac{21(1) - 8(1) + 2(1) - 4(1)}{4} = \frac{11}{4}$$

$$\frac{21 - 8 + 2 - 4}{4} = \frac{11}{4}$$

$$\frac{11}{4} = \frac{11}{4}$$

Exercise 7.2

1. Let the no. be x

$$3x + 9 = 45$$

$$3x = 45 - 9$$

$$3x = 36$$

$$x = \frac{36}{3} \quad x = 12$$

2. Let one number be x

$$\text{Another number} = \frac{2}{3}x$$

$$x + \frac{2}{3}x = 60$$

$$\frac{3x + 2x}{3} = 60$$

$$5x = 60 \times 3$$

$$x = \frac{60 \times 3}{5}$$

$$x = 36$$

$$\begin{aligned}\text{Another number} &= \frac{2}{3} \times 36 \\ &= 24\end{aligned}$$

3. Let one number be x

$$\text{Another number} = x + 1$$

$$x + x + 1 = 29$$

$$2x + 1 = 29$$

$$2x = 28$$

$$x = \frac{28}{2} = 14$$

$$\text{Another number} = 14 + 1 = 15$$

4. Let the no. be x

$$x + \frac{2}{3}x = 55$$

$$\frac{3x + 2x}{3} = 55$$

$$5x = 55 \times 3$$

$$x = \frac{55 \times 3}{5}$$

$$x = 33$$

5. Let the no. be x

$$6x - 35 = 31$$

$$6x = 31 + 35$$

$$6x = 66$$

$$x = \frac{66}{6} = 11$$

6. Let the unknown no. be x

$$x + 87 = 170$$

$$x = 170 - 87$$

$$x = 83$$

7. Let two consecutive old no. be x and $x + 2$

$$x + x + 2 = 644$$

$$2x + 2 = 644$$

$$2x = 644 - 2$$

$$2x = 642$$

$$x = \frac{642}{2} = 321$$

Numbers = 321, 323

8. Let three even positive integers be

$$x, x + 2, x + 4$$

$$x + x + 2 + x + 4 = 90$$

$$3x + 6 = 90$$

$$3x = 90 - 6$$

$$3x = 84$$

$$x = \frac{84}{3} = 28$$

Three even positive integers are 28, 30, 32

9. Let the age of Shekhar be x

$$\text{Anil's age} = x + 10$$

$$2(x - 5) = (x + 10 - 5)$$

$$2x - 10 = x + 5$$

$$2x - x = 5 + 10$$

$$x = 15$$

Shekhar's age = 15 years

Anil's age = 25 years

10. Let the age of Vivek and Vishal be $7x$ and $5x$

After 10 years

$$\frac{7x + 10}{5x + 10} = \frac{9}{7}$$

$$7(7x + 10) = 9(5x + 10)$$

$$49x + 70 = 45x + 90$$

$$49x - 45x = 90 - 70$$

$$4x = 20$$

$$x = \frac{20}{4} = 5$$

$$\text{Vivek's age} = 7 \times 5 = 35 \text{ years}$$

$$\text{Vishal's age} = 5 \times 5 = 25 \text{ years}$$

11. Let Mohan's age be x

$$\frac{1}{2}(x + 2) + \frac{1}{4}(x - 4) = 30$$

$$\frac{1}{2}x + 1 + \frac{1}{4}x - 1 = 30$$

$$\frac{2x + x}{4} = 30$$

$$3x = 30 \times 4$$

$$x = \frac{30 \times 4}{3} = 40$$

$$\text{Mohan's age} = 40 \text{ years}$$

12. Let the present age of man be x and the son be y

5 years ago

$$x - 5 = 7(y - 5)$$

$$x - 7y = -35 + 5$$

$$x - 7y = -30$$

$$x = 7y - 30$$

...(i)

5 years from now

$$x + 5 = 3(y + 5)$$

$$x = 3y + 15 - 5$$

$$x = 3y + 10$$

...(ii)

Equation (i) & (ii)

$$7y - 30 = 3y + 10$$

$$7y - 3y = 10 + 30$$

$$4y = 40$$

$$y = \frac{40}{4}$$

$$x = 7 \times 10 - 30 = 40 \text{ years}$$

Man's age = 40 years

Son's age = 10 years

- 13.** Let the no. of ₹2 coins be x

Then the no. of ₹5 coins be x

$$2x + 5x = 70$$

$$7x = 70$$

$$x = \frac{70}{7} = 10$$

The wallet contain 10 coins of each type.

- 14.** Let the number of ₹5 coins be x

Then the number of ₹2 coins $4x$

$$5x + 2(4x) = 117$$

$$5x + 8x = 117$$

$$13x = 117$$

$$x = \frac{117}{13} = 9$$

The number of 5 rupee coin is 9 and the number of 2 rupees coins is 36.

- 15.** Let the breadth of rectangle be x

Length = $2x - 8$

Perimeter of rectangle = 56 m

$$2(l + b) = 56$$

$$2(2x - 8 + x) = 56$$

$$3x - 8 = \frac{56}{2}$$

$$3x - 8 = 28$$

$$3x = 28 + 8$$

$$3x = 36$$

$$x = \frac{36}{3} = 12$$

$$\text{Length} = 16 \text{ m}$$

$$\text{Breadth} = 12 \text{ m}$$

- 16.** Let the breadth of rectangle be x

$$\text{Length of rectangle} = 2x$$

$$\text{Perimeter} = 150 \text{ cm}$$

$$2(l + b) = 150 \text{ cm}$$

$$2(x + 2x) = 150 \text{ cm}$$

$$3x = \frac{150}{2}$$

$$3x = 75$$

$$x = \frac{75}{3} = 25$$

$$\text{Length} = 2 \times 25 = 50 \text{ cm}$$

$$\text{Breadth} = 25 \text{ cm}$$

- 17.** Let the breadth of rectangle be x

$$\text{Length of rectangle be} = 2x - 5$$

$$\text{Perimeter of rectangle} = 62 \text{ m}$$

$$2(l + b) = 62$$

$$2(x + 2x - 5) = 62$$

$$2(3x - 5) = 62$$

$$3x - 5 = \frac{62}{2} = 31$$

$$3x = 31 + 5$$

$$3x = 36$$

$$x = \frac{36}{3} = 12$$

Length = 19 m

Breadth = 12 m

- 18.** Let the base angles be x

Vertex angle = $3x$

$$3x + x + x = 180^\circ$$

$$5x = 180^\circ$$

$$x = \frac{180^\circ}{5}$$

$$= 36^\circ$$

Base angles = 36°

Vertex angle = 108°

- 19.** Let the runs scored by B be x

The runs scored by $A = 2x$

$$x + 2x = 195$$

$$3x = 195$$

$$x = \frac{195}{3} = 65$$

Runs scored by $A = 2 \times 65 = 130$

Runs scored by $B = 65$

- 20.** Let the denominator be x

Numerator = $x - 2$

$$\frac{x - 2 + 1}{x - 2} = \frac{4}{3}$$

$$\frac{x - 1}{x - 2} = \frac{4}{3}$$

$$3(x - 1) = 4(x - 2)$$

$$3x - 3 = 4x - 8$$

$$4x - 3x = -3 + 8$$

$$x = 5$$

Numerator = 3

Denominator = 5

$$\text{Original fraction} = \frac{3}{5}$$

MCQs

1.	(d)	2.	(c)	3.	(b)	4.	(d)	5.	(c)	6.	(b)
7.	(a)	8.	(a)	9.	(b)	10.	(a)				

$$1. \frac{x}{4} = 9$$

$$x = 98 \times 4$$

$$= 392$$

$$2. \frac{2}{7}y - \frac{5}{3} = \frac{2}{5}$$

$$\frac{2}{7}y = \frac{2}{5} + \frac{5}{3}$$

$$\frac{2}{7}y = \frac{2 \times 3 + 5 \times 5}{15}$$

$$\frac{2}{7}y = \frac{6 + 25}{15}$$

$$\frac{2}{7}y = \frac{31}{15}$$

$$y = \frac{31}{15} \times \frac{7}{2}$$

$$= \frac{217}{30}$$

$$3. 0.4x = 64$$

$$x = \frac{64 \times 10}{04}$$

$$=160$$

$$4. \quad 2x + \frac{5}{3} = \frac{1}{4}x + 4$$

$$\frac{2x}{1} - \frac{1}{4}x = 4 - \frac{5}{3}$$

$$\frac{8x - 1x}{4} = \frac{12 - 5}{3}$$

$$\frac{7x}{4} = \frac{7}{3}$$

$$7x = \frac{7}{3} \times 4$$

$$x = \frac{7}{3} \times \frac{4}{7}$$

$$x = \frac{4}{3}$$

5. Let the number be x

$$x \times 4 = x + 54$$

$$4x = x + 54$$

$$4x - x = 54$$

$$3x = 54$$

$$x = \frac{54}{3}$$

$$x = 18$$

6. Let the angle be x°

$$\text{Complimentary angle} = (90 - x)^\circ$$

$$x - (90^\circ - x) = 14^\circ$$

$$x - 90^\circ + x = 14^\circ$$

$$2x = 14^\circ + 90^\circ$$

$$2x = 104^\circ$$

$$x = \frac{104}{2} = 52$$

7. Let the consecutive odd no. be x and $x + 2$

$$x + x + 2 = 36$$

$$2x + 2 = 36$$

$$2x = 36 - 2$$

$$2x = 34$$

$$x = \frac{34}{2} = 17$$

One number = 17

Other = $x + 2 = 17 + 2 = 19$

8. Let one angle be x°

Supplementary angle = $(180 - x)^\circ$

$$x^\circ - (180 - x)^\circ = 20^\circ$$

$$x - 180^\circ + x = 20^\circ$$

$$2x - 180^\circ = 20^\circ$$

$$2x = 200^\circ$$

$$x = \frac{200}{2} = 100^\circ$$

9. $\frac{x}{2} - 1 = \frac{x}{3} + 4$

$$\frac{x}{2} - \frac{x}{3} = 4 + 1$$

$$\frac{3x - 2x}{6} = 5$$

$$x = 5 \times 6$$

$$x = 30$$

10. $3(m - 3) = 5(2m + 1)$

$$3m - 9 = 10m + 5$$

$$-9 - 5 = 10m - 3m$$

$$-14 = 7m$$

$$\frac{-14}{7} = m$$

$$m = -2$$

Fill in the blanks

1. solution or root 2. 12 3. one 4. 36 5. 35

6. -6 7. 9 8. 33 and 36

2. $\frac{p}{6} = 2$

$$p = 6 \times 2 = 12$$

4. Let the no. be x

$$\frac{x}{9} = 4$$

$$x = 4 \times 9$$

$$x = 36$$

5. $2x - 5 = 15$

$$2x = 15 + 5$$

$$2x = 20$$

$$x = \frac{20}{2} = 10$$

$$3x + 5$$

$$= 3(10) + 5$$

$$= 30 + 5$$

$$= 35$$

6. $\frac{x}{3} + 3 = \frac{x}{2} + 4$

$$\frac{x}{3} - \frac{x}{2} = 4 - 3$$

$$\frac{2x - 3x}{6} = 1$$

$$-x = 6$$

$$x = -6$$

$$7. \frac{4x + 6}{6} = 7$$

$$4x + 6 = 42$$

$$4x = 42 - 6$$

$$4x = 36$$

$$x = \frac{36}{4} = 9$$

8. Let the consecutive multiples of 3 be

$$3x \text{ and } 3(x + 1)$$

$$3x + 3x + 3 = 69$$

$$6x + 3 = 69$$

$$6x = 69 - 3$$

$$6x = 66$$

$$x = \frac{66}{6} = 11$$

$$3x = 3 \times 11 = 33$$

$$3(x + 1) = 3(11 + 1) = 36$$

True or False

1. True

2. True

3. False

4. True

5. False

6. False

8

Comparing Quantities

Exercise 8.1

1. Express each of the following ratios in simplest form :

$$(i) \quad \frac{{}^3\cancel{60}}{{}_5\cancel{100}} = \frac{3}{5}$$

₹1 = 100 paise

$$3 = 3 \times 100 \text{ paise}$$

$$= 300 \text{ paise}$$

$$(ii) \quad \frac{65}{45} = \frac{13}{9}$$

1 hour = 60 mins

$$(iii) \quad \frac{9}{12} = \frac{3}{4}$$

1 year = 12 months

$$(iv) \quad \frac{2000}{400} = \frac{5}{1}$$

1 km = 1000 m

$$2 \text{ km} = 2 \times 1000 \text{ m}$$

$$= 2000 \text{ m}$$

$$(v) \quad \frac{3600}{3000} = \frac{6}{5}$$

1 kg = 1000 g

$$3 \text{ kg} = 3000 \text{ g}$$

$$(vi) \quad \frac{30}{165} = \frac{2}{11}$$

1 hour = 60 mins

2 hours = 120 mins

$$\frac{3}{4} \times 60 = 45$$

120 mins + 45 mins

$$= 165 \text{ mins}$$

2. Simplify the following ratios :

$$(i) \quad \frac{7}{3} : \frac{21}{5}$$

$$\left(\frac{7}{3} \times 15 \right) : \left(\frac{21}{5} \times 15 \right)$$

$$= \frac{35}{63} = \frac{5}{9}$$

$$(ii) \quad \frac{16}{3} : \frac{13}{4}$$

$$\left(\frac{16}{3} \times 12\right) : \left(\frac{13}{4} \times 12\right)$$

$$= 64 : 39$$

$$= \frac{64}{39}$$

$$(iii) \quad \frac{1}{6} : \frac{1}{8} : \frac{5}{12}$$

$$\left(\frac{1}{6} \times 24\right) : \left(\frac{1}{8} \times 24\right) : \left(\frac{5}{12} \times 24\right)$$

$$4 : 3 : 10$$

$$(iv) \quad \frac{20}{3} : \frac{15}{2}$$

$$\left(\frac{20}{3} \times 6^2\right) : \left(\frac{15}{2} \times 6^3\right)$$

$$40 : 45$$

$$\frac{40}{45} = 8 : 9$$

$$(v) \quad \frac{5}{4} : \frac{4}{3} : \frac{7}{8}$$

$$\left(\frac{5}{4} \times 24\right) : \left(\frac{4}{3} \times 24\right) : \left(\frac{7}{8} \times 24\right)$$

$$30 : 32 : 21$$

3. Arrange the following ratios in ascending order :

$$(i) \quad \frac{17}{28}, \frac{8}{21}, \frac{11}{14}, \frac{3}{7}$$

$$\frac{17}{28} \times \frac{6}{6} = \frac{102}{168}$$

$$\frac{8}{21} \times \frac{8}{8} = \frac{64}{168}$$

$$\frac{11}{14} \times \frac{12}{12} = \frac{132}{168}$$

$$\frac{3}{7} \times \frac{24}{24} = \frac{72}{168}$$

$$\frac{64}{168} < \frac{72}{168} < \frac{102}{168} < \frac{132}{168}$$

$$8 : 21 < 3 : 7 < 17 : 28 < 11 : 14$$

$$(ii) \quad \frac{11}{14}, \frac{5}{7}, \frac{17}{21}, \frac{2}{3}$$

$$\frac{11}{14} \times \frac{3}{3} = \frac{33}{42}$$

$$\frac{5}{7} \times \frac{6}{6} = \frac{30}{42}$$

$$\frac{17}{21} \times \frac{2}{2} = \frac{34}{42}$$

$$\frac{2}{3} \times \frac{14}{14} = \frac{28}{42}$$

$$\frac{28}{42} < \frac{30}{42} < \frac{33}{42} < \frac{34}{42}$$

$$2 : 3 < 5 : 7 < 11 : 14 < 17 : 21$$

4. Arrange the following ratios in descending order :

$$(i) \quad \frac{4}{5}, \frac{6}{7}, \frac{7}{10}, \frac{11}{24}$$

$$\frac{4}{5} \times \frac{168}{168} = \frac{672}{840}$$

$$\frac{6}{7} \times \frac{120}{120} = \frac{720}{840}$$

$$\frac{7}{10} \times \frac{84}{84} = \frac{588}{840}$$

$$\frac{11}{24} \times \frac{35}{35} = \frac{385}{840}$$

$$\frac{720}{840} > \frac{672}{840} > \frac{588}{840} > \frac{385}{840}$$

$$6 : 7 > 4 : 5 > 7 : 10 > 11 : 24$$

$$(ii) \quad \frac{16}{11}, \frac{13}{9}, \frac{25}{23}, \frac{20}{17}$$

$$\frac{16}{11} \times \frac{3519}{3519} = \frac{56304}{38709}$$

$$\frac{13}{9} \times \frac{4301}{4301} = \frac{55913}{38709}$$

$$\frac{25}{23} \times \frac{1683}{1683} = \frac{42075}{38709}$$

$$\frac{20}{17} \times \frac{2277}{2277} = \frac{45540}{38709}$$

$$\frac{56304}{38709} > \frac{55913}{38709} > \frac{45540}{38709} > \frac{42075}{38709}$$

$$16 : 11 > 13 : 9 > 20 : 17 > 25 : 23$$

$$5. \quad A : B = 18 : 25 \quad \frac{A}{B} = \frac{18}{25}$$

$$B : C = 5 : 8 \quad \frac{B}{C} = \frac{5}{8}$$

$$\frac{A}{B} \times \frac{B}{C} = \frac{18}{25} \times \frac{5}{8} = \frac{9}{20}$$

$$\frac{A}{C} = \frac{9}{20} \quad A : C = 9 : 20$$

$$6. \quad 2A = 3B = 4C \text{ find } A : B : C$$

$$\text{Let } 2A = x$$

$$3B = x$$

$$4C = x$$

$$A = \frac{x}{2}$$

$$B = \frac{x}{3}$$

$$C = \frac{x}{4}$$

$$A : B : C = \frac{x}{2} : \frac{x}{3} : \frac{x}{4}$$

LCM of 2, 3, 4 is 12

$$A : B : C = 12 \frac{x}{2} : 12 \frac{x}{3} : 12 \frac{x}{4}$$

$$A : B : C = 6x : 4x : 3x$$

$$A : B : C = 6 : 4 : 3$$

7. $\frac{a}{b} = \frac{6}{11}$

$$a = \frac{6}{11}b$$

$$= \frac{6\left(\frac{6}{11}b\right) - 3b}{3\left(\frac{6}{11}b\right) + 2b}$$

$$= \frac{\frac{36}{11}b - 3b}{\frac{18}{11}b + 2b}$$

$$= \frac{\frac{36b - 33b}{11}}{\frac{18b + 22b}{11}}$$

$$= \frac{\frac{3b}{11}}{\frac{40b}{11}}$$

$$= \frac{3b}{11} \times \frac{11}{40b} = \frac{3}{40}$$

8. Total amount = 640

Ratio = 5 : 7 : 8

Total units = 5 + 7 + 8 = 20

$$\text{Amount A get} = \frac{5}{20} \times 640$$

$$= 160$$

$$\text{Amount B get} = \frac{7}{20} \times 640$$

$$= 224$$

$$\text{Amount C get} = \frac{8}{20} \times 640$$

$$= 256$$

9. Ratio of two numbers = $\frac{7}{11}$

Let the no's be $7x$ and $11x$

$$\frac{7x + 7}{11x + 7} = \frac{2}{3}$$

$$3(7x + 7) = 2(11x + 7)$$

$$21x + 21 = 22x + 14$$

$$22x - 21x = 21 - 14$$

$$x = 7$$

$$7x = 7 \times 7 = 49$$

$$11x = 11 \times 7 = 77$$

10. Check whether the following numbers are in proportion or not:

(i) Product of extremes = $4.8 \times 45 = 216$

Product of means = $2.7 \times 80 = 216$

Product of means = Product of extremes

$\therefore$ Given number are in proportion.

(ii) Product of extremes = $36 \times 7 = 252$

Product of means = $49 \times 6 = 294$

$\therefore$ Given numbers are not in proportion.

(iii) Product of extremes = $7 \times \frac{34}{3} = \frac{238}{3}$

$$\text{Product of means} = \frac{17}{2} \times \frac{28}{2} = \frac{476}{6}$$

∴ Given numbers are in proportion.

$$(iv) \text{ Product of extremes} = 0.24 \times 3.75 = 0.9$$

$$\text{Product of means} = 1.2 \times 7.5 = 9$$

∴ Given numbers are not in proportion.

