

Foundation Mathematics 7

1.

Integers

Learning Target 1.1

1.

		Second Number										
		x	-4	-3	-2	-1	0	1	2	3	4	
First Number	-4	16	12	8	4	0	-4	-8	-12	-16		
	-3	12	9	6	3	0	-3	-6	-9	-12		
	-2	8	6	4	2	0	-2	-4	-6	-8		
	-1	4	3	2	1	0	-1	-2	-3	-4		
	0	0	0	0	0	0	0	0	0	0		
	1	-4	-3	-2	-1	0	1	2	3	4		
	2	-8	-6	-4	-2	0	2	4	6	8		
	3	-12	-9	-6	-3	0	3	6	9	12		
	4	-16	-12	-8	-4	0	4	8	12	16	Yes; Yes; $a \times b = b \times a$	

2. (i) Negative (ii) Negative
(iii) Negative (iv) Negative
3. (i) $2 \times (-15) = -(2 \times 15) = -30$
(ii) $(-17) \times (-20) = +(17 \times 20) = 340$
(iii) $3 \times (-8) \times 5 = -24 \times 5 = -120$
(iv) to (xii) Do yourself.
4. (i) $(1569 \times 887) - (569 \times 887) \Rightarrow 887 \times (1569 - 569)$
 $= 887 \times 1000 = 887000$
(ii) to (vi) Do yourself.
5. (i) $x \times (-1) = -40 \Rightarrow (-40) \times (-1) = -40$
(ii) to (iii) Do yourself.
6. (i) $(8 + 9) \times 10$ and $8 + 9 \times 10$
 17×10 and $8 + 90$
170 > 98
So, $(8 + 9) \times 10 > 8 + 9 \times 10$
(ii) to (iii) Do yourself.
7. (i) $19 \times [7 + (-3)] = 19 \times 7 + 19 \times (-3)$
LHS. = $19 \times [7 + (-3)] = 19 \times [7 - 3]$
 $= 19 \times 4 = 76$
RHS. = $19 \times 7 + 19 \times (-3) = 133 - 57 = 76$

8. $a \times (-1) = -30 \Rightarrow a = (-1) \times (-30) = \mathbf{30}$

So, it is positive.

9. $a \times (-1) = 30 \Rightarrow 30 \times (-1) = \mathbf{-30}$

So, it is negative.

10. (i) T (ii) F (iii) F (iv) F (v) F

11. (i) $18 \div (-3) = (18) \times \frac{1}{-3} = \mathbf{-6}$

(ii) $(-18) \div 3 = (-18) \times \frac{1}{3} = \mathbf{-6}$

(iii) $(-18) \div (-3) = -18 \times \frac{1}{-3} = \mathbf{6}$

(iv) to (x) Do yourself.

(xi) $200000 \div (-100) = 200000 \times \frac{1}{-100} = \mathbf{-2000}$

(xii) Do yourself.

12. (i) 1 (ii) -3785 (iii) 0 (iv) -3065 (v) -312
(vi) -567

13. (i) T (ii) F (iii) F (iv) T (v) F
(vi) F.

14. (i) $10 \times 10 \times 10 \times 10 = \mathbf{10^4}$

(ii) $(-13) \times (-13) \times (-13) \times (-13) \times (-13) \times (-13)$
 $= (-13)^6 = \mathbf{13^6}$

15. (i) $50^2 = 50 \times 50 = \mathbf{2500}$ (ii) $(-1)^{51} = \mathbf{-1}$

(iii) $1^{100} = \mathbf{1}$ (iv) to (vi) Do yourself.

(vii) $2^3 \times 2^5 = 2^{3+5} = 2^8 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$
 $= 2^8 = \mathbf{256}$

(viii) to (xii) Do yourself.

Apply Your Mind!

1. (b)

2. (b)

3. (a)

4. (b)



2.

Fractions

Learning Target 2.1

1. (i) $\frac{9}{30} + \frac{11}{30} + \frac{15}{30} = \frac{35}{30} = \frac{7}{6}$ (ii) $\frac{8}{25} + \frac{12}{25} + \frac{5}{25} = \frac{25}{25} = 1$

(iii) to (vi) Do yourself.

2. (i) $\frac{8}{17} - \frac{5}{17} = \frac{3}{17}$

(ii) to (iv) Do yourself.

(v) $3\frac{2}{5} - 1\frac{3}{10} = \frac{17}{5} - \frac{13}{10} = \frac{21}{10} = 2\frac{1}{10}$

(vi) Do yourself.

3. (i) $\frac{3}{4} + \frac{15}{16} - \frac{13}{8} = \frac{12 + 15 - 26}{16} = \frac{27 - 26}{16} = \frac{1}{16}$

(ii) to (vi) yourself.

4. Required number = $\frac{57}{14} - \frac{19 \times 2}{14} = \frac{57}{14} - \frac{38}{14} = \frac{19}{14} = 1\frac{5}{14}$

5. Do yourself.

6. Cost of a book = ₹ $85\frac{1}{5} = ₹ \frac{426}{5}$

Cost of a note book = ₹ $25\frac{1}{4} = ₹ \frac{101}{4}$

Total cost = $\frac{426}{5} + \frac{101}{4} = \frac{1704 + 505}{20} = \frac{2209}{20} = ₹ 110\frac{9}{20}$

7. $\frac{4}{7}$ th, $\frac{5}{8}$ th = $\frac{32, 35}{56}$ Since **35** > **32**. Or $\frac{5}{8} > \frac{4}{7}$

(So, his daughter got more of his property.)

8. Height of Juhi = $1\frac{3}{5}$ m $\Rightarrow \frac{8}{5}$ m

Height of Megha = $1\frac{3}{4}$ m $\Rightarrow \frac{7}{4}$ m

So, Megha is longer than Juhi.

Difference = $\frac{7}{4} - \frac{8}{5} = \frac{3}{20}$ m

9. $\frac{1}{17}, \frac{3}{19}, \frac{5}{21} = \frac{399, 1071, 1615}{6783}$ Since **399** < **1017** < **1615**

So, Soap C has most and soap A has least incense.

10. Total weight of fruits = $3\frac{1}{4} + 2\frac{2}{5} + 5\frac{2}{5} = \frac{13}{4} + \frac{12}{5} + \frac{27}{5}$
 $= \frac{65 + 48 + 108}{20} = \frac{221}{20} = 11\frac{1}{20}$ kg

11. Length of pencil = $17\frac{3}{4} = \frac{71}{4}$ cm

It is sharpened = $2\frac{1}{3}$ cm = $\frac{7}{3}$ cm

$$\begin{aligned} \text{Remaining length} &= \frac{71}{4} - \frac{7}{3} = \frac{213 - 28}{12} \\ &= \frac{185}{12} = \mathbf{15 \frac{5}{12} \text{ cm}} \end{aligned}$$

12. Naman walks to go school = $5 \frac{1}{2}$ km = $\frac{11}{2}$ km

Naman rides to bus = $12 \frac{3}{4}$ km = $\frac{51}{4}$ km

Naman walks again = $1 \frac{2}{3}$ = $\frac{5}{3}$ km

$$\begin{aligned} \text{Total distance} &= \frac{11}{2} + \frac{51}{4} + \frac{5}{3} = \frac{66 + 153 + 20}{12} \\ &= \frac{239}{12} = \mathbf{19 \frac{11}{12} \text{ km}} \end{aligned}$$

Thus, $19 \frac{11}{12}$ km is the total distance travelled by Naman.

Learning Target 2.2

1. (i) $\frac{5}{11} \times \frac{11}{5} = \frac{55}{55} = \mathbf{1}$ (ii), (iii) Do yourself.

(iv) $3 \frac{1}{5} \times \frac{25}{32} = \frac{16}{5} \times \frac{25}{32} = \frac{5}{2} = \mathbf{2 \frac{1}{2}}$

(v), (vi), (vii), (viii), (ix), (x) Do yourself.