11. Find the value of x if :

$$(i) \quad \frac{10}{3} : x :: \frac{5}{2} : \frac{5}{4}$$

Product of means = Product of extremes

$$x \times \frac{5}{2} = \frac{10}{3} \times \frac{5}{4}$$

$$x \times \frac{5}{2} = \frac{25}{6}$$

$$x = \frac{25}{6} \times \frac{2}{5} = \frac{10}{6} = \frac{5}{3}$$

(ii) Product of Means = Product of extremes

$$x \times 16 = 8 \times 35$$

$$16x = 280$$

$$x = \frac{280}{16} = 17\frac{1}{2}$$

(iii) Product of means = Product of extremes

$$x \times 0.4 = 0.16 \times 7$$

$$x = \frac{1.12}{0.4}$$

$$= 2.8$$

(iv) Product of means = Product of extremes

$$27 \times 3.5 = 2 \times x$$

$$\frac{27 \times 3.5}{2} = x$$

$$47.25 = x$$

12. Find the fourth proportional to the numbers :

(i) Let fourth proportional be x

Product of extremes = Product of means

$$72 \times x = 168 \times 3$$

$$x = \frac{168 \times 3}{72}$$

$$= 7$$

(ii) Product of extremes = Product of means

$$\frac{1}{3} \times x = \frac{1}{4} \times \frac{1}{5}$$

$$x = \frac{1}{20} \times 3$$

$$= \frac{3}{20}$$

(iii) Product of extremes = Product of means

$$8 \times x = 36 \times 6$$

$$x = \frac{36 \times 6}{8}$$

$$= 27 \text{ kg}$$

13. Find the third proportional to

Let the third proportional be x

(i) $\frac{7}{2}, \frac{35}{4}$, and x are in continued proportion

$$\frac{7}{2} : \frac{35}{4} :: \frac{35}{4} : x$$

$$\frac{7}{2} \times \frac{4}{35} = \frac{35}{4} \times \frac{1}{x}$$

$$\frac{2}{5} = \frac{35}{4x}$$

$$x = \frac{35 \times 5}{4 \times 2}$$

$$= \frac{175}{8}$$

(ii) 4.5, 6 and x are in continued proportion

$$4.5 : 6 :: 6 : x$$

$$\frac{4.5}{6} = \frac{6}{x}$$

$$x = \frac{6 \times 6 \times 10}{45} = 8$$

(iii) 2.4 kg, 9.6 kg and x kg are in continued proportion

$$2.4 : 9.6 : 9.6 : x$$

$$\frac{2.4}{9.6} = \frac{9.6}{x}$$

$$x = \frac{96 \times 96}{24 \times 10}$$

$$= \frac{192}{5} = 38.4 \text{ kg}$$

14. Find the mean proportional to

Let the mean proportional be x

(i) Then $\frac{33}{4} : x :: x : \frac{11}{3}$

$$\frac{33}{4} \times \frac{1}{x} = x \times \frac{3}{11}$$

$$\frac{33}{4x} = \frac{3x}{11}$$

$$x^2 = \frac{33 \times 11}{12}$$

$$x = \sqrt{\frac{11 \times 11}{2 \times 2}} = \frac{11}{2} = 5\frac{1}{2}$$

(ii) $0.4 : x :: x : 0.9$

$$\frac{0.4}{x} = \frac{x}{0.9}$$

$$x^2 = 0.4 \times 0.9$$

$$x = \sqrt{0.36} \Rightarrow x = 0.6$$

$$(iii) \quad 80 : x :: x : 20$$

$$\frac{80}{x} = \frac{x}{20}$$

$$x^2 = 80 \times 20$$

$$x^2 = 1600$$

$$x = \sqrt{1600}$$

$$x = 40$$

15. Distance in map = 4 cm

Let real distance = x cm

$$4 : x = 1 : 2500000$$

$$\frac{4}{x} = \frac{1}{2500000}$$

$$x = 4 \times 2500000$$

$$= 1,00,00,000 \text{ m}$$

$$\text{in km} = \frac{10000000}{100 \times 100} \text{ km}$$

$$= 100 \text{ km}$$

Exercise 8.2

1. Convert each of the following fractions into a percentage :

$$(i) \quad \frac{37}{100} \times 100 = 37\%$$

$$(ii) \quad \frac{19}{50} \times 100 = 38\%$$

$$(iii) \quad \frac{3}{8} \times 100 = \frac{75}{2} \% = 37.5\%$$

$$(iv) \frac{7}{20} \times 100 = 35\%$$

$$(v) \frac{8}{5} \times 100 = 160\%$$

$$(vi) \frac{6}{25} \times 100 = 24\%$$

2. Convert each of the following into a fraction :

$$(i) \frac{24}{100} = \frac{6}{25}$$

$$(ii) \frac{25}{4} \times \frac{1}{100} = \frac{1}{16}$$

$$(iii) \frac{150}{100} = \frac{3}{2}$$

$$(iv) \frac{045}{100 \times 100} = \frac{9}{2000}$$

$$(v) \frac{006}{100 \times 100} = \frac{3}{5000}$$

$$(vi) \frac{225}{100 \times 100} = \frac{9}{400}$$

3. Express each of the following decimal into the form of percent:

$$(i) \frac{004}{100} \times 100 = 4\%$$

$$(ii) \frac{063}{100} \times 100 = 63\%$$

$$(iii) \frac{0005}{1000} \times 100 = \frac{1}{2} \% = 0.5\%$$

$$(iv) \frac{325}{100} \times 100 = 325\%$$

$$(v) \frac{0125}{1000} \times 100 = \frac{25}{2} \% = 12.5\%$$

$$(vi) \frac{205}{100} \times 100 = 205\%$$

4. Express each of the following as decimal :

$$(i) \frac{35}{100} = 0.35$$

$$(ii) \frac{018}{100 \times 100} = \frac{9}{5000} = 0.0018$$

$$(iii) \frac{25}{8 \times 100} = 0.03125$$

$$(iv) \frac{27}{2 \times 100} = 0.135$$

$$(v) \frac{75}{10 \times 100} = \frac{3}{40} = 0.075$$

$$(vi) \frac{144}{100} = 1.44$$

5. Express each of the following ratios as a percent:

$$(i) \frac{2}{5} \times 100 = 40\%$$

$$(ii) \frac{8}{25} \times 100 = 32\%$$

$$(iii) \frac{7}{100} \times 100 = 7\%$$

$$(iv) \frac{9}{10} \times 100 = 90\%$$

$$(v) \frac{5}{4} \times 100 = 125\%$$

$$(vi) \frac{3}{2} \times 100 = 150\%$$

6. Express each of the following as a ratio :

$$(i) \frac{12}{100} = 3 : 25$$

$$(ii) \frac{7.5}{100 \times 10} = 3 : 40$$

$$(iii) \frac{125}{100} = 5 : 4$$

$$(iv) \frac{44}{100} = 11 : 25$$

$$(v) \frac{65}{100} = 13 : 20$$

$$(vi) \frac{180}{100} = 9 : 5$$

7. Find the value of the following :

$$(i) \frac{60}{100} \times 55 = 33$$

$$(ii) \frac{90}{100} \times 130 = 117$$

$$(iii) \frac{25}{100} \times 500 = 125 \text{ g}$$

$$(iv) \frac{30}{100} \times 300 = 90 \text{ m}$$

$$(v) \frac{06}{100 \times 10} \times 45 = \frac{27}{100} \text{ l} = 0.27 \text{ l}$$

$$(vi) \frac{10}{3 \times 100} \times 90 = 3 \text{ kg}$$

$$(vii) \frac{40}{100} \times \frac{3}{2} = \frac{3}{5} \text{ hours} = 0.6 \text{ hours}$$

$$(viii) \frac{250}{100} \times 18 = ₹ 45$$

$$(ix) \frac{21}{2 \times 100} \times 12 = \frac{63}{50} \text{ m} = 1.26 \text{ m}$$

8. What per cent of :

$$(i) \frac{x}{100} \times 32 = 80$$

$$x = \frac{80 \times 100}{32} = 250\%$$

$$(ii) \quad \frac{x}{100} \times 125 = 750$$

$$x = \frac{750 \times 4}{5}$$

$$= 600\%$$

$$(iii) \quad 3 \text{ days} = 3 \times 24 \text{ hours} \\ = 72 \text{ hrs}$$

$$\frac{x}{100} \times 8 = 72$$

$$x = \frac{72 \times 25}{2}$$

$$= 900\%$$

$$(iv) \quad \frac{x}{100} \times \frac{7}{2} = 25$$

$$x = \frac{25 \times 200}{7}$$

$$= 714.2\%$$

$$(v) \quad \frac{x}{100} \times 175 = 1000$$

$$x = \frac{1000 \times 4}{7}$$

$$= 571.4\%$$

9. What per cent is :

$$(i) \quad \frac{15}{120} \times 100 = \frac{25\%}{2} = 12.5\%$$

$$(ii) \quad 1 \text{ m} = 100 \text{ cm}$$

$$4 \text{ m} = 4 \times 100$$

$$= 400 \text{ cm}$$

$$\frac{25}{400} \times 100 = \frac{25}{4} = 6.25\%$$

(iii) 1 day = 24 hours

$$2 \text{ days} = 2 \times 24 \text{ hours} \\ = 48 \text{ hours}$$

$$\frac{8}{48} \times 100 = \frac{50}{3} \% = 16.7\%$$

(iv) ₹6 = 6 × 100

$$= 600 \text{ paise}$$

$$\frac{75}{600} \times 100 = \frac{25}{2} \% = 12.5\%$$

(v) 1 l = 1000 ml

$$3.5 \text{ l} = 3.5 \times 1000 \text{ ml} \\ = 3500 \text{ ml}$$

$$\frac{700}{3500} \times 100 = 20\%$$

10. Find the number which is

(i) 20% of 60 = $\frac{20}{100} \times 60 = 12$

$$60 - 12 = 48$$

(ii) 30% of 90 = $\frac{30}{100} \times 90 = 27$

$$90 + 27 = 117$$

(iii) 25% of 180

$$\frac{25}{100} \times 180 = 45$$

$$180 + 45 = 225$$

(iv) $\frac{25}{4 \times 100}$ of 200

$$\frac{25}{400} \times 200 = \frac{25}{2}$$

$$200 - \frac{25}{2} = \frac{400 - 25}{2} = \frac{375}{2} = 187.5$$

11. Find the percentage increase in the following cases :

$$\begin{aligned} \text{(i) Increase} &= 6 \text{ kg} - 5.4 \text{ kg} \\ &= 0.6 \\ &= \frac{06}{54} \times 100 = \frac{100}{9} \% = 11\frac{1}{9} \% \end{aligned}$$

$$\begin{aligned} \text{(ii) Increase} &= ₹400 - ₹320 \\ &= ₹80 \end{aligned}$$

$$\frac{80}{320} \times 100 = 25\%$$

$$\begin{aligned} \text{(iii) Increase} &= 80 \text{ kg} - 60 \text{ kg} \\ &= 20 \text{ kg} \\ &= \frac{20}{60} \times 100 = \frac{100}{3} \% = 33\frac{1}{3} \% \end{aligned}$$

$$\begin{aligned} \text{(iv) Increase} &= 10 \text{ hrs} - 8 \text{ hrs} \\ &= 2 \text{ hrs} \\ &\frac{2}{8} \times 100 = 25\% \end{aligned}$$

12. Find the percentage reduction in the following cases :

$$\begin{aligned} \text{(i) reduction} &= 500 - 300 \\ &= 200 \\ &\frac{200}{500} \times 100 = 40\% \end{aligned}$$

$$\begin{aligned} \text{(ii) Reduction} &= 81 - 72 \\ &= 9 \\ &\frac{9}{81} \times 100 = \frac{100}{9} \% = 11\frac{1}{9} \% \end{aligned}$$

$$\begin{aligned} \text{(iii) Reduction} &= 12 - 10 \\ &= 2 \end{aligned}$$

$$\frac{2}{12} \times 100 = \frac{100\%}{6} = 16\frac{2}{3}\%$$

$$\begin{aligned} \text{(iv) Reduction} &= 12 - 10 \\ &= 2 \end{aligned}$$

$$\frac{2}{12} \times 100 = \frac{100\%}{6} = 16\frac{2}{3}\%$$

13. Let the number be x

$$13\% \text{ of } x = 78$$

$$\frac{13}{100} \times x = 78$$

$$x = \frac{78 \times 100}{13}$$

$$= 600$$

14. Let the number be x

$$\frac{25}{4 \times 100} \times x = 3$$

$$x = \frac{3 \times 400}{25} = 48$$

15. Let the number be x

$$\frac{125}{100 \times 10} \times x = 6$$

$$x = \frac{6 \times 1000}{125}$$

$$= 48$$

Exercise 8.3

1. Population of a village = 24000

Percentage of men = 40%

Percentage of women = 30%

Percentage of children = $100\% - (40 + 35)\%$

$$= 100\% - 75\%$$

$$= 25\%$$

$$\text{No. of men} = \frac{40}{100} \times 24000 = 9600$$

$$\text{No. of women} = \frac{35}{100} \times 24000 = 8400$$

$$\text{No. of children} = \frac{25}{100} \times 24000 = 6000$$

2. No. of eggs in a basket = 350

$$\text{No. of rotten eggs} = 12\% \text{ of } 350$$

$$= \frac{12}{100} \times 350$$

$$= 42$$

$$\text{No. of eggs that are good} = 350 - 42$$

$$= 308$$

308 eggs are good enough to be sold.

3. Marks Suhani secures = 600 out of 900

$$\text{Marks Preeti secures} = 650 \text{ out of } 1300$$

$$\text{Percentage of Suhani} = \frac{600}{900} \times 100$$

$$= 66.6\%$$

$$\text{Percentage of Preeti} = \frac{650}{1300} \times 100 = 50\%$$

Suhani's performed better.

4. Percentage of candidates passed = 96%

$$\text{Percentage of candidates failed} = 100 - 96\%$$

$$= 4\%$$

$$\text{Total no. of candidates appeared} = x$$

$$4\% \text{ of } x = 50$$

$$\frac{4}{100} \times x = 50$$

$$x = \frac{50 \times 100}{4}$$

$$= 1250$$

1250 candidates appeared in the examination.

5. Percentage of female workers in a factory = 25%

$$\text{Percentage of male workers in a factory} = 100\% - 25\%$$

$$= 75\%$$

No. of male workers = 360

Total no. of workers = x

$$75\% \text{ of } x = 360$$

$$\frac{75}{100} \times x = 360$$

$$x = \frac{360 \times 100}{75}$$

$$= 480$$

Total workers in a factory are 480.

6. Percentage of nitrogen = 75%

Percentage of sulphur = 10%

$$\text{Percentage of charcoal} = 100\% - (75 + 10)\%$$

$$= 100\% - 85\%$$

$$= 15\%$$

Quantity of charcoal = 15% of 8 kg

$$= \frac{15}{100} \times 84 = \frac{6}{5}$$

$$= 1.2 \text{ kg}$$

8 kg of gunpowder contains 1.2 kg charcoal.

7. Total no. of voters = 80000

Percentage of votes polled = 75%

$$\text{No. of votes polled} = \frac{75}{100} \times 80000 = 60000$$

Percentage of voters polled in favour of $A = 60\%$

No. of votes of $A = 60\%$ of 60000

$$= \frac{60}{100} \times 60000$$

$$= 36000$$

No. of votes of $B = 60000 - 36000$

$$= 24000$$

24000 votes were received by B .

8. Percentage of students pass exam in section A

$$= \frac{45}{60} \times 100$$

$$= 75\%$$

No. of students passed exam in section $B = 50 - 12 = 38$

No. of students passed exam in section B

$$= \frac{38}{50} \times 100 = 76\%$$

Section B has better result.

9. No. of days Imran went school = 220

No. of school days = x

$$80\% \text{ of } x = 220$$

$$\frac{80}{100} \times x = 220$$

$$x = \frac{220 \times 100}{80}$$

$$= 275$$

School was open for 275 days.

10. Total salary of Shalini = ₹1,50,000

Expenditure of Shalini = ₹30,000

Savings of Shalini = ₹(150000 - 30,000)

$$= ₹120,000$$

Amount donated to charitable trust

$$= 15\% \text{ of ₹1,20,000}$$

$$= \frac{15}{100} \times 1,20,000$$

$$= ₹18000$$

Amount recieved by her each daughter and son

$$= \frac{₹(120,000 - 18000)}{3} = \frac{102000}{3}$$

$$= ₹34000$$

Each daughter and son get ₹34000

Exercise 8.4

1. Find the gain or loss per cent when :

(i) CP = ₹ 4000 SP = ₹ 4800

$$SP > CP$$

$$\text{Gain} = SP - CP$$

$$= 4800 - 4000 = 800$$

$$\text{Profit \%} = \frac{\text{Profit}}{CP} \times 100$$

$$= \frac{800}{4000} \times 100$$

$$= 20\%$$

(ii) CP = ₹ 12000 SP = ₹ 9000

$$CP > SP$$

$$\text{Loss} = CP - SP$$

$$= ₹(12000 - 9000)$$

$$= ₹3000$$

$$\text{Loss\%} = \frac{\text{Loss}}{CP} \times 100$$

$$= \frac{3000}{12000} \times 100 = 25\%$$

(iii) CP = ₹ 8510 SP = ₹ 9361

$$SP > CP$$

$$\text{Profit} = SP - CP$$

$$= ₹ 9361 - 8510$$

$$= ₹ 851$$

$$\text{Profit \%} = \frac{\text{Profit}}{CP} \times 100$$

$$= \frac{851}{8510} \times 100$$

$$= 10\%$$

(iv) CP = ₹ 6000 SP = ₹ 5100

$$CP > SP$$

$$\text{Loss} = CP - SP$$

$$\text{Loss} = ₹ (6000 - 5100)$$

$$= ₹ 900$$

$$\text{Loss \%} = \frac{\text{Loss}}{CP} \times 100$$

$$= \frac{900}{6000} \times 100$$

$$= 15\%$$

2. Find SP when :

(i) $SP = \frac{100 + \text{Profit \%}}{100} \times CP$

$$= \frac{100 + 5\%}{100} \times 500$$

$$= \frac{105}{100} \times 500$$

$$= ₹ 525$$

$$(ii) \quad CP = 900 \quad \text{Loss} = 6\frac{2}{3}\%$$

$$SP = \frac{100 - \text{Loss}\%}{100} \times CP$$

$$= \frac{100 - \frac{20}{3}}{100} \times 900$$

$$= \left(\frac{300 - 20}{3} \right) \times 3$$

$$= 280 \times 3$$

$$= ₹ 840$$

3. Find CP when :

$$(i) \quad SP = ₹ 5000, \text{ Gain} = 10\%$$

$$CP = \frac{100}{100 + \text{Profit}} \times SP$$

$$= \frac{100}{100 + 10} \times 5000$$

$$= \frac{100}{110} \times 5000 = \frac{50000}{11}$$

$$= ₹ 4545.45$$

$$(ii) \quad SP = ₹ 5600, \quad \text{Loss} = 6\frac{2}{3}\% = \frac{20}{3}\%$$

$$CP = \frac{100}{100 - \text{Loss}\%} \times SP$$

$$= \frac{100}{100 - \frac{20}{3}} \times 5600$$

$$= \frac{100}{\left(\frac{300 - 20}{3} \right)} \times 5600$$

$$\begin{aligned}
 &= \frac{100}{280} \times 5600 \\
 &= \frac{100 \times 3}{280} \times 5600 \\
 &= ₹ 6000
 \end{aligned}$$

$$\begin{aligned}
 \text{4. CP of the car} &= ₹ 68000 + ₹ 12000 \\
 &= ₹ 80000
 \end{aligned}$$

$$\text{SP of the car} = ₹ 95000$$

$$\text{Gain} = \text{SP} - \text{CP}$$

$$\begin{aligned}
 &= ₹ (95000 - 80000) \\
 &= ₹ 15000
 \end{aligned}$$

$$\begin{aligned}
 \text{Gain\%} &= \frac{\text{Gain}}{\text{CP}} \times 100 \\
 &= \frac{15000}{80000} \times 100 \\
 &= \frac{75}{4} \% \\
 &= 18.75\%
 \end{aligned}$$

$$\begin{aligned}
 \text{5. CP of stereo} &= ₹ (5863 + 137) \\
 &= ₹ 6000
 \end{aligned}$$

$$\text{SP of stereo} = ₹ 5700$$

$$\text{Loss} = \text{CP} - \text{SP}$$

$$\begin{aligned}
 &= ₹ (6000 - 5700) \\
 &= ₹ 300
 \end{aligned}$$

$$\begin{aligned}
 \text{Loss \%} &= \frac{\text{Loss}}{\text{CP}} \times 100 \\
 &= \frac{300}{6000} \times 100 \\
 &= 5\%
 \end{aligned}$$

6. Let the CP of room heater be x

SP of room heater = ₹ 322

$$\text{Gain} = \frac{1}{6}x$$

Selling price = CP + Gain

$$322 = x + \frac{1}{6}x$$

$$322 = \frac{6x + 1x}{6}$$

$$\frac{322 \times 6}{7} = x$$

$$276 = x$$

CP of room heater = ₹ 276

$$\text{Gain} = \frac{1}{6} \times 276$$

$$= \frac{46}{276} \times 100$$

$$= \frac{1}{3} \times 50 = \frac{50}{3} = 16.6\%$$

7. Let the SP of balls be ₹ 1

So the SP of 15 balls = ₹ 15

According to question

Selling price of 2 balls = Cost price of 15 balls

$$= ₹ 12$$

SP = ₹ 15

CP = ₹ 12

$$\text{SP} > \text{CP}$$

Gain = SP – CP

$$= 15 - 12$$

$$= 3$$

$$\text{Gain\%} = \frac{\text{Gain}}{\text{CP}} \times 100$$

$$= \frac{3}{12} \times 100$$

$$= 25\%$$

8. Selling price of an article = ₹ 368

$$\text{Loss \%} = 8\%$$

$$\text{Cost price of article} = \frac{100}{100 - \text{Loss\%}} \times \text{SP}$$

$$= \frac{100}{100 - 8} \times 368$$

$$= \frac{100}{92} \times 368$$

$$= \frac{100 \times 368}{92} = 400$$

$$\text{CP} = ₹ 400$$

SP when gain 10%

$$\text{SP} = \frac{100 + \text{Gain\%}}{100} \times \text{CP}$$

$$= \frac{100 + 10}{100} \times 400$$

$$= \frac{110}{100} \times 400$$

$$\text{SP} = ₹ 440$$

9. Cost price of 400 eggs = ₹ 400

$$\text{No. of eggs break} = 400 - 25 = 375$$

$$\text{Selling price of 375 eggs} = 375 \times ₹ 1.20$$

$$= ₹ 450$$

$$\text{SP} > \text{CP}$$

$$(i) \quad \text{Profit} = \text{SP} - \text{CP}$$

$$= 450 - 375 = 75$$

$$(ii) \quad \text{Profit \%} = \frac{\text{Profit}}{\text{CP}} \times 100 = \frac{75}{400} \times 100$$

$$= 19\%$$

10. 12 pen, 1 dozen

$$1 \text{ pen} = \frac{1}{12} \text{ dozen}$$

$$2400 \text{ pens} = \frac{2400}{12} \text{ dozen}$$

$$\text{Cost price of a dozen} = ₹15$$

$$\begin{aligned} \text{Cost price of 200 dozen} &= ₹15 \times 200 \\ &= ₹3000 \end{aligned}$$