2. (i) $\frac{5}{6} \times \frac{32}{25} \times \frac{3}{2} = \frac{8}{5} = \mathbf{1 \frac{3}{5}}$

(ii), (iii), (iv), (v), (vi) Do yourself.

3. (i) One-half of ₹ 124 = $\frac{1}{2}$ of ₹ 124 = $\frac{1}{2} \times ₹ 124 = ₹ \mathbf{62}$

(ii), (iii), (iv) Do yourself.

4. Cost of 1 kg rice = ₹ $44 \frac{2}{3} = ₹ \frac{134}{3}$

Cost of $3 \frac{1}{3}$ kg rice = $\frac{134}{3} \times 3 \frac{1}{3} = \frac{134}{3} \times \frac{10}{3} = ₹ \mathbf{148 \frac{8}{9}}$

Thus, cost of $3 \frac{1}{3}$ kg rice is ₹ $148 \frac{8}{9}$.

5. Speed of fox = $150 \frac{2}{3}$ mile/hour = $\frac{452}{3}$ mile/hour

Speed of panther = $\frac{452}{3} \times 10 = \frac{4520}{3} = \mathbf{1506 \frac{2}{3} \text{ mile/hour}}$

Thus, speed of panther is $1506 \frac{2}{3}$ mile/hour.

6. A farmer can put up a fence in one day = $\frac{1}{3}$ km

A farmer can put up a fence in $6\frac{2}{3}$ days = $\frac{1}{3} \times \frac{20}{3} = \frac{20}{9} = 2\frac{2}{9}$ km

7. Johny spends on food and rent = $\frac{3}{5}$

Remaining part of his salary = $1 - \frac{3}{5} = \frac{2}{5}$

Now, $\frac{1}{5}$ of $\frac{2}{5} = \frac{1}{5} \times \frac{2}{5} = \frac{2}{25}$

$\frac{2}{25}$ of ₹ 40,000 = ₹ **3200**

So, Johny donates ₹ 3200.

8. 1 marble weighs = $10\frac{1}{2}$ grams = $\frac{21}{2}$ grams

230 marbles weigh = $\frac{21}{2} \times 230$ gram = **2415 grams**

Thus, weight of 230 marbles is 2415 grams.

9. A car can run in 1L of petrol = $16\frac{1}{4}$ km or $\frac{65}{4}$ km

A car can run in $5\frac{2}{3}$ L of petrol = $\frac{65}{4} \times \frac{17}{3} = \frac{1105}{12} = 92\frac{1}{12}$ km

Learning Target 2.3

1. (i) The reciprocal of $\frac{3}{2} = \frac{2}{3}$ (ii), (iii), (iv) and (v) Do yourself.

2. (i) $\frac{4}{5} \div \frac{7}{15} \Rightarrow \frac{4}{5} \times \frac{15}{7} = \frac{12}{7} = 1\frac{5}{7}$

(ii), (iii), (iv), (v) Do yourself.

(vi) $3\frac{4}{7} \div 1\frac{5}{14} \Rightarrow \frac{25}{7} \div \frac{19}{14} \Rightarrow \frac{25}{7} \times \frac{14}{19} = \frac{50}{19} = 2\frac{12}{19}$

(vii), (viii), (ix) Do yourself.

3. A factory produced steel in a month = $6000\frac{5}{12} = \frac{72005}{12}$ tons

A factory produced steel in a day = $\frac{72005}{12} \div 30$

= $\frac{72005}{12} \times \frac{1}{30} = \frac{14401}{72} = 200\frac{1}{72}$ tons

Thus, $200\frac{1}{72}$ tons is the daily production.

4. The product of two numbers = $5\frac{2}{3} = \frac{17}{3}$

One of them is = $2\frac{4}{15} = \frac{34}{15}$

Other is $\frac{17}{3} \div \frac{34}{15} = \frac{17}{3} \times \frac{15}{34} = 2\frac{1}{2}$

5. The number should be multiplied $\frac{5}{6} \div 3\frac{4}{7}$

= $\frac{5}{6} \div \frac{25}{7} = \frac{5}{6} \times \frac{7}{25} = \frac{7}{30}$

6. A boat can carry weight = 690 kg

A box weight = $7\frac{2}{3} = \frac{23}{3}$ kg

Thus the boat can carry = $690 \div \frac{23}{3} = \frac{690 \times 3}{23} = 90$ boxes

Thus, 90 boxes can be shipped.

7. Speed = $\frac{\text{Distance}}{\text{Time}} = \frac{420\frac{2}{5}}{4\frac{1}{5}} = \frac{\frac{2102}{5}}{\frac{21}{5}} = \frac{2102}{21}$

= $100\frac{2}{21}$ km/hour

Thus, speed is $100\frac{2}{11}$ km/hour.

8. Area of rectangle = $83\frac{3}{4} \text{ m}^2 = \frac{335}{4} \text{ m}^2$

One side of rectangle = $12\frac{1}{2} \text{ m} = \frac{25}{2} \text{ m}$

Other side of rectangle = $\frac{335}{4} \div \frac{25}{2} = \frac{335}{4} \times \frac{2}{25}$
 = $\frac{67}{10} = 6\frac{7}{10} \text{ m}$

Thus, the other side is $6\frac{7}{10}$ m.

9. Number of cans of juice = $\frac{20}{1\frac{1}{3}} = \frac{20 \times 3}{4} = 15$ cans

Thus, there are 15 cans of juice used.

10. Cost of an egg = ₹ $5\frac{1}{4}$ = ₹ $\frac{21}{4}$
 Number of eggs = $\frac{840}{\frac{21}{4}} = \frac{840}{21} \times 4 = 40 \times 4 = 160$

Apply Your Mind!

1. (a) 2. (b) 3. (b)



3. Decimal

Learning Target 3.1

1. (i) 4.0300, 4.0303, 0.4000, 0.0400
 (ii) 1.2100, 56.0000, 0.2359, 12.1000, 0.0120
 2. (i) 3.9129, 39.0129, 39.129, 39.219 (ii) 0.0501, 0.5019,
 2.05019, 2.5019
 (iii) 0.0004, 0.00234, 0.0034, 0.02340
 (iv) 30.0506, 32.0056, 32.0506, 32.05061
 (v) 0.00123, 0.00124, 0.00213, 0.00412
 3. (i) 1.11, 1.101, 1.1, 1.0101, 1.01 (ii) 2.43, 2.4, 2.34, 2.3
 (iii) 99.09, 9.09, 0.990, 0.909, 0.099.

Learning Target 3.2

1. (i) $1.25 = \frac{125}{100} = \frac{5}{4}$ (ii) $7.56 = \frac{756}{100} = \frac{189}{25}$
 (iii) to (vii) Do yourself. (viii) $0.099 = \frac{99}{1000}$
 2. (i) $\frac{15}{4} = 3.75$ (ii) Do yourself. (iii) $\frac{483}{16} = 30.1875$
 (iv) Do yourself.
 3. (i) $\frac{5}{100} = 0.05$ (ii) 0.02 (iii) $\frac{385}{10} = 38.5$
 (iv) 0.0052 (v) $\frac{517}{100000} = 0.00517$
 (vi) $\frac{111}{1000000} = 0.000111$ (vii) $\frac{49}{1} = 49$

Learning Target 3.3

1. (i) $15.19 = 15.20$ (ii) $4.256 = 4.260$ (iii) Do yourself.
 (iv) $45.0385 = 45.0390$ (v) to (viii) Do yourself.

2. (i) $\frac{43}{12} = 3.58$ (ii) to (v) Do yourself.

$$\begin{array}{r} 3.58 \\ 12 \overline{) 43 } \\ \underline{36} \\ 70 \\ \underline{60} \\ 100 \\ \underline{96} \\ 4 \end{array}$$

$$\therefore \frac{43}{12} = 3.58$$

3. (i) 5.5, 13.7, 12.8, 0.35 and 1.11

$$\begin{array}{r} 5.5 \\ 13.7 \\ 12.8 \\ 0.35 \\ \hline + 1.11 \\ \hline 33.46 \end{array}$$

(ii) to (iv) Do yourself.