He sold 1050 pens at 5 for ₹8

Number of sets of 5 pens in 1050 pens is

$$\frac{1050}{5} = 210$$

$$\begin{aligned} \text{Selling price of 1050 pens} &= 210 \times 8 \\ &= ₹1680 \end{aligned}$$

$$\begin{aligned} \text{Remaining pens} &= 2400 - 1050 \\ &= 1350 \text{ pens} \end{aligned}$$

$$\begin{aligned} \text{Selling price of 1350 pens} &= 1350 \times ₹2 \\ &= ₹2700 \end{aligned}$$

$$\begin{aligned} \text{Total selling price} &= ₹2700 + ₹1680 \\ &= ₹4380 \end{aligned}$$

$$\begin{aligned} \text{Profit} &= \text{SP} - \text{CP} \\ &= 4380 - 3000 \\ &= 1380 \end{aligned}$$

$$\begin{aligned} \text{Profit \%} &= \frac{\text{Profit}}{\text{CP}} \times 100 \\ &= \frac{1380}{3000} \times 100 \\ &= 46\% \end{aligned}$$

11. Selling price of each article = ₹2376

Gain % = 10%

$$SP = CP + 10\% \text{ of } CP$$

$$2376 = x + \frac{10x}{100}$$

$$2376 = \frac{100x + 10x}{100}$$

$$\frac{2376 \times 100}{110} = x$$

$$= ₹2160$$

$$CP = ₹2160$$

Selling price of another article = ₹2376

Loss% = 10%

$$SP = CP - 10\% \text{ of } CP$$

$$2376 = x - \frac{10x}{100}$$

$$2376 = \frac{100x - 10x}{100}$$

$$2376 = \frac{90x}{100}$$

$$\frac{2376 \times 100}{90} = x$$

$$2640 = x$$

$$CP = ₹2640$$

Total cost price = (2160 + 2640) = ₹4800

Total selling price = ₹(2376 + 2376)

$$= ₹4752$$

$$\text{Loss} = CP - SP$$

$$= 4800 - 4752$$

$$= 48$$

$$\text{Loss \%} = \frac{\text{Loss}}{CP} \times 100$$

$$= \frac{48}{4800} \times 100$$

$$= 1\%$$

12. Retail price of geyser = ₹15741

Manufacturer's profit = 6%

Wholesaler's profit = 8%

Retailer's profit = 10%

Let product cost of geyser be x

SP of manufacturer = $x + 6\%$ of x

$$= x + \frac{6x}{100}$$

$$= \frac{100x + 6x}{100}$$

$$= \frac{106x}{100} = ₹ \frac{53}{50} x$$

SP of wholesaler 108% of $\frac{53x}{50}$

$$= \frac{108}{100} \times \frac{53x}{50}$$

$$= ₹ \frac{1431x}{1250}$$

SP of retailer = 110% of $\frac{1431x}{1250}$

$$= \frac{110}{100} \times \frac{1431x}{1250}$$

$$15741 = \frac{15741x}{12500}$$

$$x = \frac{15741}{15741} \times 12500$$

$$x = ₹12500$$

Cost of production is ₹12500

Exercise 8.5

1. Calculate the simple interest and amount when :

$$(i) \quad SI = \frac{P \times R \times T}{100} = \frac{3500 \times 5 \times 3}{100}$$

$$= ₹ 525$$

$$\begin{aligned} \text{Amount} &= P + I \\ &= 3500 + 525 \\ &= ₹ 4025 \end{aligned}$$

$$(ii) \quad SI = \frac{P \times R \times T}{100} = \frac{10000 \times \frac{15}{2} \times \frac{5}{2}}{100}$$

$$= \frac{2500 \times 15 \times 5}{100}$$

$$= ₹ 1875$$

$$\begin{aligned} \text{Amount} &= P + I \\ &= 10000 + 1875 \\ &= ₹ 11875 \end{aligned}$$

$$(iii) \quad SI = \frac{P \times R \times T}{100}$$

$$= \frac{5000 \times 8 \times \frac{39}{12}}{100}$$

$$= \frac{13000}{100} = 130$$

$$\begin{aligned} \text{Amount} &= P + I \\ &= 5000 + 130 \\ &= ₹ 5130 \end{aligned}$$

$$(iv) \quad SI = \frac{P \times R \times T}{100}$$

$$\begin{aligned}
 &= \frac{9600 \times 9 \times \frac{146}{365}}{100} \\
 &= \frac{34560}{100} = ₹ 345.6
 \end{aligned}$$

$$\begin{aligned}
 A &= P + I \\
 &= 9600 + 345.6 \\
 &= 9945.6
 \end{aligned}$$

2. In how many days will the interest on :

(i) $P = 1500$ $I = 16.50$ $R = 6.5$

$$SI = \frac{P \times R \times T}{100}$$

$$16.50 = \frac{1500 \times 5.5 \times T}{100}$$

$$\frac{1650 \times 100 \times 10}{150 \times 55 \times 100} = \frac{11}{55}$$

$$\begin{aligned}
 \text{Days} &= \frac{11}{55} \times 365 \\
 &= 73
 \end{aligned}$$

(ii) $SI = \frac{P \times R \times T}{100}$

$$60.80 = \frac{3800 \times 4 \times T}{100}$$

$$\frac{60.80 \times 100}{3800 \times 4} = T$$

$$0.4 = T$$

$$\text{Days} = 0.4 \times 365 = 146 \text{ days}$$

3. $P = ?$ $A = 5525$ $R = 10\%$

$$SI = \frac{P \times R \times T}{100} = \frac{P \times 10 \times 3}{100}$$

$$SI = \frac{3P}{10}$$

$$A = SI + P$$

$$5525 = \frac{3P}{10} + P$$

$$5525 = \frac{3P + 10P}{10}$$

$$\frac{5525 \times 10}{13} = P$$

$$P = ₹4250$$

4. $T = ?$ $P = ₹4500$ $A = ₹5715$ $R = 9\%$

$$A = P + I$$

$$5715 = 4500 + I$$

$$I = 5715 - 4500$$

$$= 1215$$

$$SI = \frac{P \times R \times T}{100}$$

$$1215 = \frac{4500 \times 9 \times T}{100}$$

$$\frac{1215 \times 100}{4500 \times 9} = T$$

$$T = 3 \text{ years}$$

5. $P = ₹3600$ $A = ₹4320$ $T = \frac{5}{2} \text{ years}$

$$A = P + I$$

$$4320 = 3600 + I$$

$$I = 4320 - 3600$$

$$= 720$$

$$SI = \frac{P \times R \times T}{100}$$

$$720 = \frac{3600 \times R \times \frac{5}{2}}{100}$$

$$\frac{720 \times 100}{3600 \times \frac{5}{2}} = R$$

$$\frac{20 \times 2}{5} = R$$

8% = Rate

6. $P = ₹8000$

$R = 11\%$

$A = ₹9760$

Decreased interest rate = $11\% - 2\% = 9\%$

$$A = P + I$$

$$9760 = 8000 + I$$

$$I = 9760 - 8000$$

$$= 1760$$

$$SI = \frac{P \times R \times T}{100}$$

$$1760 = \frac{8000 \times 11 \times T}{100}$$

$$\frac{1760 \times 100}{8000 \times 11} = T$$

$$T = 2 \text{ years}$$

$$SI = \frac{P \times R \times T}{100}$$

$$= \frac{8000 \times 9 \times 2}{100}$$

$$= 1440$$

$$A = I + P$$

$$= 1440 + 8000$$

$$A = ₹9440$$

7. Let the sum be x

$$\text{Amount} = \frac{8}{5}x$$

$$T = 5 \text{ years}$$

$$SI = A - P$$

$$= \frac{8}{5}x - x$$

$$= \frac{8x - 5x}{5} = \frac{3x}{5}$$

$$SI = \frac{P \times R \times T}{100}$$

$$\frac{3x}{5} = \frac{x \times R \times 5}{100}$$

$$\frac{3 \times 100}{5 \times 5 \times x} = R$$

$$R = 12\%$$

8. $A = SI + P$

$$\text{For 2 years} = 783$$

$$\text{For 3 years} = 837$$

$$SI \text{ for 1 year} = 3$$

$$837 - 783 = ₹ 54$$

$$P = A - SI$$

$$= 783 - (54 \times 2)$$

$$= 783 - 108$$

$$P = ₹ 675$$

$$SI = \frac{P \times R \times T}{100}$$

$$108 = \frac{675 \times R \times 2}{100}$$

$$\frac{108 \times 100}{675 \times 2} = R = \frac{36 \times 10}{45}$$

$$R = 8\%$$

$$\begin{aligned}
 9. \text{ SI} &= \frac{P \times R \times T}{100} \\
 &= \frac{25000 \times 10 \times \frac{7}{2}}{100} \\
 &= 250 \times 5 \times 7 \\
 &= 8750 \\
 A &= P + SI \\
 &= 25000 + 8750 \\
 &= 33750
 \end{aligned}$$

$$\begin{aligned}
 \text{Value of two cows} &= \text{Total amount} - \text{cash} \\
 &= 33750 - 18750 \\
 &= ₹15000
 \end{aligned}$$

The value of two cows is ₹15000

10. Let principal be P

Rate be R

Time = 2 years

$$\begin{aligned}
 \text{SI} &= \frac{P \times R \times T}{1000} \\
 &= \frac{P \times (R + 1) \times 2}{100} - \frac{P \times R \times 2}{100} = 24 \\
 &= 2P \left[\frac{R + 1}{100} - \frac{R}{100} \right] = 24 \\
 &= P \left[\frac{R + 1}{100} - \frac{R}{100} \right] = 12 \\
 &= P \left[\frac{R + 1 - R}{100} \right] = 12 \\
 &= P \left[\frac{1}{100} \right] = 12
 \end{aligned}$$

$$P = 1200$$

$$P = ₹1200$$

11. $P = 6000$

$$SI = \frac{P \times R \times T}{100}$$

$$= \frac{6000 \times 6 \times \frac{146}{365}}{100}$$

$$= \frac{60 \times 6 \times 146}{365}$$

$$I = ₹144$$

$$A = P + I$$

$$= 6000 + 144$$

$$= ₹6144$$

12. $SI_1 = \frac{P \times R \times T_1}{100}$

$$= \frac{30000 \times 8 \times 3}{100}$$

$$SI_1 = 300 \times 8 \times 3 = 7200$$

$$SI_2 = \frac{P \times R \times T_2}{100}$$

$$= \frac{30000 \times 8 \times 5}{100}$$

$$SI_2 = 300 \times 8 \times 5 = 12000$$

$$\text{Difference} = SI_2 - SI_1$$

$$= 12000 - 7200$$

$$= 4800$$

The difference in interest paid is ₹4800

MCQs

1.	(d)	2.	(a)	3.	(b)	4.	(b)	5.	(d)	6.	(b)
----	-----	----	-----	----	-----	----	-----	----	-----	----	-----

7.	(a)	8.	(a)	9.	(b)	10.	(c)	11.	(b)	12.	(b)
----	-----	----	-----	----	-----	-----	-----	-----	-----	-----	-----

$$1. \frac{25}{2 \times 100} \times x = 150$$

$$\frac{1}{8} \times x = 150$$

$$x = 150 \times 8 = 1200$$

$$2. \frac{35}{100} \times x + 39 = x$$

$$\frac{35x}{100} + 39 = x$$

$$39 = x - \frac{35x}{100}$$

$$39 = \frac{100x - 35x}{100}$$

$$39 = \frac{65x}{100}$$

$$\frac{39 \times 100}{65} = x$$

$$60 = x$$

3. Let original price of tea set be x

$$\text{Increased price} = x \times \left(\frac{5}{100} \right) = \frac{5}{100} x$$

$$x + \frac{5}{100} x = 441$$

$$\frac{100x + 5x}{100} = 441$$

$$\frac{105x}{100} = 441$$

$$x = \frac{441 \times 100}{105}$$

$$= ₹ 420$$

4. Loss% = 8

$$SP = 8510$$

$$CP = \left(\frac{100}{100 - 8} \right) \times 8510$$

$$\frac{100}{92} \times 8510 = ₹ 9250$$

5. Let x be SP of one apple

$$SP \text{ of } 48 \text{ apples} = 48x$$

$$\text{Loss} = 6x$$

$$CP = SP + \text{Loss}$$

$$= 48x + 6x$$

$$= 54x$$

$$\text{Loss\%} = \frac{\text{Loss}}{CP} \times 100$$

$$= \frac{6x}{54x} \times 100$$

$$= \frac{1}{9} \times 100$$

$$= 11.11\%$$

6. Let SP be selling price of one chocolate

$$\text{Let } CP \text{ be cost price of one chocolate}$$

$$15 SP = 12 CP$$

$$SP = \frac{12}{15} CP$$

$$\text{Loss} = CP - SP$$

$$= CP - \frac{12}{15} CP$$

$$= \frac{1}{5} CP$$

$$\begin{aligned}\text{Loss\%} &= \frac{\text{Loss}}{\text{CP}} \times 100 \\ &= \frac{\frac{1}{5} \text{CP}}{\text{CP}} \times 100 \\ &= 20\end{aligned}$$

8. Let CP of jug = x

SP of jug = ₹144

$$\text{Loss} = \frac{1}{7} \text{ of } x = \frac{x}{7}$$

$$\text{Loss} = \text{CP} - \text{SP}$$

$$\frac{x}{7} = x - 144$$

$$\frac{x}{7} - x = -144$$

$$\frac{x - 7x}{7} = -144$$

$$\frac{-6x}{7} = -144$$

$$x = \frac{144 \times 7}{6}$$

$$x = 168$$

New SP = ₹189

$$\text{Gain} = \text{SP} - \text{CP}$$

$$= ₹(189 - 168) = ₹21$$

$$\text{Gain \%} = \frac{\text{Gain}}{\text{CP}} \times 100 = \frac{21}{168} \times 100$$

$$= 12.5\%$$

9. $I = 8360 - 8000 = 360$

$$I = \frac{P \times R \times T}{100}$$

$$360 = \frac{8000 \times 6 \times T}{100}$$

$$\frac{360 \times 100}{8000 \times 6} = \frac{6}{8} = 9 \text{ months}$$

10. $A:B = 2:3$ $B:C = 7:8$

LCM of 3 & 7 = 21

$A:B = 2:3$ by $\frac{7}{3}$ to get a B value of 21

$$2:3 = 2 \times \frac{7}{3} : 3 \times \frac{7}{3} = 14:21$$

$$7:8 = 7 \times \frac{3}{8} : 8 \times \frac{3}{8} = 21:24$$

$$A:B:C = 14:21:24$$

11. $P = 6000$ $A = 6144$ $I = A - P$ $R = 6$

$$I = \frac{P \times R \times T}{100}$$

$$= 6144 - 6000$$

$$144 = \frac{600 \times 6 \times T}{100} \quad = 144$$

$$= \frac{144 \times 100}{600 \times 6} = T$$

$$= 146 \text{ days}$$

12. $SI = \frac{2}{5}P$

$$T = 5$$

$$SI = \frac{P \times R \times T}{100}$$

$$\frac{2}{5}P = \frac{P \times R \times 5}{100}$$

$$\frac{2P \times 100}{5 \times P \times 5} = 8\%$$

Fill in the blanks

1. cost price
2. cost price
3. principal
4. 133.33%
5. product of means
6. 450
7. 1 : 3 : 6
8. principal, simple interest

4. $x - \frac{10x}{100} = 120$

$$\frac{90x}{100} = 120$$

$$x = 133.33$$

6. $\frac{11}{100}x - \frac{7}{100}x$

$$\frac{4x}{100} = 18$$

$$x = \frac{18 \times 100}{4} = 450$$

7. $B = 3A$

$$C = 2B$$

$$C = 2(3A)$$

$$C = 6A$$

$$A : B : C = 1 : 3 : 6$$

9

Lines and Angles

Exercise 9.1

1. Write the complementary angle of the following :

- (i) Complement of $37^\circ = 90^\circ - 37^\circ$
 $= 53^\circ$
- (ii) Complement of $29^\circ = 90^\circ - 29^\circ$
 $= 61^\circ$
- (iii) Complement of $\frac{1}{3} \times 90^\circ = 90^\circ - \left(\frac{1}{3} \times 90^\circ\right)$
 $= 90^\circ - 30^\circ$
 $= 60^\circ$
- (iv) Complement of $\frac{2}{5}$ of $70^\circ = 90^\circ - \left(\frac{2}{5} \times 70^\circ\right)$
 $= 90^\circ - 28^\circ$
 $= 62^\circ$
- (v) Complement of $72^\circ = 90^\circ - 72^\circ$
 $= 18^\circ$
- (vi) Complement of $56^\circ = 90^\circ - 56^\circ$
 $= 34^\circ$
- (vii) Complement of $x^\circ = (90 - x)^\circ$
- (viii) Complement of $20^\circ + y^\circ = 90^\circ - (20^\circ + y)$
 $= 90^\circ - 20 - y$
 $= 70^\circ - y^\circ$

2. Write the supplementary angles of the following :

- (i) Supplement of $85^\circ = 180^\circ - 85^\circ$
 $= 95^\circ$
- (ii) Supplement of $127^\circ = 180^\circ - 127^\circ$
 $= 53^\circ$
- (iii) Supplement of $156^\circ = 180^\circ - 156^\circ$
 $= 24^\circ$
- (iv) Supplement of $\frac{1}{3}$ of $120^\circ = 180^\circ - \left(\frac{1}{3} \times 120^\circ\right)$
 $= 180^\circ - 40^\circ$

$$= 140^\circ$$

$$\begin{aligned} \text{(v) Supplement of } \frac{3}{5} \text{ of } 140^\circ &= 180^\circ - \left(\frac{3}{5} \times 140^\circ \right) \\ &= 180^\circ - (3 \times 28)^\circ \\ &= 96^\circ \end{aligned}$$

$$\text{(vi) Supplement of } x^\circ = (180 - x)^\circ$$

$$\begin{aligned} \text{(vii) Supplement of } 20^\circ + y^\circ &= 180^\circ - (20^\circ + y^\circ) \\ &= 180^\circ - 20^\circ - y^\circ \\ &= (160^\circ - y) \end{aligned}$$

$$\begin{aligned} \text{(viii) Supplement of 2 right angles} &= 180^\circ - 2 \times 90^\circ \\ &= 180^\circ - 180^\circ \\ &= 0 \end{aligned}$$

3. Let the angle be x

$$\text{Complementary angle} = 90^\circ - x$$

$$(90^\circ - x) - x = 12^\circ$$

$$90^\circ - x - x = 12^\circ$$

$$90^\circ - 2x = 12^\circ$$

$$2x = 90^\circ - 12^\circ$$

$$2x = 78^\circ$$

$$x = \frac{78^\circ}{2}$$

$$= 39^\circ$$

$$\text{Complementary angle} = 90^\circ - x$$

$$= 90^\circ - 39^\circ = 51^\circ$$

4. Let the angle be x

$$\text{Supplement} = (180 - x)^\circ$$

$$2(180^\circ - x) - 45^\circ = x$$

$$360^\circ - 45^\circ = x + 2x$$

$$315^\circ = 3x$$

$$\frac{315^\circ}{3} = x$$

Supplementary angle $180^\circ - 105^\circ = 75^\circ$

5. Let the angle be x

Supplementary angle $= 180^\circ - x$

$$3(180^\circ - x) = x$$

$$3 \times 180^\circ - 3 \times x = x$$

$$3 \times 180^\circ = x + 3x$$

$$3 \times 180^\circ = 4x$$

$$\frac{3 \times 180^\circ}{4} = x$$

$$x = 135^\circ$$

6. Let the angle be x

Complement $= 90^\circ - x$

$$x = 90^\circ - x$$

$$x + x = 90^\circ$$

$$2x = 90^\circ$$

$$x = \frac{90}{2}; \quad x = 45^\circ$$

7. Let the angle be x

Supplementary angle $= 180^\circ - x$

$$x = 180^\circ - x$$

$$x + x = 180^\circ$$

$$2x = 180^\circ$$

$$x = \frac{180^\circ}{2} \Rightarrow x = 90^\circ$$

8. Let the angles be $4x$ and $5x$

$$4x + 5x = 180^\circ$$

$$9x = 180^\circ$$

$$x = \frac{180^\circ}{9} \Rightarrow x = 20^\circ$$

Angles

$$4x = 4 \times 20^\circ = 80^\circ$$

$$5x = 5 \times 20^\circ = 100^\circ$$

$$9. \quad x + 68^\circ = 180^\circ \quad (\text{Linear pair})$$

$$x = 180^\circ - 68^\circ$$

$$= 112^\circ$$

$$10. \quad a + 40^\circ = 95^\circ \quad (\text{Vertically opposite angles})$$

$$a = 95^\circ - 40^\circ$$

$$a = 55^\circ$$

$$b + 30^\circ + 95^\circ = 180^\circ \quad (\text{Linear pair})$$

$$b + 125^\circ = 180^\circ$$

$$b = 180^\circ - 125^\circ$$

$$b = 55^\circ$$

$$11. \quad 3x + 7^\circ + x + 5^\circ + 40^\circ = 180^\circ \quad (\text{Linear pair})$$

$$4x + 52^\circ = 180^\circ$$

$$4x = 180^\circ - 52^\circ$$

$$4x = 128^\circ$$

$$x = \frac{128}{4} = 32^\circ$$

$$(i) \quad \angle POR + \angle ROM + \angle MOQ = 180^\circ \quad (\text{Linear pair})$$

$$\angle POR + (3 \times 32 + 7)^\circ + (32 + 5)^\circ = 180^\circ$$

$$\angle POR + 103^\circ + 37^\circ = 180^\circ$$

$$\angle POR + 140^\circ = 180^\circ$$

$$\angle POR = 180^\circ - 140^\circ$$

$$\angle POR = 40^\circ$$

$$(ii) \quad \begin{aligned} \angle POS &= 360^\circ - (\angle POR + \angle ROM + \angle MOQ + \angle QOS) \\ &= 360^\circ - (40^\circ + 103^\circ + 37^\circ + 40^\circ) \end{aligned}$$

$$= 360^\circ - 220^\circ$$

$$= 140^\circ$$

$$(iii) \quad \angle ROM = (3x + 7)^\circ$$

$$= 3 \times 32 + 7$$

$$= 103^\circ$$

$$12. \quad (3x + 15)^\circ + (2x + 5)^\circ = 180^\circ$$

$$3x + 15 + 2x + 5 = 180^\circ$$

$$5x = 180^\circ - 20^\circ$$

$$5x = 160^\circ$$

$$x = \frac{160^\circ}{5} = 32^\circ$$

$$13. \quad \angle AOD + \angle COD + \angle BOC = 180^\circ$$

$$(x + 7)^\circ + (2x + 90)^\circ + (2x + 13)^\circ = 180^\circ$$

$$x + 7 + 2x + 90 + 2x + 13 = 180^\circ$$

$$5x + 110^\circ = 180^\circ$$

$$5x = 180^\circ - 110^\circ$$

$$5x = 70^\circ$$

$$x = \frac{70}{5} \Rightarrow x = 14$$

$$\angle AOD = (14 + 7)^\circ = 21^\circ$$

$$\angle COD = (2 \times 14 + 90)^\circ = 118^\circ$$

$$\angle BOC = (2 \times 14 + 13)^\circ = 41^\circ$$

$$14. \quad 2x + 120^\circ + x + 15^\circ = 180^\circ$$

$$3x + 135^\circ = 180^\circ$$

$$3x = 180 - 135^\circ$$

$$3x = 45^\circ$$

$$x = \frac{45^\circ}{3} = 15^\circ$$

$$\angle AOB = \angle DOE \quad (\text{Vertically opposite angles})$$

$$\angle AOB = x + 15^\circ$$

$$\begin{aligned}
 &= 15 + 15^\circ \\
 &= 30^\circ \\
 \angle AOF &= \angle COD && \text{(Vertically opposite angles)} \\
 \angle AOF &= 120^\circ \\
 \angle EOF &= \angle BOC && \text{(Vertically opposite angles)} \\
 \angle EOF &= 2x \\
 &= 2 \times 15 = 30^\circ
 \end{aligned}$$

Exercise 9.2

1. Identify each given pair of angles as alternate interior angles, corresponding angles, alternate angles or none of these.