4. (i) $500 + 50 + 5 + \frac{5}{10} + \frac{5}{100}$
 $= 500 + 50 + 5 + 0.5 + 0.05 = 555.55$

(ii) Do yourself.

5. (i) 37.5 from 48.31

$$\begin{array}{r} 48.31 \\ - 37.50 \\ \hline 10.81 \end{array}$$

(ii), (iii) Do yourself.

(iv) 1.2345 from 7.0091

$$\begin{array}{r} 7.0091 \\ - 1.2345 \\ \hline 5.7746 \end{array}$$

6. Twinkle had thread = 100 m
 Thread broke = 12.03 m
 Left thread = 100 m - 12.03 m = **87.97 m**

7. Rahim was standing from a plane mirror = 5.36 ft
 The distance of image from him = 5.36 ft + 5.36 ft = **10.72 ft**

8. Mrs. Saasha bought flour = 4 kg 250 g
 Mrs. Saasha bought nuts = 3 kg 50 g
 Mrs. Saasha bought olive oil = 350 g

$$\begin{aligned} \text{Total weight did she buy} &= 4 \text{ kg } 250 \text{ g} + 3 \text{ kg } 50 \text{ g} + 350 \text{ g} \\ &= \mathbf{7 \text{ kg } 650 \text{ g}} \end{aligned}$$

9. The length of triathlon = 10 km
 Kunal ran = 5.1 km
 Kunal cycled = 4.2 km
 Total of running and cycling = 5.1 km + 4.2 km = 9.3 km
 Rest distance = 10 km – 9.3 km
 = **0.7 km or 700 m**

So, Kunal swam 0.7 km or 700 m.

10. It must be added $301.5 - 294.315 = 7.185$

11. It must be subtracted = $90.1 - 9.09 = \mathbf{81.01}$

Learning Target 3.4

1. (i) 25.36×10 (ii) to (ix) Do yourself.

$$\begin{array}{r} 25.36 \\ \times 10 \\ \hline 0000 \\ \underline{2536 \times} \\ 253.60 \end{array}$$

- (x) 13.3×100 (xi) to (xv) Do yourself.

$$\begin{array}{r} 13.3 \\ \times 100 \\ \hline 000 \\ 000 \times \\ \underline{133 \times \times} \\ 1330.0 \end{array}$$

- (xvi) 50.56×1000 (xvii), (xviii) Do yourself.

$$\begin{array}{r} 50.56 \\ \times 1000 \\ \hline 0000 \\ 0000 \times \\ 0000 \times \times \\ \underline{5056 \times \times \times} \\ 50560.00 \end{array}$$

2. (i) 23.05×12 (ii) to (vii) Do yourself.

$$\begin{array}{r} 23.05 \\ \times 12 \\ \hline 4610 \\ \underline{2305 \times} \\ 276.60 \end{array}$$

(viii) 42.03×14.06

$$\begin{array}{r} 42.03 \\ \times 14.06 \\ \hline 25218 \\ 0000\times \\ 16812\times\times \\ \hline 4203\times\times\times \\ \hline 590.9418 \end{array}$$

(ix) to (xii) Do yourself.

(xiii) 0.256×0.378

$$\begin{array}{r} 0.256 \\ \times 0.378 \\ \hline 2048 \\ 1792\times \\ 0768\times\times \\ \hline 0000\times\times\times \\ \hline 0.096768 \end{array}$$

(xiv), (x) Do yourself.

3. (i) $1.5 \times 6.2 \times 3$

$$\begin{array}{r} 1.5 \\ \times 6.2 \\ \hline 30 \\ \hline 90\times \\ \hline 9.30 \\ \hline \times 3 \\ \hline 27.90 \end{array}$$

(ii), (iii) Do yourself.

(iv) $0.97 \times 0.05 \times 0.42$

$$\begin{array}{r} 0.97 \\ \times 0.05 \\ \hline 485 \\ 000\times \\ \hline 000\times\times \\ \hline 0.0485 \end{array}$$

(v) Do yourself.

$$\begin{array}{r} 0.0485 \\ \times 0.42 \\ \hline 00970 \\ 01940\times \\ \hline 00000\times\times \\ \hline 0.020370 \end{array}$$

4. A fan rotates per minute = 123.5

The fan adjusted 3.5 times more = 123.5×3.5

= **432.25 per minute**

5. A box of wood weighs = 13.3 kg

15 boxes of wood weigh = $13.3 \times 15 =$ **199.5 kg**

6. Motor bike goes in 1 L = 67.33 km

Motor bike goes in 3.25 L = $67.33 \times 3.25 =$ **218.8225 km**

7. Charges for one unit = ₹ 4.28

Charges for 49 units = $4.28 \times 49 = ₹ 209.72$

8. Mohan spent for rice = $36.30 \times 2.5 = ₹ 90.75$

Mohan spent for apples = $4 \times ₹ 50.50 = ₹ 202.00$

Mohan spent for petrol = $₹ 12.39 \times 79.03 = ₹ 979.18$

Mohan spent total = $₹ 90.75 + ₹ 202.00 + ₹ 979.18 = ₹ 1271.93$

Learning Target 3.5

1. (i) 56 by 10

$$\begin{array}{r} \underline{5.6} \\ 10) 56 \\ \underline{50} \\ 60 \\ \underline{60} \\ \times \end{array}$$

(ii) Do yourself.

(iii) 0.051 by 10

$$\begin{array}{r} \underline{0.0051} \\ 10) 0.051 \\ \underline{50} \\ 10 \\ \underline{10} \\ \times \end{array}$$

(iv), (v) (vi) Do yourself.

2. (i) 132.65 by 100

$$\begin{array}{r} \underline{1.3265} \\ 100) \underline{132.65} \\ \underline{100} \\ 326 \\ \underline{300} \\ 265 \\ \underline{200} \\ 650 \\ \underline{600} \\ 500 \\ \underline{500} \\ \times \end{array}$$

(ii), (iii) Do yourself.

(iv) 0.5 by 100

$$\begin{array}{r} \underline{0.005} \\ 100) \underline{0.500} \\ \underline{500} \\ \times \end{array}$$

(v) to (ix) Do yourself.

3. (i) 7 by 2

$$\begin{array}{r} 3.5 \\ 2 \overline{) 7} \\ \underline{6} \\ 10 \\ \underline{10} \\ \times \end{array}$$

(ii), (iii) Do yourself.

(iv) 699 by 40

$$\begin{array}{r} 17.475 \\ 40 \overline{) 699} \\ \underline{40} \\ 299 \\ \underline{280} \\ 190 \\ \underline{160} \\ 300 \\ \underline{280} \\ 200 \\ \underline{200} \\ \times \end{array}$$

(v), (vi) Do yourself.

4. (i) 19.2 by 6

$$\begin{array}{r} 3.2 \\ 6 \overline{) 19.2} \\ \underline{18} \\ 12 \\ \underline{12} \\ \times \end{array}$$

(ii), (iii) Do yourself

(iv) 0.4212 by 18

$$\begin{array}{r} 0.0234 \\ 18 \overline{) 0.4212} \\ \underline{36} \\ 61 \\ \underline{54} \\ 72 \\ \underline{72} \\ \times \end{array}$$

(v) to (ix) Do yourself.

5. (i) 3.24 by 0.6,

$$\begin{array}{r} 5.4 \\ 0.6 \overline{) 3.24} \\ \underline{30} \\ 24 \\ \underline{24} \\ \times \end{array}$$

(ii), (iii), (iv) Do yourself.

(v) 0.63512 by 13.6

$$\begin{array}{r} 0.0467 \\ 13.6 \overline{) 0.63512} \\ \underline{544} \\ 911 \\ \underline{810} \\ 952 \\ \underline{952} \\ \times \end{array}$$

(vi) Do yourself.