- (a) (i) corresponding angles (ii) none of these (iii) alternate interior angles (iv) corresponding angles (v) alternate exterior angles
- (b) (i) corresponding angles (ii) alternate interior angles (iii) alternate exterior angles (iv) none of these

2. In the adjoining fig. 32, identify the following :

- (i) $\angle 2$ and $\angle 6$ (ii) $\angle 3$ (iii) $\angle 6$ (iv) $\angle 7$ (v) $\angle 3$ and $\angle 6$ (vi) $\angle 1$ and $\angle 2$ (vii) $\angle 1$ and $\angle 3$

3. $(2x - 3) + (3x - 2) = 180^\circ$

$$2x - 3 + 3x - 2 = 180^\circ$$

$$5x - 5 = 180^\circ$$

$$5x = 180 + 5$$

$$5x = 185^\circ$$

$$x = \frac{185^\circ}{5} = 37^\circ$$

4. $\angle 1 = 60^\circ$

$$\angle 3 = \angle 1$$

(Vertically opposite angles)

$$\angle 3 = 60^\circ$$

$$\begin{aligned}\angle 2 &= (180^\circ - \angle 1) \\ &= (180^\circ - 60^\circ) \\ &= 120^\circ\end{aligned}$$

5. $\angle ABC = 65^\circ$

$$\angle BAC = 55^\circ$$

$$\angle ACE = \angle BAC \quad (\text{Alternate interior angles})$$

$$\angle ACE = 55^\circ$$

$$\angle ABC = \angle ECD$$

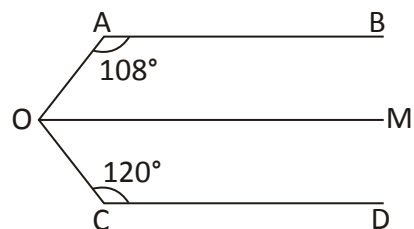
$$\angle ECD = 65^\circ \quad (\text{Corresponding angles})$$

$$\angle ACD = \angle ACE + \angle ECD$$

$$= 55^\circ + 65^\circ$$

$$= 120^\circ$$

6.



Draw $OM \parallel AB \& CD$

$$\angle AOM + \angle OAB = 180^\circ$$

$$\angle AOM + 108^\circ = 180^\circ$$

$$\angle AOM = 180^\circ - 108^\circ$$

$$= 72^\circ$$

$$\angle COM + \angle OCD = 180^\circ$$

$$\angle COM + 120^\circ = 180^\circ$$

$$\angle COM = 180^\circ - 120^\circ$$

$$= 60^\circ$$

$$\angle AOC = \angle AOM + \angle COM$$

$$= 72^\circ + 60^\circ$$

$$= 132^\circ$$

7. $\angle B = 65^\circ$

$\angle C = 45^\circ$

$\angle DAB = x^\circ$

$\angle EAC = y^\circ$

$\angle DAB = \angle ABC$ (Alternate interior angle)

$\angle DAB = 65^\circ = x$

$\angle EAC = \angle ACB$ (Alternate interior angle)

$\angle EAC = 45^\circ = y^\circ$

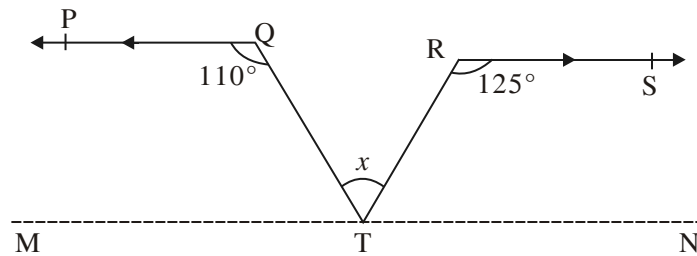
8. $\angle DEC = b$

$b = 45^\circ$ (Alternate interior angle)

$\angle EDC = a$

$a = 35^\circ$ (Alternate interior angle)

9.



Draw a line MN parallel to PQ and RS

$\angle PQT + \angle QTM = 180^\circ$

$110^\circ + \angle QTM = 180^\circ$

$\angle QTM = 180^\circ - 110^\circ$

$= 70^\circ$

$\angle TRS + \angle RTN = 180^\circ$

$125^\circ + \angle RTN = 180^\circ$

$\angle RTN = 180^\circ - 125^\circ$

$= 55^\circ$

$\angle QTM + x + \angle RTN = 180^\circ$

$70^\circ + x + 55^\circ = 180^\circ$

$$x = 180 - 70^\circ - 55^\circ$$

$$x = 55^\circ$$

10. $120^\circ + x = 180^\circ$

$$x = 180^\circ - 120^\circ$$

$$x = 60^\circ$$

$$x + y + 90^\circ = 180^\circ$$

$$60 + y + 90^\circ = 180^\circ$$

$$y = 180^\circ - 150^\circ$$

$$y = 30^\circ$$

$$z + y = 180^\circ$$

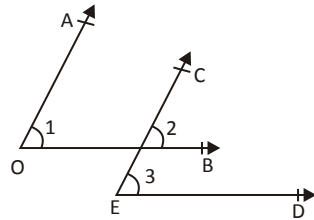
$$z + 30^\circ = 180^\circ$$

$$z = 180^\circ - 30^\circ$$

$$z = 150^\circ$$

11. $OA \parallel EC$, $OB \parallel ED$

To prove $\angle AOB = \angle CED$



$\angle 1$ and $\angle 2$ are corresponding angles

$$\angle 1 = \angle 2 \quad \dots(1)$$

$\angle 2$ and $\angle 3$ are corresponding angles

$$\angle 2 = \angle 3 \quad \dots(2)$$

from (1) & (2)

$$\angle 1 = \angle 3$$

$$\angle AOB = \angle CED \quad (\text{Hence proved})$$

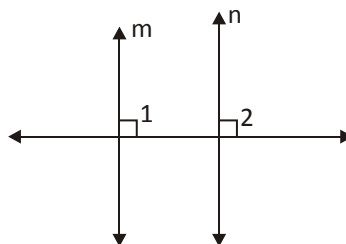
12. $\angle 1 = 90^\circ$

$\angle 2 = 90^\circ$

$\angle 1 = \angle 2$

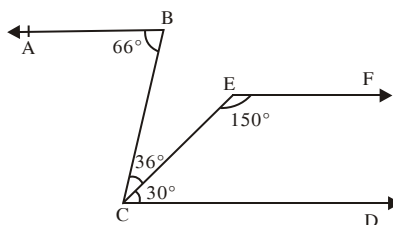
But these angles form a pair of equal corresponding angles so.

$m \parallel n$



13. $x = 75^\circ$ (Alternate interior angles as $PQ \parallel RS$)

14. Produce EF to intersect BC at C



$\angle DCE + \angle CEF = 180^\circ$

So $EF \parallel CD$

...(1)

$\angle ABC = \angle BCD = 66^\circ$

(Alternate angles are equal)

$AB \parallel CD$

...(2)

From (1) & (2)

$AB \parallel EF$

15. $x + 125^\circ = 180^\circ$

$x = 180^\circ - 125^\circ$

$x = 55^\circ$

$x + z = 180^\circ$

$55^\circ + z = 180^\circ$

$z = 180^\circ - 55^\circ = 125^\circ$

$y + x = 180^\circ$

$y + 55^\circ = 180^\circ$

$y = 180^\circ - 55^\circ$

$y = 125^\circ$

MCQs

1.	(b)	2.	(a)	3.	(c)	4.	(d)	5.	(a)	6.	(c)
7.	(a)	8.	(b)	9.	(d)	10.	(c)	11.	(c)	12.	(d)

8. $5x + 7x = 180^\circ$

$$12x = 180^\circ$$

$$x = \frac{180}{12} \Rightarrow x = 15^\circ$$

$$5 \times 15 = 75^\circ$$

$$7 \times 15 = 105^\circ$$

9. $x + 40 + y + 10^\circ = 180^\circ$

$$x + y + 50^\circ = 180^\circ$$

$$x + y = 180^\circ - 50^\circ$$

$$x + y = 130^\circ$$

10. Complement of $87^\circ = 90^\circ - 87^\circ = 3^\circ$

Fill in the blanks

1. Adjacent angles 2. Intersect 3. 90°
 4. Supplementary angles 5. 360° 6. equal

True or False

1. True 2. True 3. False
 4. False 5. False 6. False

10

Triangle and Its Properties

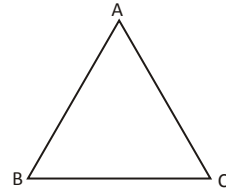
Exercise 10.1

1. **Triangular Region:** The region enclosed by triangle is called triangular region.

Triangle : A triangle is a polygon with three sides, three vertices and three angles.

2. Explain the following terms:

- (i) A triangle is a polygon with three sides, three vertices and three angles.
- (ii) Basic elements of $\triangle ABC$ are :
 Sides : AB, BC, CA
 Angles : $\angle ABC, \angle BAC, \angle ACB$
 Vertices : A, B, C
- (iii) A scalene triangle is a triangle with all three sides of different lengths.
- (iv) A right-angled triangle is a triangle in which any one of the angles is equal to 90°
- (v) The region inside a triangle is called interior of a triangle.
- (vi) The region outside a triangle is called exterior of a triangle.



3. Is it possible to have a triangle, in which

- (i) No (ii) Yes (iii) No (iv) No (v) No

4. Median = AE , Altitude = AD

5. $\angle A + \angle B + \angle C = 180^\circ$

$$30^\circ + 70^\circ + \angle C = 180^\circ$$

$$100^\circ + \angle C = 180^\circ$$

$$\angle C = 180^\circ - 100^\circ$$

$$= 80^\circ$$

6. $\angle A = 30^\circ$ $\angle B = 50^\circ$

$$\angle A + \angle B + \angle C = 180^\circ$$

$$30^\circ + 50^\circ + \angle C = 180^\circ$$

$$80^\circ + \angle C = 180^\circ$$

$$\angle C = 180^\circ - 80^\circ$$

$$= 100^\circ$$

7. Let the angle be $5x, 3x$ and $1x$

$$5x + 3x + 1x = 180^\circ$$

$$9x = 180^\circ$$

$$x = \frac{180^\circ}{9}$$

$$x = 20^\circ$$

Angles :

$$5x = 5 \times 20 = 100^\circ$$

$$3x = 3 \times 20 = 60^\circ$$

$$1x = 1 \times 20^\circ = 20^\circ$$

8. $\angle P = 30^\circ$

$$\angle R = 90^\circ$$

$$\angle Q = ?$$

$$\angle P + \angle Q + \angle R = 180^\circ$$

$$30^\circ + \angle Q + 90^\circ = 180^\circ$$

$$120^\circ + \angle Q = 180^\circ$$

$$\angle Q = 180^\circ - 120^\circ$$

$$\angle Q = 60^\circ$$

9. $\angle A + \angle B + \angle C$... (1)

$$\angle A + \angle B + \angle C = 180^\circ$$
 ... (2)

$$\angle C + \angle C = 180^\circ$$

$$2\angle C = 180^\circ$$

$$\angle C = \frac{180^\circ}{2}$$

$$\angle C = 90^\circ$$

10. $3\angle A = 4\angle B$

$$\angle A = \frac{4}{3} \angle B$$

$$4\angle B = 6\angle C$$

$$\angle C = \frac{4}{6}\angle B$$

$$\angle A + \angle B + \angle C = 180^\circ$$

$$\frac{4}{3}\angle B + \angle B + \frac{4}{6}\angle B = 180^\circ$$

$$\frac{8\angle B + 6\angle B + 4\angle B}{6} = 180^\circ$$

$$\frac{18\angle B}{6} = 180^\circ$$

$$\angle B = \frac{180 \times 6}{18}$$

$$\angle B = 60^\circ$$

$$\angle A = \frac{4}{3} \times \angle B = \frac{4}{3} \times 60^\circ$$

$$\angle A = 80^\circ$$

$$\angle A + \angle B + \angle C = 180^\circ$$

$$80^\circ + 60^\circ + \angle C = 180^\circ$$

$$\angle C = 180^\circ - 140^\circ$$

$$\angle C = 40^\circ$$

11. Let the angles of triangle be $\angle A, \angle B, \angle C$

$$\angle C = \angle A + \angle B$$

We know $\angle A + \angle B + \angle C = 180^\circ$

$$\angle A + \angle B + \angle A + \angle B = 180^\circ$$

$$2(\angle A + \angle B) = 180^\circ$$

$$\angle A + \angle B = \frac{180^\circ}{2}$$

$$\angle A + \angle B = 90^\circ$$

Then $\angle C$

$$\angle A + \angle B + \angle C = 180^\circ$$

$$90^\circ + \angle C = 180^\circ$$

$$\angle C = 180^\circ - 90^\circ$$

$$\angle C = 90^\circ$$

If one angle of triangle is 90° , then it is right angle triangle.

12. $2\angle A = 3\angle B$

$$\angle A = \frac{3}{2} \angle B$$

$$3\angle B = 6\angle C$$

$$\angle C = \frac{3}{6} \angle B$$

$$\angle A + \angle B + \angle C = 180^\circ$$

$$\frac{3}{2} \angle B + \angle B + \frac{3}{6} \angle B = 180^\circ$$

$$\frac{9\angle B + 6\angle B + 3\angle B}{6} = 180^\circ$$

$$\frac{18\angle B}{6} = 180^\circ$$

$$\angle B = \frac{180^\circ \times 6}{18} = 60^\circ$$

$$\angle A = \frac{3}{2} \times 60^\circ$$

$$= 90^\circ$$

$$\angle C = \frac{3}{6} \times 60^\circ$$

$$= 30^\circ$$

13. (i) $70^\circ + 20^\circ = x$ (Exterior angle property)

$$90^\circ = x$$

$90^\circ + 70^\circ + y = 180^\circ$ (Angle sum property)

$$160 + y = 180^\circ$$

$$y = 180^\circ - 160^\circ$$

$$= 20^\circ$$

$$\begin{aligned}
 \text{(ii)} \quad x + 65^\circ &= 115^\circ && \text{(Exterior angle property)} \\
 x &= 115^\circ - 65^\circ \\
 x &= 50^\circ \\
 50^\circ + 65^\circ + y &= 180^\circ && \text{(Angle sum property)} \\
 115^\circ + y &= 180^\circ \\
 y &= 180^\circ - 115^\circ \\
 y &= 65^\circ \\
 \text{(iii)} \quad 30^\circ + 50^\circ &= x && \text{(Exterior angle property)} \\
 80^\circ &= x \\
 80^\circ + 45^\circ + z &= 180^\circ && \text{(Angle sum property)} \\
 125^\circ + z &= 180^\circ \\
 z &= 180^\circ - 125^\circ \\
 z &= 55^\circ \\
 50^\circ + 55^\circ + y &= 180^\circ && \text{(Linear pair)} \\
 105^\circ + y &= 180^\circ \\
 y &= 180^\circ - 105^\circ \\
 &= 75^\circ \\
 \text{(iv)} \quad 50^\circ + 18^\circ &= y && \text{(Exterior angle property)} \\
 68^\circ &= y \\
 68^\circ + 35^\circ &= x && \text{(Exterior angle property)} \\
 103^\circ &= x \\
 \text{(v)} \quad 50^\circ + y &= 100^\circ && \text{(Exterior angle property)} \\
 y &= 100^\circ - 50^\circ \\
 y &= 50^\circ \\
 50^\circ + 50^\circ + x &= 180^\circ && \text{(Angle sum property)} \\
 100^\circ + x &= 180^\circ \\
 x &= 180^\circ - 100^\circ \\
 x &= 80^\circ \\
 40^\circ + 100^\circ &= 50^\circ + z && \text{(Exterior angle property)}
 \end{aligned}$$

$$140^\circ - 50^\circ = z$$

$$90^\circ = z$$

$$(vi) \quad 64^\circ + y = 110^\circ \quad \text{(Linear pair)}$$

$$y = 180^\circ - 64^\circ$$

$$y = 116^\circ$$

$$64^\circ + 56^\circ = z \quad \text{(Exterior angle property)}$$

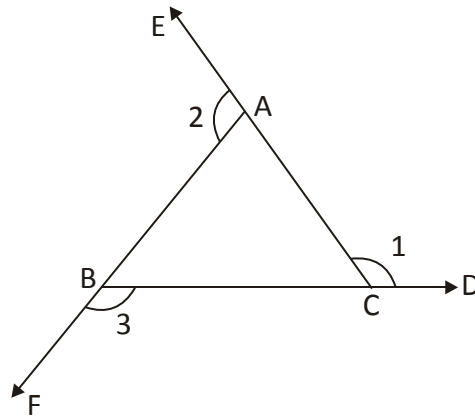
$$120^\circ = z$$

$$56^\circ + x = 180^\circ \quad \text{(Linear Pair)}$$

$$x = 180^\circ - 56^\circ$$

$$x = 124^\circ$$

14.



Angle sum property of a triangle states that the sum of all three interior angles of a triangle is always equal to 180° .

By angle sum property,

$$\angle A + \angle B + \angle C = 180^\circ$$

AB, BC and CA are produced to F, D and E .

Exterior angles are defined as the angles formed between the side of the polygon and the extended adjacent side of the polygon.

From the figure,

The exterior angles are $\angle 1, \angle 2$ and $\angle 3$.

The exterior angle theorem states that the measure of an exterior angle is equal to the sum of the measures of the two opposite interior angles of the triangle.

$$\angle 3 = \angle A + \angle C$$

$$\angle 1 = \angle A + \angle B$$

$$\angle 2 = \angle B + \angle C$$

$$\text{Sum of exterior angles} = \angle 1 + \angle 2 + \angle 3$$

$$= (\angle A + \angle C) + (\angle A + \angle B) + (\angle B + \angle C)$$

$$= \angle A + \angle A + \angle B + \angle B + \angle C + \angle C$$

$$= 2(\angle A + \angle B + \angle C)$$

$$= 2(180^\circ)$$

$$= 360^\circ$$

Therefore, the sum of the exterior angles is 360° .

15. Let $\angle A = 3x$

$$\angle B = 2x$$

$$\angle C = 1x$$

$$3x + 2x + 1x = 180^\circ$$

(Angle sum property)

$$6x = 180^\circ$$

$$x = \frac{180^\circ}{6} = 30^\circ$$

$$\angle A = 3 \times 30^\circ = 90^\circ$$

$$\angle B = 2 \times 30^\circ = 60^\circ$$

$$\angle C = 1 \times 30^\circ = 30^\circ$$

$$\angle ACB + \angle ACE + \angle ECD = 180^\circ$$

(Linear pair)

$$30^\circ + 90^\circ + \angle ECD = 180^\circ$$

$$\angle ECD = 180^\circ - 120^\circ$$

$$= 60^\circ$$

16. Exterior angles of 103° and 74° correspond to supplementary interior angles of

$$A = 180^\circ - 103^\circ = 77^\circ$$

and $B = 180^\circ - 74^\circ = 106^\circ$

Since $A + B = 77^\circ + 106^\circ = 183^\circ$, exceeding 180° , its not possible for these to be angles in the same triangle.

17. In $\triangle FCD$

$$\angle B + \angle BFC + \angle FCD = 180^\circ \quad (\text{Angle sum property})$$

$$\angle B + 90^\circ + 50^\circ = 180^\circ$$

$$\angle B = 180^\circ - 140^\circ$$

$$= 40^\circ$$

In $\triangle ABD$

$$\angle A + \angle B = \angle D \quad (\text{Exterior angle property})$$

$$\angle A + 40^\circ = 90^\circ$$

$$\angle A = 90^\circ - 40^\circ$$

$$\angle A = 50^\circ$$

18. (i) $120 + a = 180^\circ \quad (\text{Linear pair})$

$$a = 180^\circ - 120^\circ$$

$$= 60^\circ$$

$$110 + b = 180^\circ$$

(Linear pair)

$$b = 180^\circ - 110^\circ$$

$$= 70^\circ$$

$$60^\circ + 70^\circ + x = 180^\circ$$

(Angle sum property)

$$130^\circ + x = 180^\circ$$

$$x = 180^\circ - 130^\circ$$

$$x = 50^\circ$$

(ii) $35^\circ + 22.5^\circ = 57.5^\circ = a \quad (\text{Exterior angle property})$

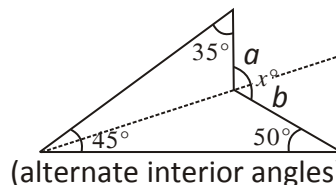
$22.5^\circ + 50^\circ = 72.5^\circ = b \quad (\text{Exterior angle property})$

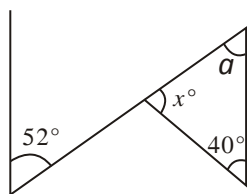
$$a + b = x$$

$$57.5^\circ + 72.5^\circ = x$$

$$130^\circ = x$$

(iii) $a = 52^\circ$





$$40^\circ + 52^\circ + x = 180^\circ$$

$$92^\circ + x = 180^\circ$$

(Angle sum property)

$$x = 180^\circ - 92^\circ$$

$$= 88^\circ$$

$$(iv) \quad 2x + 3x = 130^\circ$$

(Exterior angle property)

$$5x = 130^\circ$$

$$x = \frac{130^\circ}{5}$$

$$x = 26^\circ$$

$$19. \quad \angle A + \angle B + \angle C = 180^\circ$$

(Angle sum property)...(1)

$$\angle D + \angle E + \angle F = 180^\circ$$

(Angle sum property)...(2)

Adding (1) & (2)

$$\angle A + \angle B + \angle C + \angle D + \angle E + \angle F = 180^\circ + 180^\circ$$

$$\angle A + \angle B + \angle C + \angle D + \angle E + \angle F = 360^\circ$$

20. Do yourself.

Exercise 10.2

1. Is it possible to have a triangle of sides whose lengths are :

(i) Clearly $5 + 7 = 12$

i.e., sum of two of given numbers is not greater than third number. Therefore, it is not possible to have a triangle with sides 5 cm, 7cm and 12 cm.

(ii) $3 + 4 = 7 > 6$

$$4 + 6 = 10 > 3$$

and $3 + 6 = 9 > 4$

Thus the sum of any two of these numbers is greater than the third number. Hence, it is possible to have a triangle of sides 3 cm, 4 cm and 6 cm.

(iii) $3 + 3 = 6$

i.e., sum of two of given numbers is not greater than third number. Therefore it is not possible to have a triangle with sides 3 cm, 3 cm and 9 cm.

(iv) $6 + 7 = 13$

i.e., sum of two of given numbers is not greater than third number. Therefore it is not possible to have a triangle with sides 6 cm, 7 cm and 14 cm.

(v) $3.4 + 2.1 = 5.5 > 5.3$

$2.1 + 5.3 = 7.4 > 3.4$

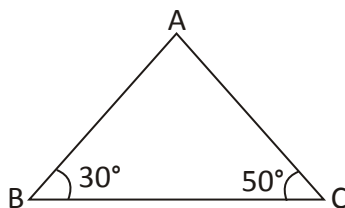
$3.4 + 5.3 = 8.7 > 2.1$

Thus, sum of two of given numbers is not greater than third number. Therefore it is not possible to have a triangle with sides 3.4 cm, 2.1 cm and 5.3 cm.

2. Therefore third side has to be less than the sum of the two sides. The third side is thus less than $8 + 6 = 14$ cm. The side can not be less than the difference of the two sides Thus the third side has to be more than $8 - 6 = 2$ cm The length of the third side could be any length greater than 2 and less than 14 cm.

3. (i) < (ii) < (iii) <

4.



$\angle A + \angle B + \angle C = 180^\circ$

$\angle A + 30^\circ + 50^\circ = 180^\circ$

$$\angle A = 180^\circ - 80^\circ$$

$$\angle A = 100^\circ$$

AC is the smallest side {Side opposite to corresponding angles}
 BC is the largest side.

5. We know that, the sum of the length of any two sides is always greater than the third side.

Let us consider $\triangle ABM$,

$$\Rightarrow AB + BM > AM \quad \dots(1)$$

Now, consider the other triangle $\triangle ACM$

$$\Rightarrow AC + CM > AM \quad \dots(2)$$

By adding equation (1) and (2), we get,

$$AB + BM + AC + CM > AM + AM$$

From the figure we can observe that, $BC = BM + CM$

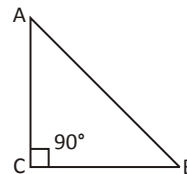
Therefore, $AB + BC + AC > 2AM$

6. In $\triangle ABC$, $\angle C = 90^\circ$

AB is the longest side

(side opposite to largest angle is greatest)

In triangle ABC , AB is the greatest side as the greatest side is the side opposite to right angle which is AB .



7. In $\triangle ABC$

$$AB : BC : CA = 3 : 8 : 5$$

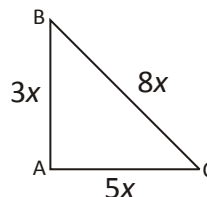
Let the sides be $AB = 3x$

$$BC = 8x$$

$$CA = 5x$$

- (i) $\angle C$ (as angle opposite to greatest side is greater)

- (ii) $\angle A$



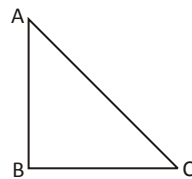
8. $\triangle ABC$

By triangle inequality theorem,

Since $\angle B$ is greater than $\angle C$, AC must be greater than AB

We conclude that $AC > AB$

$$BC < AB < AC$$



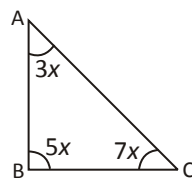
(Ascending order)

9. Let the angles be $3x, 5x$ and $7x$

We know side opposite to largest angle is longest.

(i) AB

(ii) BC



10. Let the measure of other angles be x .

$$x + x + 100^\circ = 180^\circ$$

$$2x = 180^\circ - 100^\circ$$

$$2x = 80^\circ$$

$$x = \frac{80^\circ}{2} = 40^\circ$$

11. Let the third angle be x

Other two angles = $2x$ each

$$2x + 2x + x = 180^\circ$$

$$5x = 180^\circ$$

$$x = \frac{180^\circ}{5} = 36^\circ$$

Angles = $36^\circ, 72^\circ, 72^\circ$

12. $\angle A = 180^\circ - (75^\circ + 35^\circ)$

$$= 180^\circ - 110^\circ$$

$$= 70^\circ$$

$$\text{Since } AD \text{ bisects } \angle A = \frac{70^\circ}{2}$$

$$= 35^\circ$$

In $\triangle ABD$

$$\angle BAD = 35^\circ = \angle DAC$$

$$\angle ABD + \angle BAD = \angle ADC \quad (\text{Exterior angle})$$

$$75^\circ + 35^\circ = 110^\circ$$

$$\angle ADB = \angle DAC + \angle C$$

$$= 35^\circ + 35^\circ$$

$$= 70^\circ$$

In $\triangle ABD$

$$\angle BAD < \angle ADB < \angle ABD$$

$$BD < AB < AD$$

Side opposite to smaller angle is smaller.

Also in $\triangle DAC$

$$DC < AD < AC$$

$$\text{So, } BD < DC < AB$$

13. In $\triangle ABD$

$$\angle BAD = \angle ABD = x$$

$$x + x = \angle ADC$$

$$\angle ADC = 2x \quad \text{In } \triangle ADC$$

$$2x + x + 35 = 180^\circ$$

$$3x = 180^\circ - 35^\circ$$

$$3x = 145^\circ$$

$$x = \frac{145^\circ}{3} = 48.3$$

$$\angle BAD = 48.3^\circ$$

$$\angle ADB = 48.3^\circ + 35^\circ$$

$$= 83.3^\circ$$

$$\angle B = 48.3^\circ$$

$$\angle ADB > \angle B \quad (\text{Side opposite to greatest angle is greatest})$$

$$\text{Hence } AB > AD$$

14. Let the angles of equilateral triangle be x

$$x + x + x = 180^\circ$$

$$3x = 180^\circ$$

$$x = \frac{180}{3} = 60^\circ$$

15. (i) We know angle opposite to equal sides are equal

$$\angle ABC = \angle BAC$$

$$\angle ABC = 70^\circ$$

$$\angle ABC + \angle BAC + \angle ACB = 180^\circ$$

$$70^\circ + 70^\circ + \angle ACB = 180^\circ$$

$$140^\circ + \angle ACB = 180^\circ$$

$$\angle ACB = 180^\circ - 140^\circ$$

$$= 40^\circ$$

(ii) $x = \angle A + \angle ACB$ (Exterior angle property)

$$= 70^\circ + 40^\circ$$

$$x = 110^\circ$$

$y = \angle A + \angle ABC$ (Exterior angle property)

$$= 70^\circ + 70^\circ$$

$$y = 140^\circ$$

16. $\angle ABC = \angle ACB = x$ (Angle opposite to equal sides are equal)

In $\triangle ABC$

$$60^\circ + x + x = 180^\circ$$

$$60^\circ + 2x = 180^\circ$$

$$2x = 180^\circ - 60^\circ$$

$$2x = 120^\circ$$

$$x = \frac{120^\circ}{2} = 60^\circ$$

(i) $\angle ABC = 60^\circ$

- (ii) $\angle ACB = 60^\circ$
 $\angle DBC = \angle DCB = x$ (Angle opposite to equal sides are equal)

In $\triangle DBC$

$$\angle DBC + \angle DCB + \angle D = 180^\circ$$

$$x + x + 50^\circ = 180^\circ$$

$$2x + 50^\circ = 180^\circ$$

$$2x = 180^\circ - 50^\circ$$

$$2x = 130^\circ$$

$$x = 65^\circ$$

- (iii) $\angle DBC = 65^\circ$
 (iv) $\angle DCB = 65^\circ$
 (v) $\angle ABD = \angle ABC + \angle DBC$
 $= 60^\circ + 65^\circ$
 $= 125^\circ$

- (vi) $\angle ACD = \angle ACB + \angle DCB$
 $= 60^\circ + 65^\circ$
 $= 125^\circ$

Exercise 10.3

1. Verify that the following numbers represent Pythagorean triplet :

- (i) $c^2 = a^2 + b^2$
 $(37)^2 = (12)^2 + (35)^2$
 $1369 = 144 + 1225$
 $1369 = 1369$ Verified
- (ii) $(45)^2 = (27)^2 + (36)^2$
 $2025 = 729 + 1296$
 $= 2025$ Verified

$$(iii) \quad (39)^2 = (15)^2 + (36)^2$$

$$1521 = 225 + 1296$$

$$= 1521$$

2. The lengths of the sides of some triangles are given below. Which of them are right angled?

$$(i) \quad (25)^2 = (15)^2 + (20)^2$$

$$625 = 225 + 400$$

$$= 625$$

$$c^2 = a^2 + b^2$$

Given triangle is right angled.

$$(ii) \quad (26)^2 = (10)^2 + (24)^2$$

$$676 = 100 + 576$$

$$= 676$$

Given triangle is right angled.

$$(iii) \quad (9)^2 = (3)^2 + (3)^2$$

$$81 = 9 + 9$$

$$81 \neq 18$$

Given triangle is not right angled.

$$(iv) \quad (34)^2 = (16)^2 + (30)^2$$

$$1156 = 256 + 900$$

$$= 1156$$

Given triangle is right angled.

3. Find the lengths of the unknown sides in the following figures:

$$(i) \quad H^2 = P^2 + B^2$$

$$H^2 = (4)^2 + (3)^2$$

$$= 16 + 9$$

$$H^2 = 25$$

$$H = 5$$

$$(ii) \quad H^2 = P^2 + B^2$$

$$(10.1)^2 = P^2 + (9.9)^2$$

$$102.01 = P^2 + 98.01$$

$$102.01 - 98.01 = P^2$$

$$4 = P^2$$

$$2 = P$$

$$P = 2 \text{ cm}$$

$$(iii) \quad (AB)^2 = (AD)^2 + (BD)^2$$

$$(5)^2 = (3)^2 + (BD)^2$$

$$25 - 9 = (BD)^2$$

$$16 = (BD)^2$$

$$4 = BD$$

$$BD = 4 \text{ cm}$$

$$(AC)^2 = (AD)^2 + (DC)^2$$

$$(12)^2 = (3)^2 + (DC)^2$$

$$144 = 9 + (DC)^2$$

$$144 - 9 = (DC)^2$$

$$135 = DC^2$$

$$3\sqrt{15} = DC$$

**4. In right angled triangle, the lengths of the legs are given.
Find the length of the hypotenuse.**

$$(i) \quad H^2 = P^2 + B^2$$

$$H^2 = (6)^2 + (8)^2$$

$$= 36 + 64$$

$$H^2 = 100$$

$$H = 10 \text{ cm}$$

$$\begin{aligned} \text{(ii)} \quad H^2 &= P^2 + B^2 \\ &= (2)^2 + (1.5)^2 \\ &= 4 + 2.25 \\ H^2 &= 6.25 \end{aligned}$$

$$H = 2.5 \text{ cm}$$

$$\begin{aligned} \text{(iii)} \quad H^2 &= P^2 + B^2 \\ &= (9)^2 + (12)^2 \\ &= 81 + 144 \\ H &= 15 \text{ cm} \end{aligned}$$

5. Let the legs of right angled triangle be x

$$\text{Hypotenuse} = 5\sqrt{2} \text{ cm}$$

$$\begin{aligned} H^2 &= P^2 + B^2 \\ (5\sqrt{2})^2 &= x^2 + x^2 \\ 50 &= 2x^2 \\ \frac{50}{2} &= x^2 \\ x &= 5 \text{ cm} \end{aligned}$$

6. Distance walked west is 12 m

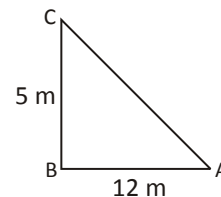
Distance walked north is 5 m

$$\begin{aligned} H^2 &= P^2 + B^2 \\ &= (12)^2 + (5)^2 \\ &= 144 + 25 \\ H^2 &= 169 \\ H &= 13 \text{ cm} \end{aligned}$$

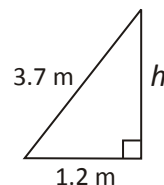
She is 13 cm for from her initial position.

7. Length of ladder = 3.7 m

Distance between wall and ladder = 1.2 m



$$\begin{aligned}
 H^2 &= P^2 + B^2 \\
 (3.7)^2 &= h^2 + (1.2)^2 \\
 13.69 &= h^2 + 1.44 \\
 13.69 - 1.44 &= h^2 \\
 12.25 &= h^2 \\
 \frac{1225}{100} &= h^2 \\
 \frac{35}{10} &= h \\
 h &= 3.5 \text{ m}
 \end{aligned}$$



8. Let x be the length of each leg

Since is an isosceles triangle both legs are equal

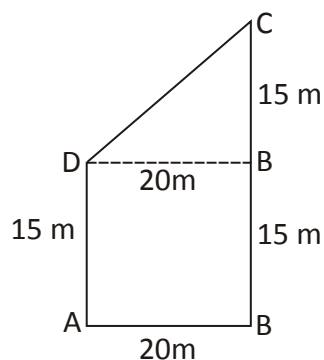
$$\begin{aligned}
 H^2 &= P^2 + B^2 \\
 98 &= x^2 + x^2 \\
 98 &= 2x^2 \\
 \frac{98}{2} &= x^2 \\
 \sqrt{49} &= x \\
 7 &= x
 \end{aligned}$$

Length of each leg = 7 cm

9. Height of poles = 30 m and 15 m

Distance between poles = 20 m

$$\begin{aligned}
 H^2 &= P^2 + B^2 \\
 (DC)^2 &= (15)^2 + (20)^2 \\
 (DC)^2 &= 225 + 400 \\
 (DC)^2 &= 625 \\
 DC &= \sqrt{625} \\
 DC &= 25 \text{ m}
 \end{aligned}$$



The distance between top most point of two poles is 25 m.

10. Height at which tree is broken = 5 m

Top touch ground at a distance = 12 m

$$H^2 = p^2 + B^2$$

$$H^2 = (5)^2 + (12)^2$$

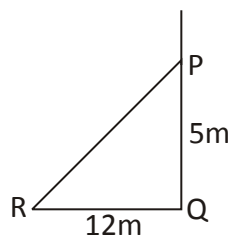
$$H^2 = 25 + 144$$

$$H^2 = 169$$

$$H = \sqrt{169}$$

$$H = 13 \text{ m}$$

Original height of tree = 13 m + 5 m
= 18 m



11. $H^2 = p^2 + B^2$

$$H^2 = (12)^2 + (16)^2$$

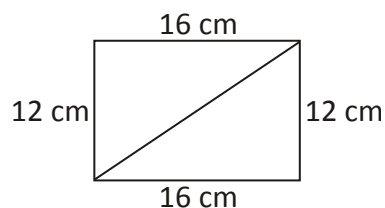
$$H^2 = 144 + 256$$

$$H^2 = 400$$

$$H = \sqrt{400}$$

$$H = 20 \text{ cm}$$

Length of diagonal = 20 m



12. $AO + OC = \text{Width of the street}$

In $\triangle ABO$

$$H^2 = p^2 + B^2$$

$$(17)^2 = (8)^2 + (AO)^2$$

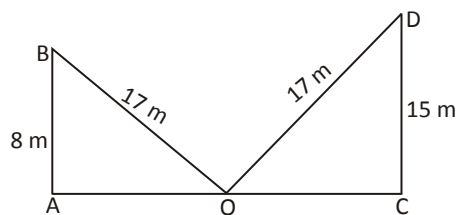
$$(AO)^2 = (17)^2 - (8)^2$$

$$(AO)^2 = 289 - 64$$

$$(AO) = \sqrt{225}$$

$$AO = 15 \text{ m}$$

In $\triangle DOC$

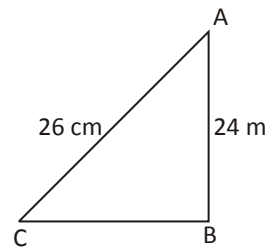


$$\begin{aligned}
 H^2 &= P^2 + B^2 \\
 (17)^2 &= (15)^2 + (OC)^2 \\
 (OC)^2 &= (17)^2 - (15)^2 \\
 (OC)^2 &= 289 - 225 \\
 (OC)^2 &= 64 \\
 (OC) &= 8 \text{ m} \\
 \text{Width of street} &= 15 \text{ m} + 8 \text{ m} \\
 &= 23 \text{ m}
 \end{aligned}$$

- 13.** AC be the length of wire and AB is the pole of height = 24 m

$$\begin{aligned}
 H^2 &= P^2 + B^2 \\
 (26)^2 &= P^2 + (24)^2 \\
 P^2 &= (26)^2 - (24)^2 \\
 P^2 &= 676 - 576 \\
 P^2 &= 100 \\
 P &= \sqrt{100} \\
 P &= 10 \text{ m}
 \end{aligned}$$

Distance between base of pole and wire
= 10 m.

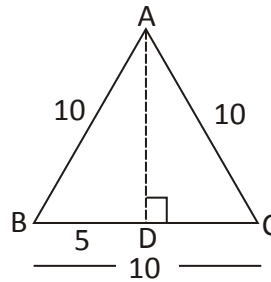


- 14.** Side of equilateral triangle = 10 cm

In $\triangle ABD$

$$\begin{aligned}
 (AB)^2 &= (BD)^2 + (AD)^2 \\
 (10)^2 &= (5)^2 + (AD)^2 \\
 (AD)^2 &= (10)^2 - (5)^2 \\
 (AD)^2 &= 100 - 25 \\
 (AD)^2 &= 75 \\
 AD &= 5\sqrt{3} \text{ cm}
 \end{aligned}$$

Altitude = $5\sqrt{3}$ cm



$$15. H^2 = P^2 + B^2$$

$$(AB)^2 = (AD)^2 + (BD)^2$$

$$(AB)^2 = (AD)^2 + \left(\frac{1}{2}BC\right)^2$$

$$(AB)^2 = (AD)^2 + \left(\frac{1}{2}AB\right)^2$$

$$AB^2 - \frac{1}{4}AB^2 = AD^2$$

$$\frac{4AB^2 - AB^2}{4} = AD^2$$

$$3AB^2 = 4AD^2$$

Hence proved.

$$16. \text{ Side of right triangle} = a, a-1, a+8$$

Hypotenuse is the longest side

$$H^2 = P^2 + B^2$$

$$(a+8)^2 = a^2 + (a-1)^2$$

$$a^2 + 64 + 2(8)(a) = a^2 + a^2 + 1 - 2a$$

$$a^2 + 64 + 16a = a^2 + a^2 + 1 - 2a$$

$$a^2 + 64 + 16a = 2a^2 + 1 - 2a$$

$$2a^2 - a^2 - 2a - 16a + 1 - 64 = 0$$

$$a^2 - 18a - 63 = 0$$

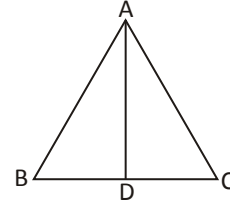
$$a^2 - 21a + 3a - 63$$

$$a(a-21) + 3(a-21)$$

$$(a+3)(a-21)$$

Since a is natural number.

$$\text{So, } a = 21$$



(as $AB = BC = AC$)

MCQs

1.	(c)	2.	(c)	3.	(a)	4.	(c)	5.	(a)	6.	(d)
7.	(b)	8.	(b)	9.	(b)	10.	(c)	11.	(c)	12.	(a)
13.	(d)	14.	(b)	15.	(c)						

3. $H^2 = P^2 + B^2$

$$(5)^2 = (3)^2 + (4)^2$$

$$25 = 9 + 16$$

$$25 = 25$$

4. $\angle P = \angle R$ as PQR is an isosceles triangle

Let $\angle P = x$

$$\angle R = x$$

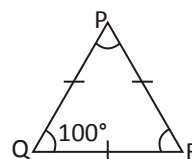
$$\angle P + \angle Q + \angle R = 180^\circ$$

$$x + 100 + x = 180^\circ$$

$$2x = 180^\circ - 100^\circ$$

$$2x = 80^\circ$$

$$x = \frac{80^\circ}{2} = 40^\circ$$



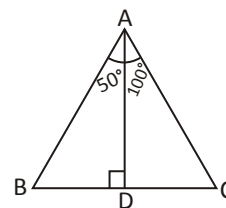
8. $\triangle ABD$

$$\angle A + \angle B + \angle D$$

$$50^\circ + \angle B + 90^\circ = 180^\circ$$

$$\angle B = 180^\circ - 140^\circ$$

$$= 40^\circ$$



13. Sum of any two side is always greater than third side

$$10 + 6.5 > a$$

$$10 - 6.5 > a$$

$$16.5 > a$$

$$3.5 > a$$

$$a > 16.5$$

$$a > 3.5$$

15. $x + x = 130^\circ$

$$2x = 130^\circ$$

$$x = \frac{130}{2} = 65^\circ$$

Fill in the blanks

- | | | | |
|-----------------------------|----------------|----------------|----------|
| 1. obtuse | 2. altitude | 3. two | 4. equal |
| 5. centroid | 6. 180° | 7. 360° | 8. one |
| 9. hypotenuse | 10. perimeter | | |
| 11. perpendicular, opposite | 12. greater | | |

True or False

- | | | | | |
|----------|----------|----------|----------|----------|
| 1. False | 2. False | 3. True | 4. False | 5. True |
| 6. False | 7. False | 8. False | 9. False | 10. True |

11

Perimeter and Area

Exercise 11.1

1. Find the area of parallelogram whose

(i) $B = 16 \text{ cm}$ $H = 12 \text{ cm}$

$$\begin{aligned} \text{Area} &= b \times h \\ &= (16 \times 12) \text{ cm} \\ &= 192 \text{ cm}^2 \end{aligned}$$

(ii) $B = 8 \text{ cm}$ $H = 3 \text{ cm}$

$$\begin{aligned} \text{Area} &= b \times h \\ &= (8 \times 3) \text{ cm} \\ &= 24 \text{ cm}^2 \end{aligned}$$

(iii) $B = 14.5 \text{ cm}$ $h = 8.4 \text{ cm}$

$$\text{Area} = b \times h$$

$$= (14.5 \times 8.4) \text{ cm}$$

$$= 121.8 \text{ cm}^2$$

(iv) $B = 20 \text{ cm}$ $H = 12.5 \text{ cm}$

$$\text{Area} = b \times h$$

$$= (20 \times 12.5) \text{ cm}$$

$$= 250 \text{ cm}^2$$

(v) $B = 24 \text{ cm}$ $H = 12.5 \text{ cm}$

$$\text{Area} = b \times h$$

$$= (24 \times 12.5) \text{ cm}$$

$$= 300 \text{ cm}^2$$

(vi) $B = 17 \text{ cm}$ $H = 13 \text{ cm}$

$$\text{Area} = b \times h$$

$$= (17 \times 13) \text{ cm}$$

$$= 221 \text{ cm}^2$$

(vii) $B = 16.25 \text{ cm}$ $H = 11.8 \text{ cm}$

$$\text{Area} = b \times h$$

$$= (16.25 \times 11.8) \text{ cm}$$

$$= 191.75 \text{ cm}^2$$

(viii) $B = 32 \text{ cm}$ $H = 24 \text{ cm}$

$$\text{Area} = b \times h$$

$$= (32 \times 24) \text{ cm}$$

$$= 768 \text{ cm}^2$$

2. Find the area of each of the following parallelogram :

(i) $B = 14 \text{ cm}$ $H = 8 \text{ cm}$

$$\text{Area} = b \times h$$

$$= (14 \times 8) \text{ cm}$$

$$= 112 \text{ cm}^2$$

(ii) $B = 18 \text{ cm}$ $H = 10 \text{ cm}$

$$\begin{aligned}\text{Area} &= b \times h \\ &= (18 \times 10) \text{ cm} \\ &= 180 \text{ cm}^2\end{aligned}$$

(iii) $B = 14 \text{ cm}$ $H = 6 \text{ cm}$

$$\begin{aligned}\text{Area} &= b \times h \\ &= (14 \times 6) \text{ cm} \\ &= 84 \text{ cm}^2\end{aligned}$$

(iv) $B = 8 \text{ cm}$ $H = 8.5 \text{ cm}$

$$\begin{aligned}\text{Area} &= b \times h \\ &= (8 \times 8.5) \text{ cm} \\ &= 68 \text{ cm}^2\end{aligned}$$

(v) $B = 16 \text{ cm}$ $H = 20 \text{ cm}$

$$\begin{aligned}\text{Area} &= b \times h \\ &= (16 \times 20) \text{ cm} \\ &= 320 \text{ cm}^2\end{aligned}$$

3. Find the base of the parallelogram whose

(i) $\text{Area} = 248 \text{ cm}^2$ $H = 16 \text{ cm}$

$$\begin{aligned}\text{Base} &= \frac{\text{Area}}{\text{Height}} \\ &= \frac{248 \text{ cm}^2}{16 \text{ cm}} \\ &= 15.5 \text{ cm}\end{aligned}$$

(ii) $\text{Area} = 231.25 \text{ cm}^2$ $\text{Height} = 12.5 \text{ cm}$

$$\begin{aligned}\text{Base} &= \frac{\text{Area}}{\text{Height}} \\ &= \frac{231.25 \text{ cm}^2}{12.5 \text{ cm}} \\ &= 18.5 \text{ cm}\end{aligned}$$

(iii) Area = 432.4cm^2 Height = 18.4 cm

$$\text{Base} = \frac{\text{Area}}{\text{Height}}$$

$$= \frac{432.4}{18.4}$$

$$= 23.5 \text{ cm}$$

(iv) Area = 1280cm^2 Height = 32 cm

$$\text{Base} = \frac{\text{Area}}{\text{Height}}$$

$$= \frac{1280\text{cm}^2}{32\text{cm}}$$

$$= 40 \text{ cm}$$

4. Find the height of the parallelogram whose

(i) Area = 231cm^2 Base = 16.5 cm

$$\text{Height} = \frac{\text{Area}}{\text{Base}}$$

$$= \frac{231\text{cm}^2}{16.5\text{cm}}$$

$$= 14 \text{ cm}$$

(ii) A = 528cm^2 Base = 33 cm

$$\text{Height} = \frac{\text{Area}}{\text{Base}}$$

$$= \frac{528\text{cm}^2}{33\text{cm}}$$

$$= 16 \text{ cm}$$

(iii) A = 143cm^2 B = 16.25 cm

$$\text{Height} = \frac{\text{Area}}{\text{Base}}$$

$$= \frac{143\text{cm}^2}{16.25\text{cm}}$$

$$= 8.8 \text{ cm}$$

(iv) $A = 630\text{cm}^2$ $B = 28 \text{ cm}$

$$\text{Height} = \frac{\text{Area}}{\text{Base}}$$

$$= \frac{630\text{cm}^2}{28\text{cm}}$$

$$= 22.5 \text{ cm}$$

5. Let the altitude be x

$$\text{Base} = 2x$$

$$\text{Area} = 648\text{cm}^2$$

$$\text{Area} = b \times h$$

$$648 = 2x \times x$$

$$648 = 2x^2$$

$$\frac{648}{2} = x^2$$

$$324 = x^2$$

$$x = \sqrt{324}$$

$$= 18$$

$$\text{Base} = 2 \times x = 2 \times 18 = 36 \text{ cm}$$

$$\text{Height} = x = 18 \text{ cm}$$

6. $\text{Area} = 1875\text{cm}^2$

Let the altitude be x

$$\text{Base} = 3x$$

$$\text{Area} = b \times h$$

$$1875 = 3x \times x$$

$$1875 = 3x^2$$

$$\frac{1875}{3} = x^2$$

$$625 = x^2$$

$$x = 25$$

Height $x = 25$ cm

7. Base = 4 cm

Height = 1.8 cm

Area of parallelogram = $b \times h$

$$= (4 \times 1.8) \text{ cm}$$

$$= 7.2 \text{ cm}^2$$

Base = 3 cm

Area = $B \times h$

$$7.2 = 3 \times h$$

$$\frac{7.2}{3} = h$$

$$h = 2.4 \text{ cm}$$

8. Given bigger side as base = 15 cm

Smaller side as base = 8 cm

Distance between the longer side = 4 cm

Area of parallelogram = base $\times$ height

$$= 15 \times 4$$

$$= 60 \text{ cm}^2$$

Area of parallelogram = base $\times$ height

$$60 = 8 \times \text{height}$$

$$\text{height} = \frac{60}{8} = 7.5 \text{ cm}$$

Hence, the distance between the shorter side is 7.5 cm.

Exercise 11.2

1. Find the area of the triangle in which

(i) $B = 16 \text{ cm}$ $H = 10 \text{ cm}$

$$\begin{aligned}\text{Area} &= \frac{1}{2} \times b \times h \\ &= \frac{1}{2} \times 16 \times 10 \\ &= 80 \text{ cm}^2\end{aligned}$$

(ii) $B = 24 \text{ cm}$ $H = 16.5 \text{ cm}$

$$\begin{aligned}\text{Area} &= \frac{1}{2} \times b \times h \\ &= \frac{1}{2} \times 24 \times 16.5 \\ &= 198 \text{ cm}^2\end{aligned}$$

(iii) $B = 50$ $H = 32 \text{ cm}$

$$\begin{aligned}\text{Area} &= \frac{1}{2} \times b \times h \\ &= \frac{1}{2} \times 50 \times 32 \\ &= 800 \text{ cm}^2\end{aligned}$$

(iv) $B = 8 \text{ dm}$ $H = 35 \text{ cm}$

$$\begin{aligned}&= 80 \text{ cm} \\ \text{Area} &= \frac{1}{2} \times b \times h \\ &= \frac{1}{2} \times 80 \times 35 \\ &= 1400 \text{ cm}^2\end{aligned}$$

(v) $\text{Base} = 1.5 \text{ cm}$ $H = 80 \text{ cm}$

$$\text{Area} = \frac{1}{2} \times b \times h$$

$$= \frac{1}{2} \times 1.5 \times 80$$

$$= 60 \text{ cm}^2$$

(vi) $B = 9.4 \text{ cm}$ $h = 8.7 \text{ cm}$

$$\text{Area} = \frac{1}{2} \times b \times h$$

$$= \frac{1}{2} \times 9.4 \times 8.7$$

$$= 40.89 \text{ cm}^2$$

2. Find the height of the triangle whose

(i) $A = 225 \text{ cm}^2$ Base = 25 cm

$$\text{Height} = \frac{2 \times \text{Area}}{\text{Base}}$$

$$= \frac{2 \times 225}{25}$$

$$= 18 \text{ cm}$$

(ii) $A = 103.125 \text{ cm}^2$ $B = 16.5 \text{ cm}$

$$\text{Height} = \frac{2 \times \text{Area}}{\text{Base}}$$

$$= \frac{2 \times 103.125}{16.5}$$

$$= 12.5 \text{ cm}$$

(iii) $A = 52 \text{ cm}^2$ $B = 1.6 \text{ dm} = 16 \text{ cm}$

$$\text{Height} = \frac{2 \times \text{Area}}{\text{Base}}$$

$$= \frac{2 \times 52}{16}$$

$$= 6.5 \text{ cm}$$

(iv) $A = 784 \text{ cm}^2$ Base = 0.7 m = 70 cm

$$\begin{aligned}\text{Height} &= \frac{2 \times \text{Area}}{\text{Base}} \\ &= \frac{2 \times 784}{70} \\ &= 22.4 \text{ cm}\end{aligned}$$

3. Let the base be x Area = 600cm^2

$$\begin{aligned}\text{height} &= \frac{1}{3} \times x \\ &= \frac{x}{3} \\ \text{Area} &= \frac{1}{2} \times b \times h \\ 600 &= \frac{1}{2} \times x \times \frac{x}{3} \\ 600 &= \frac{x^2}{6} \\ 600 \times 6 &= x^2 \\ 3600 &= x^2 \\ x &= 60\end{aligned}$$

Base = 60 cm

4. (i) Side = 7.5 cm

$$\begin{aligned}\text{Area} &= \frac{\sqrt{3}}{4} \times a^2 \\ &= \frac{1.73}{4} \times 7.5 \times 7.5 \\ &= 24.32\text{cm}^2\end{aligned}$$

(ii) Side = 8 cm

$$\text{Area} = \frac{\sqrt{3}}{4} \times a^2$$

$$\begin{aligned}
 &= \frac{\sqrt{3}}{4} \times 8 \times 8 \\
 &= \frac{1.73}{4} \times 8 \times 8 \\
 &= 27.68 \text{ cm}^2
 \end{aligned}$$

(iii) Side = 12 cm

$$\begin{aligned}
 \text{Area} &= \frac{\sqrt{3}}{4} \times a^2 \\
 &= \frac{\sqrt{3}}{4} \times 12 \times 12 \\
 &= \frac{1.73}{4} \times 12 \times 12 \\
 &= 62.28 \text{ cm}^2
 \end{aligned}$$

(iv) Side = $2\sqrt{3}$ cm

$$\begin{aligned}
 \text{Area} &= \frac{\sqrt{3}}{4} \times a^2 \\
 &= \frac{\sqrt{3}}{4} \times 2\sqrt{3} \times 2\sqrt{3} \\
 &= \frac{1.73}{4} \times 4 \times 3 \\
 &= 5.19 \text{ cm}^2
 \end{aligned}$$

(v) Side = $10\sqrt{3}$ cm

$$\begin{aligned}
 \text{Area} &= \frac{\sqrt{3}}{4} \times a^2 \\
 &= \frac{\sqrt{3}}{4} \times 10\sqrt{3} \times 10\sqrt{3} \\
 &= \frac{1.73}{4} \times 100 \times 3 \\
 &= 129.75 \text{ cm}^2
 \end{aligned}$$

5. Side of equilateral triangle = 16 cm

$$\begin{aligned}\text{Area of equilateral triangle} &= \frac{\sqrt{3}}{4}a^2 \\ &= \frac{\sqrt{3}}{4} \times 16 \times 16 \\ &= 1.73 \times 4 \times 16 \\ &= 110.72 \text{ cm}^2\end{aligned}$$

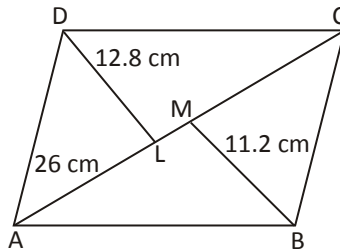
$$\text{Area} = \frac{1}{2} \times b \times h$$

$$110.72 = \frac{1}{2} \times 16 \times h$$

$$h = \frac{110.72 \times 2}{16}$$

$$= 13.84 \text{ cm}$$

6. The quadrilateral with given measurements is



Given— $AC = 26 \text{ cm}$

$DM = 12.8 \text{ cm}$

$BM = 11.2 \text{ cm}$

Area of

$$\triangle ACD = \frac{1}{2} \times AC \times DM = \frac{1}{2} \times 26 \times 12.8 = 166.4 \text{ cm}^2$$

Area of

$$\triangle ABC = \frac{1}{2} \times AC \times BM = \frac{1}{2} \times 26 \times 11.2 = 145.6 \text{ cm}^2$$

Therefore, Area of quadrilateral

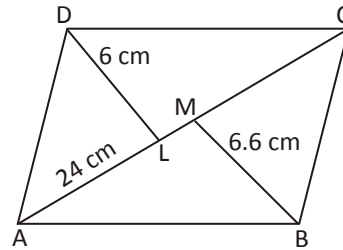
$$= ar(\triangle ACD) + ar(\triangle ABC) \\ = 166.4 + 145.6 = 312 \text{ cm}^2$$

7. $AC = 24 \text{ cm}$

$$DL = 6 \text{ cm}$$

$$BM = 6 \text{ cm}$$

$$\begin{aligned} \text{Area of } \triangle ADC &= \frac{1}{2} \times b \times h \\ &= \frac{1}{2} \times 24 \times 6 \\ &= 72 \text{ cm}^2 \end{aligned}$$



Similarly area of $\triangle ABC = 72 \text{ cm}^2$

$$\begin{aligned} \text{Area of quadrilateral} &= ar(\triangle ADC) + ar(\triangle ABC) \\ &= 72 \text{ cm}^2 + 72 \text{ cm}^2 \\ &= 144 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{8. (i) Area of } \triangle ABC &= \frac{1}{2} \times b \times h \\ &= \frac{1}{2} \times 4 \times 3 \\ &= \frac{1}{2} \times 12 \\ &= 6 \text{ cm}^2 \end{aligned}$$

(ii) Length of AC

$$AC^2 = AB^2 + BC^2$$

$$AC^2 = (4)^2 + (3)^2$$

$$= 16 + 9$$

$$AC^2 = 25$$

$$AC = \sqrt{25}$$

$$AC = 5 \text{ cm}$$

$$(iii) \text{ Area} = \frac{1}{2} \times b \times h$$

$$6 = \frac{1}{2} \times 5 \times h$$

$$h = \frac{2 \times 6}{5}$$

$$= 2.4 \text{ cm}$$

$$9. \text{ Area of garden} = \frac{2916}{216} \text{ hectares}$$

$$\frac{1}{2} \times 3x \times x = 13.5 \text{ hectares}$$

$$3x^2 = 27$$

$$x^2 = 9$$

$$x = 3$$

$$\text{Base of garden} = 3(3) = 9 \text{ hectares}$$

$$\text{Altitude} = 3 \text{ hectares}$$

$$10. \text{ Let the legs be } 3x \text{ and } 4x$$

Then,

$$\frac{1}{2} \times 12x^2 = 1014$$

$$6x^2 = 1014$$

$$x^2 = 169$$

$$x = 13$$

$$\text{Therefore, length of legs is } 3x = 3 \times 13 = 39 \text{ cm and}$$

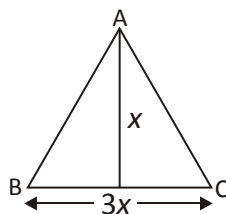
$$4x = 4 \times 13 = 52 \text{ cm.}$$

$$11. \text{ Let the side of an equilateral triangle be } a$$

$$8\sqrt{3} = \sqrt{3} \times (a/2)$$

$$8 \times 2 = a$$

$$16 = a$$



$$\begin{aligned}
 \text{Area} &= \frac{\sqrt{3}}{4} a^2 \\
 &= \frac{\sqrt{3}}{4} \times 16 \times 16 \\
 &= 64\sqrt{3} \text{ cm}^2
 \end{aligned}$$

12. Base = 24 cm

Hypoternuse = 25 cm

$$H^2 = p^2 + B^2$$

$$(25)^2 = p^2 + (24)^2$$

$$625 = p^2 + 576$$

$$625 - 576 = p^2$$

$$49 = p^2$$

$$7 = p$$

$$\text{Area} = \frac{1}{2} \times b \times h$$

$$= \frac{1}{2} \times 24 \times 7$$

$$= 84 \text{ cm}^2$$

$$\text{Area} = \frac{1}{2} \times b \times h$$

$$84 = \frac{1}{2} \times 25 \times BD$$

$$\frac{84 \times 2}{25} = BD$$

$$= 6.72 \text{ cm} = BD$$

Exercise 11.3

1. Find the area of the circle whose :

(i) $r = 14 \text{ cm}$

$$\text{Area} = \pi r^2$$

$$= \frac{22}{7} \times 14 \times 14$$

$$= 616 \text{ cm}^2$$

(ii) $r = 2.8 \text{ cm}$

$$\text{Area} = \pi r^2$$

$$= \frac{22}{7} \times 2.8 \times 2.8$$

$$= 24.64 \text{ cm}^2$$

(iii) $d = 18 \text{ cm}$ $r = 9 \text{ cm}$

$$\text{Area} = \pi r^2$$

$$= \frac{22}{7} \times 9 \times 9$$

$$= 254.57 \text{ cm}^2$$

(iv) $d = 1.4 \text{ cm}$ $r = 0.7 \text{ cm}$

$$\text{Area} = \pi r^2$$

$$= \frac{22}{7} \times 0.7 \times 0.7$$

$$= 1.54 \text{ cm}^2$$

(v) $r = 5.6 \text{ cm}$

$$\text{Area} = \pi r^2$$

$$= \frac{22}{7} \times 5.6 \times 5.6$$

$$= 98.56 \text{ cm}^2$$

2. Find the area of the semi-circle whose :

(i) $r = 3.5 \text{ cm}$

$$\text{Area} = \frac{1}{2} \pi r^2$$

$$= \frac{1}{2} \times \frac{22}{7} \times 3.5 \times 3.5$$

$$= 19.25 \text{ cm}^2$$

(ii) $r = 10 \text{ cm}$

$$\begin{aligned} \text{Area} &= \frac{1}{2} \pi r^2 \\ &= \frac{1}{2} \times \frac{22}{7} \times 10 \times 10 \\ &= 157.14 \text{ cm}^2 \end{aligned}$$

(iii) $d = 5 \text{ cm}$

$$\begin{aligned} r &= 2.5 \text{ cm} \\ \text{Area} &= \frac{1}{2} \pi r^2 \\ &= \frac{1}{2} \times \frac{22}{7} \times 2.5 \times 2.5 \\ &= 9.82 \text{ cm}^2 \end{aligned}$$

(iv) $d = 28 \text{ cm}$

$$\begin{aligned} r &= 14 \text{ cm} \\ \text{Area} &= \frac{1}{2} \pi r^2 \\ &= \frac{1}{2} \times \frac{22}{7} \times (14)^2 \\ &= 308 \text{ cm}^2 \end{aligned}$$

3. Find the circumference of the circle whose :

(i) $r = 14 \text{ cm}$

$$\begin{aligned} \text{Circumference} &= 2\pi r \\ &= 2 \times \frac{22}{7} \times 14 \\ &= 88 \text{ cm} \end{aligned}$$

(ii) $r = 2.8 \text{ cm}$

$$\text{Circumference} = 2\pi r$$

$$= 2 \times \frac{22}{7} \times 2.8$$

$$= 17.6 \text{ cm}$$

(iii) $d = 5.6 \text{ cm}$

$r = 2.8 \text{ cm}$

Circumference $= 2\pi r$

$$= 2 \times \frac{22}{7} \times 2.8$$

$$= 17.6 \text{ cm}$$

(iv) $d = 10 \text{ cm}$

$r = 5 \text{ cm}$

Circumference $= 2\pi r$

$$= 2 \times \frac{22}{7} \times 5$$

$$= 31.42 \text{ cm}$$

4. (i) $d = 77 \text{ cm}$ $r = \frac{77}{2} \text{ cm} = 38.5$

Circumference $= 2\pi r$

$$= 2 \times \frac{22}{7} \times 38.5$$

$$= 242 \text{ cm}$$

Area $= \pi r^2$

$$= \frac{22}{7} \times 38.5 \times 38.5$$

$$= 4658.5 \text{ cm}^2$$

Circumference $= 88 \text{ cm}$

$2\pi r = 88 \text{ cm}$

$$2 \times \frac{22}{7} \times r = 88 \text{ cm}$$

$$r = \frac{88 \times 7}{2 \times 22}$$

$$= 14 \text{ cm}$$

$$d = 2r$$

$$= 2 \times 14$$

$$= 28 \text{ cm}$$

$$\text{Area} = \pi r^2$$

$$= \frac{22}{7} \times 14 \times 14$$

$$= 616 \text{ cm}^2$$

$$\text{Circumference} = 176 \text{ cm}$$

$$\pi r = 176 \text{ cm}$$

$$\frac{22}{7} \times r = 176 \text{ cm}$$

$$r = \frac{176 \times 7}{22}$$

$$r = 56 \text{ cm}$$

$$d = 2r$$

$$= 2 \times 56$$

$$= 112 \text{ cm}$$

$$\text{Area} = \frac{\pi r^2}{2}$$

$$= \frac{22}{7} \times \frac{56 \times 56}{2}$$

$$= 4928 \text{ cm}^2$$

$$\text{Area} = 1232 \text{ cm}^2$$

$$\frac{\pi r^2}{2} = 1232 \text{ cm}^2$$

$$\frac{22 \times r^2}{7 \times 2} = 1232 \text{ cm}^2$$

$$r^2 = \frac{1232 \times 7 \times 2}{22}$$

$$r^2 = 784$$

$$r = \sqrt{784}$$

$$r = 28 \text{ cm}$$

$$d = 2r$$

$$= 2 \times 28$$

$$= 56 \text{ cm}$$

$$\text{Circumference} = \pi r$$

$$= \frac{22}{7} \times 28$$

$$= 88 \text{ cm}$$

$$\text{Area} = 9.625 \text{ cm}^2$$

$$\pi r^2 = 9.625 \text{ cm}^2$$

$$\frac{22}{7} \times r^2 = 9.625 \text{ cm}^2$$

$$r^2 = \frac{9.625 \times 7}{22 \times 1000}$$

$$r^2 = 3.0625$$

$$r^2 = \frac{30625}{10000}$$

$$r = \frac{175}{100}$$

$$r = 1.75 \text{ cm}$$

$$d = 2 \times r$$

$$= 2 \times 1.75$$

$$= 3.5 \text{ cm}$$

$$\text{Circumference} = 2\pi r$$

$$= 2 \times \frac{22}{7} \times 3.5$$

$$= 22 \text{ cm}$$

5. Circumference ratio = 3 : 5

Let r_1 and r_2 be the radii of two circles

Let c_1 and c_2 be the circumference of two circles

$$\frac{c_1}{c_2} = \frac{2\pi r_1}{2\pi r_2} = \frac{3}{5}$$

$$\frac{r_1}{r_2} = \frac{3}{5}$$

Now A_1 and A_2 be the area of two circles

$$\frac{A_1}{A_2} = \frac{\pi r_1^2}{\pi r_2^2} = \left(\frac{r_1}{r_2}\right)^2 = \left(\frac{3}{5}\right)^2 = \frac{9}{25} = 9 : 25$$

6. Circumference of two concentric circles = 121 cm and 154 cm

$$\text{Circumference} = 121 \text{ cm}$$

$$2\pi r_1 = 121 \text{ cm}$$

$$2 \times \frac{22}{7} \times r_1 = 121 \text{ cm}$$

$$r_1 = \frac{121 \times 7}{2 \times 22}$$

$$= 19.25 \text{ cm}$$

$$\text{Circumference} = 154 \text{ cm}$$

$$2\pi r_2 = 154 \text{ cm}$$

$$2 \times \frac{22}{7} \times r_2 = 154 \text{ cm}$$

$$r_2 = \frac{154 \times 7}{2 \times 22}$$

$$= 24.5 \text{ cm}$$

$$\text{Difference} = 24.5 \text{ cm} - 16.5 \text{ cm}$$

$$= 5.25 \text{ cm}$$

7. Ratio of diameters of two circles = 4 : 5

Let d_1 and d_2 be the diameters of two circles and r_1 and r_2 be the radius

$$\frac{d_1}{d_2} = \frac{2r_1}{2r_2} = \frac{4}{5} = \frac{2r_1}{2r_2}$$

$$\frac{4}{5} = \frac{r_1}{r_2}$$

Let c_1 and c_2 be the circumference of two circles

$$\frac{c_1}{c_2} = \frac{2\pi r_1}{2\pi r_2}$$

$$= \frac{r_1}{r_2} = \frac{4}{5} = 4 : 5$$

8. Radius of circle = x

Circumference of circle = $2\pi r + 37$ cm

$$2\pi r = r + 37$$

$$2 \times \frac{22}{7} \times r = r + 37$$

$$r = \frac{(r + 37) \times 7}{2 \times 22}$$

$$r = \frac{7r + 259}{44}$$

$$44r - 7r = 259$$

$$37r = 259$$

$$r = \frac{259}{37}$$

$$\begin{aligned}
 r &= 7 \text{ cm} \\
 \text{Area} &= \pi r^2 \\
 &= \frac{22}{7} \times 7 \times 7 \\
 &= 154 \text{ cm}^2
 \end{aligned}$$

9. Circumference of circle = perimeter of square

$$\begin{aligned}
 2\pi r &= 4 \times \text{side} \\
 2\pi r &= 4 \times 11 \text{ cm} \\
 2 \times \frac{22}{7} \times r &= 4 \times 11 \\
 r &= \frac{4 \times 11 \times 7}{2 \times 22} \\
 &= 7 \text{ cm} \\
 \text{Area} &= \pi r^2 \\
 &= \frac{22}{7} \times 7 \times 7 \\
 &= 154 \text{ cm}^2
 \end{aligned}$$

10. Area of smaller circle = 1386 cm^2

Area of larger circle = 1886.5 cm^2

$$\begin{aligned}
 A_1 &= \pi r_1^2 \\
 r_1^2 &= \frac{A_1}{\pi} \\
 r_1 &= \sqrt{\frac{A_1}{\pi}} \\
 r_1 &= \sqrt{\frac{1386}{\frac{22}{7}}} \\
 r_1 &= 21 \text{ cm} \\
 A_2 &= \pi r_2^2
 \end{aligned}$$

$$\begin{aligned}
 r_2^2 &= \frac{A_2}{\pi} \\
 r_2 &= \sqrt{\frac{A_2}{\pi}} \\
 &= \sqrt{\frac{1886.5}{\frac{22}{7}}} \\
 r_2 &= 24.5 \text{ cm}
 \end{aligned}$$

11. Radius = 70 m

$$\begin{aligned}
 \text{Radius of the park with the road} &= 70 + 7 \\
 &= 77 \text{ m}
 \end{aligned}$$

$\therefore$ Area of the road

$$\begin{aligned}
 &= \pi(r_2^2 - r_1^2) \\
 &= \pi(77^2 - 70^2) \\
 &= \frac{22}{7} \times 147 \times 7 \\
 &= 22 \times 147 \\
 &= 3234 \text{ m}^2
 \end{aligned}$$

$\therefore$ Total cost for levelling = (3239×2.30)
 $= 7438.2$ rupees.

12. Height of the rectangular sheet = 34 cm

It's breadth = 24 cm

$$\begin{aligned}
 \text{Area of rectangle} &= \text{length} \times \text{breadth} \\
 &= 816 \text{ cm}^2
 \end{aligned}$$

Now, diameter of each button = 3.5 cm

$$\text{It's radius} = \frac{3.5}{2} \text{ cm}$$

$$\text{Area of circle} = \pi r^2$$

$$\begin{aligned}
&= \frac{22}{7} \times \left(\frac{3.5}{2}\right)^2 \\
&= \frac{22}{7} \times \frac{3.5}{2} \times \frac{3.5}{2} \\
&= \frac{5.5 \times 3.5}{2} \\
&= 9.625 \text{ cm}^2
\end{aligned}$$

$$\begin{aligned}
\text{Area of such 64 buttons} &= 9.625 \times 64 \\
&= 616 \text{ cm}^2
\end{aligned}$$

So, area of sheet wasted = Area of rectangle board
 – Area of 64 buttons

$$\begin{aligned}
&= 816 \text{ cm}^2 - 616 \text{ cm}^2 \\
&= 200 \text{ cm}^2
\end{aligned}$$

13. $d_1 + d_2 = 2.8 \text{ m} = 280 \text{ cm}$

$$r_1 + r_2 = 140$$

$$2\pi(r_1 - r_2) = 0.88 \text{ m} = 88 \text{ cm}$$

$$r_1 - r_2 = \frac{88}{2\pi} = \frac{88 \times 7}{44} = 2 \times 7 = 14$$

$$r_1 + r_2 = 140$$

$$\underline{r_1 - r_2 = 14}$$

$$2r_1 = 154$$

$$r_1 = 77$$

$$r_2 = 140 - 77 = 63$$

$$r_1 = 77 \text{ cm}, r_2 = 63 \text{ cm}$$

14. Radius of circle = 3.9 cm

$$\text{Area of circle} = \pi r^2$$

$$= \frac{22}{7} \times 3.9 \times 3.9$$

$$= 47.80\text{cm}^2$$

Side of equilateral triangle = 13 cm

$$\begin{aligned}\text{Area of equilateral triangle} &= \frac{\sqrt{3}a^2}{4} \\ &= \frac{1.732}{4} \times 13 \times 13 \\ &= 73.177\text{cm}^2\end{aligned}$$

$$\begin{aligned}\text{Area of Shaded region} &= (73.177 - 47.80)\text{cm}^2 \\ &= 25.377\text{cm}^2\end{aligned}$$

MCQs

1.	(b)	2.	(a)	3.	(c)	4.	(a)	5.	(c)	6.	(d)
7.	(a)	8.	(b)	9.	(d)	10.	(c)				

1. Radius = r $A = a$

If r is doubled ie $2r$

$$\begin{aligned}\text{Area} &= \pi r^2 \\ a &= \pi(2r)^2 \\ &= 4\pi r^2 \quad = 4 \text{ times}\end{aligned}$$

2. Side = 9 cm

$$\begin{aligned}\text{Area} &= \frac{\sqrt{3}a^2}{4} \\ &= \frac{\sqrt{3}}{4} \times 9 \times 9 \\ &= \frac{1.732}{4} \times 9 \times 9 \\ &= 35.073\text{cm}^2\end{aligned}$$

3. $h = \sqrt{6}$ cm

$$h = \frac{\sqrt{3}}{2}a$$

$$\sqrt{6} = \frac{\sqrt{3}}{2}a$$

$$\frac{2 \times \sqrt{6}}{\sqrt{3}} = a$$

$$2 \times \sqrt{2} = a$$

$$2\sqrt{2} = a$$

$$\text{Area} = \frac{\sqrt{3}}{4}a^2$$

$$= \frac{\sqrt{3}}{4} \times 2\sqrt{2} \times 2\sqrt{2}$$

$$= 2\sqrt{3} \text{ cm}^2$$

4. Area = 154 cm^2

$$\pi r^2 = 154 \text{ cm}^2$$

$$\frac{22}{7} \times r^2 = 154 \text{ cm}^2$$

$$r^2 = \frac{154 \times 7}{22}$$

$$r^2 = 49$$

$$r = 7$$

$$d = 7 \times 2 = 14 \text{ cm}$$

5. Area of parallelogram = 54 cm^2

Base of parallelogram = 15 cm

$$\text{Area} = b \times h$$

$$54 = 15 \times h$$

$$\frac{54}{15} = h$$

$$h = 3.6 \text{ cm}$$

6. Base of right triangle = 1.2 m

Hypotenuse of right triangle = 3.7 m

$$H^2 = P^2 + B^2$$

$$(3.7)^2 = P^2 + (1.2)^2$$

$$(3.7)^2 - (1.2)^2 = P^2$$

$$13.69 - 1.44 = P^2$$

$$12.25 = P^2$$

$$P = \sqrt{12.25}$$

$$= 3.5 \text{ m}$$

$$\text{Area} = \frac{1}{2} \times b \times h$$

$$= \frac{1}{2} \times 1.2 \times 3.5 = 2.1 \text{ m}^2$$

7. Diameter = d

Circumference of circle = $d + 30$

$$2\pi r = d + 30$$

$$2 \times \frac{22}{7} \times r = 2r + 30$$

$$\frac{44}{7}r - \frac{2r}{1} = 30$$

$$\frac{44r - 14r}{7} = 30$$

$$\frac{30r}{7} = 30$$

$$r = \frac{30 \times 7}{30}$$

$$r = 7 \text{ cm}$$

8. Area = 616 cm^2

$$\frac{\pi r^2}{2} = 616$$

$$\begin{aligned}\frac{22}{7} \times \frac{r^2}{2} &= 616 \\ r^2 &= \frac{616 \times 14}{22} \\ r^2 &= 392 \\ r &= \sqrt{392} \\ &= 19.8 \text{ cm}\end{aligned}$$

9. Circumference = 242 cm

$$\begin{aligned}2\pi r &= 242 \\ 2 \times \frac{22}{7} \times r &= 242 \\ r &= \frac{242 \times 7}{44} \\ r &= 38.5 \text{ cm} \\ R = r + \text{width} &= (38.5 + 7) \text{ cm} \\ &= 45.5 \text{ cm}\end{aligned}$$

$$\begin{aligned}\text{Area} &= \pi R^2 - \pi r^2 \\ &= \pi(R^2 - r^2) \\ &= \frac{22}{7} [(45.5)^2 - (38.5)^2] \\ &= \frac{22}{7} [(45.5 + 38.5)(45.5 - 38.5)] \\ &= 1848 \text{ m}^2\end{aligned}$$

10. Let the altitude of parallelogram = h

$$\begin{aligned}\text{Side} &= 2h \\ \text{Side} &= 2 \times 2.9 \text{ cm} = 5.8 \text{ cm} \\ \text{Area} &= b \times h \\ &= (5.8 \times 2.9) \text{ cm} \\ &= 16.82 \text{ cm}^2\end{aligned}$$

Fill in the blanks

1. circumference 2. perimeter 3. $\pi(R^2 - r^2)$ 4. πd
5. $\frac{1}{4}\pi d^2$ 6. $\frac{1}{2}bh$ 7. doubled 8. base $\times$ height

True or False

1. False 2. True 3. False 4. False 5. True.

12

Data Handling

Exercise 12.1

1. Define the following terms :

- (i) **Data**— Data are the information collected in the form of numbers.
- (ii) **Raw Data**— It is the data that is primarily available to us in an unorganised state. Raw data is also called **primary data**.
- (iii) **Secondary Data**— Data which is systematic and properly arranged in a definite manner are called secondary data.
- (iv) **Array**—Organising the numerical figures of a data in ascending or descending order is called an array.
- (v) **Observation**—Each numerical value in a data is called an observation.
- (vi) **Statistics**— A branch of Mathematics concerned with the gathering, presentation, analysis and interpretation of numerical data is called statistics.

2. Mean ($\bar{x}$) =
$$\frac{\text{Sum of observations}}{\text{Total no. of observations}}$$

$$\begin{aligned}
& 200 + 180 + 150 + 150 + 130 + 180 + 180 + 200 + 150 + \\
& 130 + 180 + 180 + 200 + 150 + 180 \\
& = \frac{\quad}{15} \\
& = \frac{2540}{15} \\
& = ₹169\frac{1}{3}
\end{aligned}$$

$$\begin{aligned}
3. \text{ Mean } (\bar{x}) &= \frac{\text{Sum of observations}}{\text{Total no. of observations}} \\
&= \frac{175 + 158 + 180 + 164 + 182 + 160 + 171}{7} \\
&= \frac{1190}{7} \\
&= 170 \text{ cm}
\end{aligned}$$

$$\begin{aligned}
4. \text{ Mean } (\bar{x}) &= \frac{\text{Sum of observations}}{\text{Total no. of observations}} \\
&= \frac{45 + 56 + 61 + 31 + 56 + 33 + 70 + 61 + 76 + 36 + 56 \\
&\quad + 59 + 64 + 56 + 88 + 28 + 56 + 70 + 64 + 74}{20} \\
&= \frac{1140}{20} \\
&= 57
\end{aligned}$$

$$\begin{aligned}
5. (i) \text{ Mean } (\bar{x}) &= \frac{\text{Sum of observations}}{\text{Total no. of observations}} \\
&= \frac{5 + 2 + 1 + 3 + 4 + 4 + 5 + 6 + 2 + 2 + 4 + 5 + 5 \\
&\quad + 6 + 2 + 2 + 4 + 5 + 5 + 1}{20} \\
&= \frac{73}{20} \\
&= 3.65
\end{aligned}$$

$$(ii) \quad 1, 1, 2, 2, 2, 2, 2, 3, 4, 4, 4, 4, 5, 5, 5, 5, 5, 5, 6, 6$$

$$\text{Mode} = 5$$

6. First 10 whole no's

0, 1, 2, 3, 4, 5, 6, 7, 8, 9

$$\begin{aligned}\text{Mean } (\bar{x}) &= \frac{\text{Sum of observations}}{\text{Total no. of observations}} \\ &= \frac{0+1+2+3+4+5+6+7+8+9}{10} \\ &= \frac{45}{10} \\ &= 4.5\end{aligned}$$

7. First 10 even natural numbers

2, 4, 6, 8, 10, 12, 14, 16, 18, 20

$$\begin{aligned}\text{Mean } (\bar{x}) &= \frac{\text{Sum of observations}}{\text{Total no. of observations}} \\ &= \frac{2+4+6+8+10+12+14+16+18+20}{10} \\ &= \frac{110}{10} \\ &= 11\end{aligned}$$

8. First six multiples of 3

3, 6, 9, 12, 15, 18

$$\begin{aligned}\text{Mean } (\bar{x}) &= \frac{\text{Sum of observations}}{\text{Total no. of observations}} \\ &= \frac{3+6+9+12+15+18}{6} \\ &= \frac{63}{6} \\ &= 10.5\end{aligned}$$

9. First five prime numbers

2, 3, 5, 7, 11

$$\begin{aligned}\text{Mean } (\bar{x}) &= \frac{\text{Sum of observations}}{\text{Total no. of observations}} \\ &= \frac{28}{5} \\ &= 5.6\end{aligned}$$

10. Calculate the median of

- (i) 6, 8, 9, 15, 16, 18, 21, 22, 25

$$n = 9$$

$$\begin{aligned}\text{Median} &= \left(\frac{n+1}{2} \right)^{\text{th}} \text{ term} \\ &= \left(\frac{9+1}{2} \right)^{\text{th}} \text{ term} \\ &= \left(\frac{10}{2} \right)^{\text{th}} \text{ term} \\ &= 5^{\text{th}} \text{ term}\end{aligned}$$

$$\text{Median} = 16$$

- (ii) 9, 10, 17, 19, 21, 22, 32, 35

$$n = 8$$

$$\begin{aligned}\text{Median} &= \frac{\left(\frac{n}{2} \right)^{\text{th}} \text{ term} + \left(\frac{n}{2} + 1 \right)^{\text{th}} \text{ term}}{2} \\ &= \frac{\left(\frac{8}{2} \right)^{\text{th}} \text{ term} + \left(\frac{8}{2} + 1 \right)^{\text{th}} \text{ term}}{2} \\ &= \frac{4^{\text{th}} \text{ term} + 5^{\text{th}} \text{ term}}{2} \\ &= \frac{19 + 21}{2}\end{aligned}$$

$$= \frac{40}{2} = 20$$

(iii) 6, 8, 9, 13, 15, 16, 18, 20, 21, 22, 25

$$n = 11$$

$$\begin{aligned}\text{Median} &= \left(\frac{n+1}{2} \right)^{\text{th}} \text{ term} \\ &= \left(\frac{11+1}{2} \right)^{\text{th}} \text{ term} \\ &= 6^{\text{th}} \text{ term}\end{aligned}$$

$$\text{Median} = 16$$

(iv) 32, 35, 36, 37, 38, 38, 38, 40, 42, 43, 43, 43, 45, 47, 50

$$n = 15$$

$$\begin{aligned}\text{Median} &= \left(\frac{n+1}{2} \right)^{\text{th}} \text{ term} \\ &= \left(\frac{15+1}{2} \right)^{\text{th}} \text{ term} \\ &= 8^{\text{th}} \text{ term}\end{aligned}$$

$$\text{Median} = 40$$

11. Find the mode of

(i) 4, 6, 7, 8, 8, 8, 8, 10, 11, 15

$$\text{Mode} = 8$$

(ii) 2, 15, 19, 21, 23, 23, 23, 23, 26, 34, 38

$$\text{Mode} = 23$$

(iii) 0, 1, 2, 2, 2, 3, 3, 4, 5, 6

$$\text{Mode} = 2$$

(iv) 6, 8, 10, 10, 15, 15, 15, 80, 100, 120, 150

$$\text{Mode} = 15$$

12. First 10 natural numbers

1, 2, 3, 4, 5, 6, 7, 8, 9, 10

$$\begin{aligned}
 \text{Median} &= \frac{\left(\frac{n}{2}\right)^{\text{th}} \text{ term} + \left(\frac{n}{2} + 1\right)^{\text{th}} \text{ term}}{2} \\
 &= \frac{\left(\frac{10}{2}\right)^{\text{th}} \text{ term} + \left(\frac{10}{2} + 1\right)^{\text{th}} \text{ term}}{2} \\
 &= \frac{5 + 6}{2} \\
 &= \frac{11}{2} \\
 &= 5.5
 \end{aligned}$$

13. First 10 whole numbers

0, 1, 2, 3, 4, 5, 6, 7, 8, 9

$$n = 10$$

$$\begin{aligned}
 \text{Median} &= \frac{\left(\frac{n}{2}\right)^{\text{th}} \text{ term} + \left(\frac{n}{2} + 1\right)^{\text{th}} \text{ term}}{2} \\
 &= \frac{\left(\frac{10}{2}\right)^{\text{th}} \text{ term} + \left(\frac{10}{2} + 1\right)^{\text{th}} \text{ term}}{2} \\
 &= \frac{4 + 5}{2} \\
 &= \frac{9}{2} \\
 &= 4.5
 \end{aligned}$$

14. 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30

$$n = 15$$

$$\text{Median} = \left(\frac{n+1}{2}\right)^{\text{th}} \text{ term}$$

$$\begin{aligned}
 &= \left(\frac{15+1}{2} \right)^{th} \text{ term} \\
 &= \left(\frac{16}{2} \right)^{th} \text{ term} \\
 &= 16
 \end{aligned}$$

15. 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21

$$n = 11$$

$$\begin{aligned}
 \text{Median} &= \left(\frac{n+1}{2} \right)^{th} \text{ term} \\
 &= \left(\frac{11+1}{2} \right)^{th} \text{ term} \\
 &= \left(\frac{12}{2} \right)^{th} \text{ term} \\
 &= 11
 \end{aligned}$$

16. 2, 3, 5, 7, 11, 13, 17

$$n = 7$$

$$\begin{aligned}
 \text{Median} &= \left(\frac{n+1}{2} \right)^{th} \text{ term} \\
 &= \left(\frac{7+1}{2} \right)^{th} \text{ term} \\
 &= \left(\frac{8}{2} \right)^{th} \text{ term} \\
 &= 7
 \end{aligned}$$

17. 39, 48, 56, 75, 76, 81, 85, 85, 90, 95

(i) highest marks = 95

lowest marks = 39

(ii) Range = 95 – 39

$$= 56$$

18. 128, 132, 135, 139, 141, 143, 146, 149, 150, 151

(i) 151 cm

(ii) 128 cm

(iii) Range = (151 – 128) cm = 23 cm

$$\begin{aligned} \text{(iv) Mean } (\bar{x}) &= \frac{\text{Sum of observations}}{\text{Total no. of observations}} \\ &= \frac{128 + 132 + 135 + 139 + 141 + 143 + 146 + 149 + 150 + 151}{10} \\ &= \frac{1414}{10} \\ &= 141.4 \text{ cm} \end{aligned}$$

(v) 5

19. 6, 8, 10, 10, 15, 15, 15, 80, 80, 100, 120

$$\begin{aligned} \text{Mean } (\bar{x}) &= \frac{\text{Sum of observations}}{\text{Total no. of observations}} \\ &= \frac{429}{11} \\ &= 39 \end{aligned}$$

Mode = 15

$$n = 11$$

$$\begin{aligned} \text{Median} &= \left(\frac{n+1}{2} \right)^{th} \text{ term} \\ &= \left(\frac{11+1}{2} \right)^{th} \text{ term} \\ &= 6^{th} \text{ term} \end{aligned}$$

Median = 15

20. 12, 12, 18, 18, 19, 33, 33, 33, x, 37, 37, 37

$$x = 33$$

21. Median = 20

$$n = 9$$

$$\text{Median} = \left(\frac{n+1}{2} \right)^{\text{th}} \text{ term}$$

$$= \left(\frac{10}{2} \right)^{\text{th}} \text{ term}$$

$$= 5^{\text{th}} \text{ term}$$

16, 17, 18, 19, 20, 21, 22, 23, 24

$$x = 20$$

22. Mode of given data = 6

$$\begin{aligned} \text{Mean } (\bar{x}) &= \frac{\text{Sum of observations}}{\text{Total no. of observations}} \\ &= \frac{3 + 6 + 4 + 7 + 2 + 9 + x + 6}{8} \end{aligned}$$

$$= \frac{37 + x}{8}$$

$$6 = \frac{37 + x}{8}$$

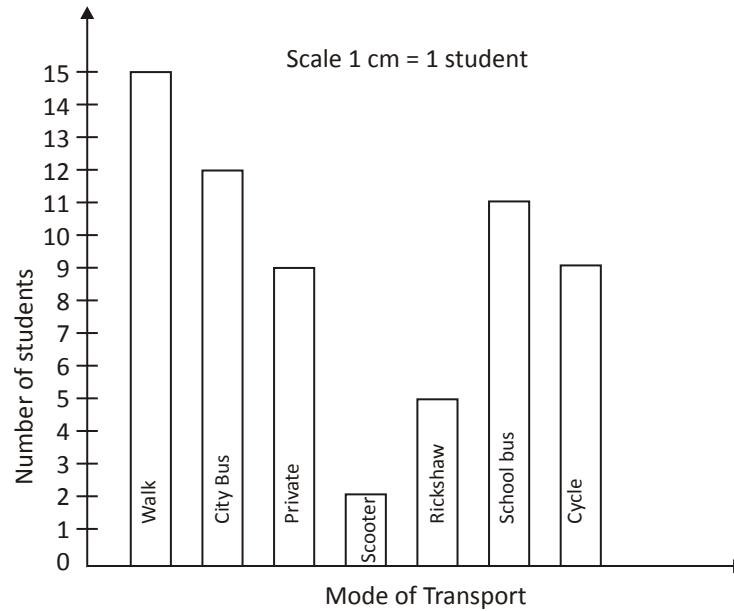
$$6 \times 8 = 37 + x$$

$$48 - 37 = x$$

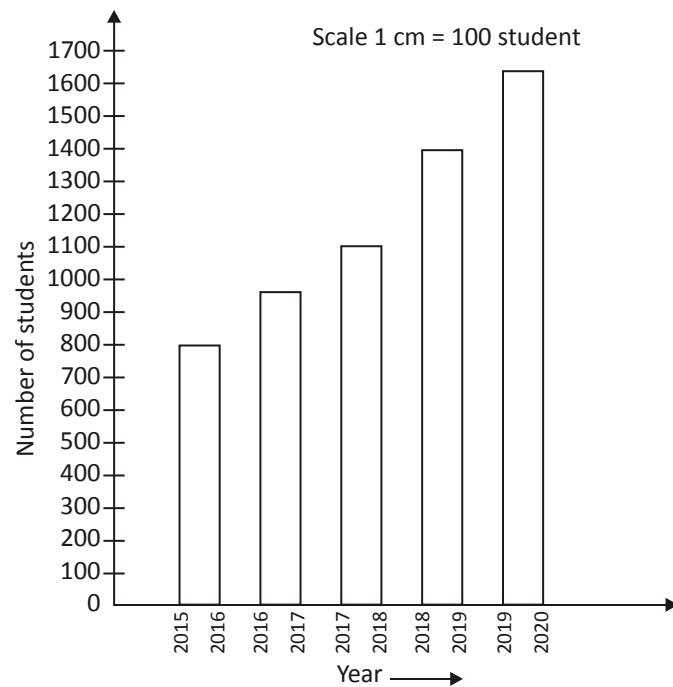
$$11 = x$$

Exercise 12.2

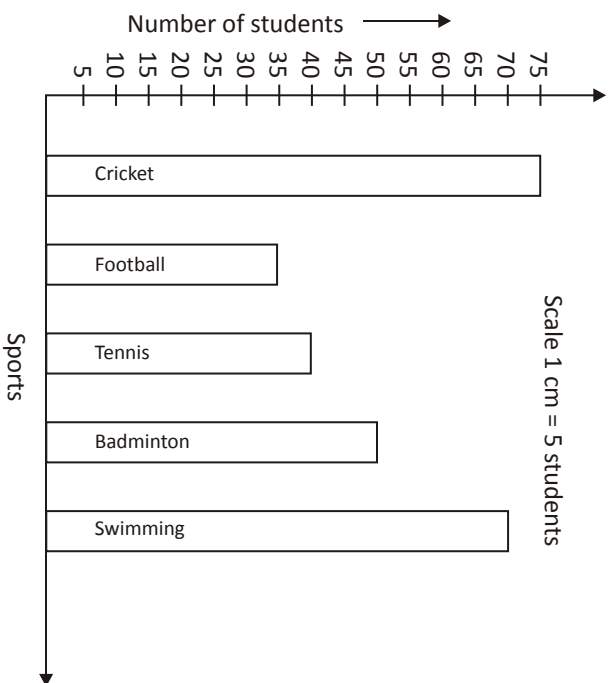
1.



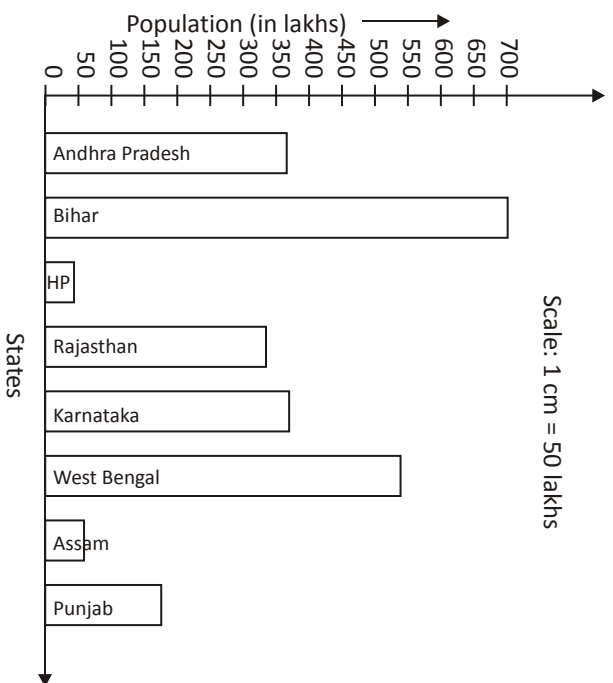
2.



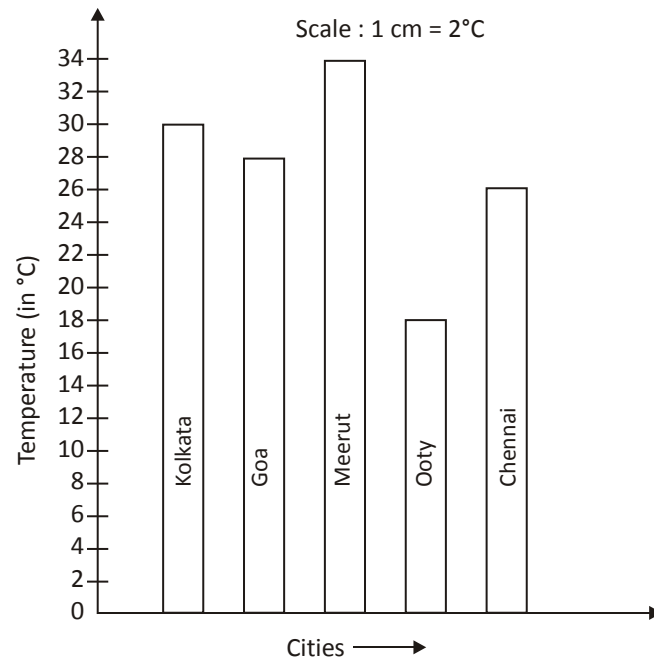
3.



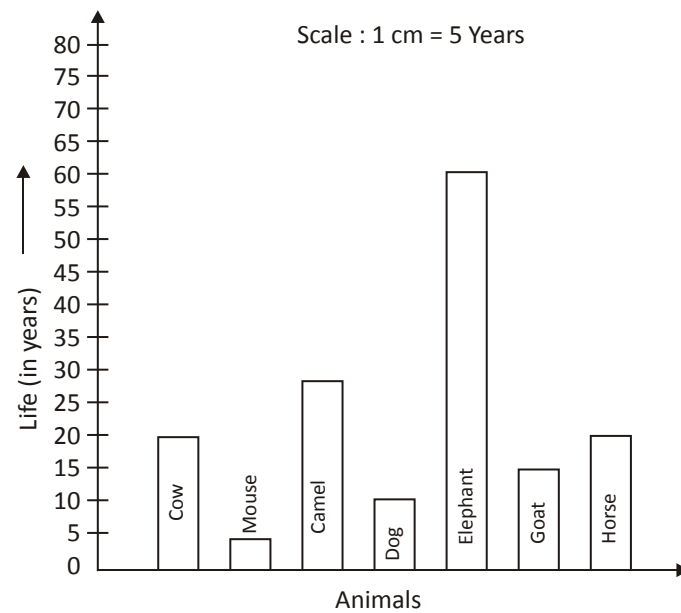
4.

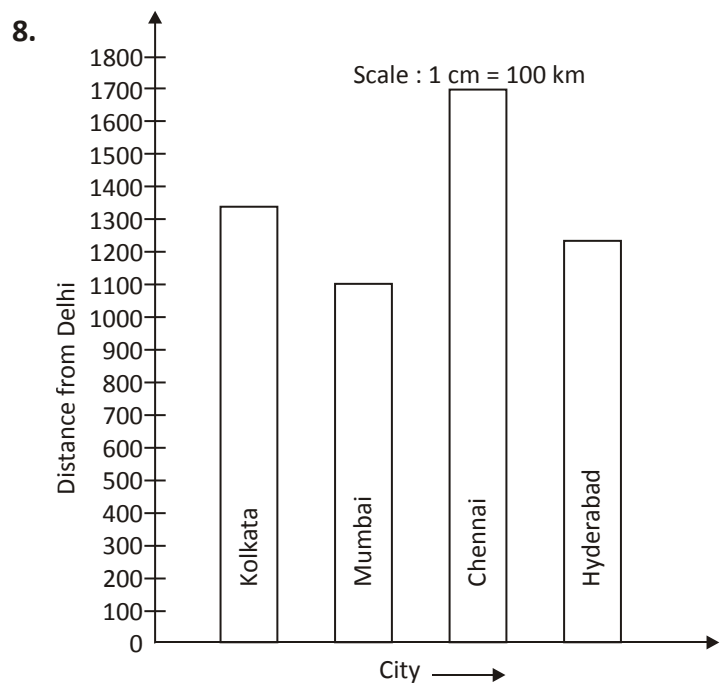
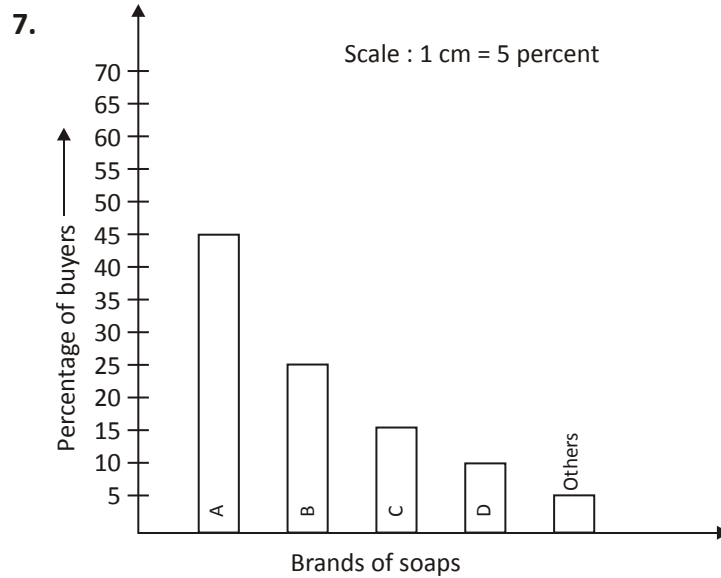


5.



6.





9. (i) No. of male and female voters in some states of India in year 2020-2021

- (ii) UP
- (iii) West Bengal
- (iv) Maximum voters are in UP
Minimum voters are in Maharashtra

10. (i) Production of food grains in an Indian state during five consecutive years.

(ii) 2002

(iii) 2002

(iv) 100 : 40

$$= \frac{100}{40} = \frac{10}{4} = \frac{5}{2} = 5 : 2$$

MCQs

1.	(d)	2.	(a)	3.	(a)	4.	(b)	5.	(b)	6.	(b)
7.	(d)	8.	(c)	9.	(b)	10.	(c)				

1. $\frac{1+2+3+4+5+6+7+8}{8} = \frac{36}{8} = 4.5$

2. $\frac{2+3+5+7}{4} = \frac{17}{4} = 4.25$

4. Median = $\left(\frac{n+1}{2}\right)^{th}$ term
 $= \left(\frac{5+1}{2}\right)^{th}$ term
 $= 3^{rd}$ term

5. Range = $43.2 - 26.23 = 16.97$

6. 3, 5, 7, 11

$$\begin{aligned}\text{Median} &= \frac{\left(\frac{n}{2}\right)^{\text{th}} \text{ term} + \left(\frac{n}{2} + 1\right)^{\text{th}} \text{ term}}{2} \\ &= \frac{2^{\text{nd}} \text{ term} + 3^{\text{rd}} \text{ term}}{2} \\ &= \frac{5 + 7}{2} = 6\end{aligned}$$

$$7. \frac{10 + 7 + x + 4 + 6}{5} = 8$$

$$27 + x = 8 \times 5$$

$$x = 40 - 27$$

$$= 13$$

$$8. \frac{5 + 10 + 15 + 20 + 25}{5}$$

$$= \frac{75}{5} = 15$$

$$9. \frac{35 + 36 + 46 + 50 + 55 + 60}{6}$$

$$= \frac{282}{6} = 47$$

Fill in the blanks

1. raw data 2. range 3. observation
4. an array 5. Highest observation, Lowest observation
6. maximum
7. Mean 8. Median
9. given number
10. always, smallest, smaller, greatest.

Exercise 13

1. State the number of lines of symmetry for the following shapes :

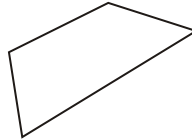
- (a) 2 (b) 4 (c) infinite (d) 2

2. Which letter has two lines of symmetry :

- (d) *H*

3. All the following shapes have at least one line of symmetry EXCEPT :

- (c) Quadrilateral



4. C has.....line/lines of symmetry.

- (a) 1

5. Identify which of the following letters have rotational symmetry :



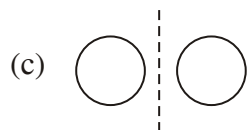
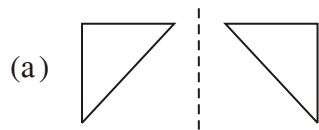
6. Fill in the blanks.

- (a) 2 (b) Circle (c) its, a parallelogram
(d) 4 (e) rotational, 3

7. State whether the following statements are "True or False"?

- (a) False (b) True (c) True
(d) True (e) False

9. Draw the mirror image of each of the following :



10. Do yourself.

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Three Dimensional Shapes

Exercise -14

1. What is the shape of :

(i) sphere (ii) cuboid (iii) cuboid (iv) cylinder

2. Mark the correct answer :

(i) b (ii) d (iii) b (iv) b (v) c

3. Match the following :

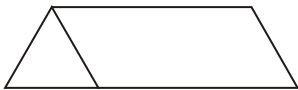
(a) sphere	(i) a cricket ball
(b) cylinder	(ii) a coke can
(c) cuboid	(iii) a chalk duster
(d) cube	(iv) a dice

4. Name each of the following shapes:

(i) sphere (ii) cube (iii) cylinder (iv) cuboid (v) quadrilateral pyramid (vi) cone (vii) triangular prism (viii) triangular pyramid

5. Fill in the blanks :

(a) A cone has **2** faces **1** vertices and **1** edges.
 (b) A pyramid has **5** faces.

- (c) A cylinder has **1** curved face and **2** flat circular faces.
- (d) The two examples of cube are **dice** and **ice cube**.
- (e) A cone has **2** faces.
6. Cylinder : pipe, pencil; Cone : birthday cap, funnel
7. 
8. Write T for true and F for false :
 (a) True (b) false (c) false (d) false (e) false
9. Write the name of each shape. Find the number of faces, edges and vertices.
 (i) Tetrahedron, 4, 6, 4 (ii) Cube, 6, 12, 8 (iii) Cuboid, 6, 12, 8
 (iv) Cylinder, 3, 2, 0 (v) Sphere, 1, 0, 0 (vi) Cone, 2, 1, 1
10. Name any two objects from your classrooms which have the form of
 (a) Eraser, duster
 (b) paper weight, iron lockers
11. Give two examples of each of the following three dimensional shapes
 (i) Ice cream cone, Christmas tree
 (ii) Moon, Football
 (iii) Cans, Rolls of paper towels
 (iv) Book, Eraser
 (v) Paper weights, Egyptians pyramid
12. What is the shape of—
 (i) hemisphere (ii) cuboid (iii) sphere (iv) cylinder
 (v) cuboid (vi) sphere
13. Which one of the following is an example of sphere?
 (b) a football
14. A tetrahedron is a pyramid whose base is a :
 (a) triangle
15. 6