6. Cost of 31 eggs = ₹ 173.60

$$\text{Cost of 1 egg} = ₹ 173.60 \div 31 = ₹ \mathbf{5.60}$$

7. Number of sweet balls = $588.38 \text{ g} \div 45.26 = \mathbf{13}$

8. Total of rainfall in one month = 37.02 mm

$$\text{Rainfall in one day} = 37.02 \text{ mm} \div 30 = \mathbf{1.234 \text{ mm}}$$

Apply your Mind!

1. (a)

2. (b)

3. (b)

4. (c)



4. Rational Numbers

Learning Target 4.1

1. (i) F

(ii) T

(iii) F

(iv) T

(v) F

(vi) F

2. (i) 12

(ii) 6

(iii) -15

(iv) -67

3. (i) 7

(ii) 49

(iii) -9

(iv) -9

4. (i) $\frac{1}{4} \times \frac{5}{5} = \frac{\mathbf{5}}{\mathbf{20}}$

(ii) $\frac{1 \times 9}{4 \times 9} = \frac{\mathbf{9}}{\mathbf{36}}$

(iii) Do yourself.

(iv) $\frac{1 \times 1000}{4 \times 1000} = \frac{\mathbf{1000}}{\mathbf{4000}}$

(v) $\frac{1 \times -25}{4 \times -25} = \frac{\mathbf{-25}}{\mathbf{-100}}$

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

2	36
2	18
3	9
3	3
	1

$$(ii) \frac{-36}{180} = \frac{-2 \times 2 \times 3 \times 3}{2 \times 2 \times 3 \times 3 \times 5} = \frac{-1}{5}$$

2	180
2	90
3	45
3	15
5	5
	1

(iii), (iv) Do yourself.

$$6. (i) \frac{2}{3} = \frac{x}{135}$$

By cross multiplication

$$2 \times 135 = 3 \times x$$

$$x = \frac{2 \times 135}{3}$$

or

$$x = 2 \times 45$$

$$x = \mathbf{90}$$

$$(ii) \frac{5}{x} = \frac{90}{216}$$

By cross multiplication

$$90 \times x = 5 \times 216$$

$$x = \frac{5 \times 216}{90}$$

\Rightarrow

$$x = \mathbf{12}$$

(iii), (iv) Do yourself.

$$(v) \frac{72}{81} = \frac{8}{x}$$

By cross multiplication

$$72 \times x = 8 \times 81$$

i.e.,

$$x = \frac{8 \times 81}{72}$$

or

$$x = \frac{81}{9} \mathbf{x = 9}$$

7. (i) $\frac{-144}{-504} = \frac{144}{504} = \frac{2 \times 2 \times 2 \times 2 \times 3 \times 3}{2 \times 2 \times 2 \times 3 \times 3 \times 7} = \frac{2}{7}$

$$\begin{array}{r|l} 2 & 144 \\ \hline 2 & 72 \\ \hline 2 & 36 \\ \hline 2 & 18 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

$$\begin{array}{r|l} 2 & 504 \\ \hline 2 & 252 \\ \hline 2 & 126 \\ \hline 3 & 63 \\ \hline 3 & 21 \\ \hline 7 & 7 \\ \hline & 1 \end{array}$$

(ii) Do yourself.

(iii) $\frac{240}{-840} = \frac{24}{-84} = \frac{2 \times 2 \times 2 \times 3}{-2 \times 2 \times 3 \times 7} = \frac{2}{-7}$

$$\begin{array}{r|l} 2 & 24 \\ \hline 2 & 12 \\ \hline 2 & 6 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

$$\begin{array}{r|l} 2 & 84 \\ \hline 2 & 42 \\ \hline 3 & 21 \\ \hline 7 & 7 \\ \hline & 1 \end{array}$$

(iv) $\frac{225}{625} = \frac{3 \times 3 \times 5 \times 5}{5 \times 5 \times 5 \times 5} = \frac{9}{25}$

$$\begin{array}{r|l} 5 & 225 \\ \hline 5 & 45 \\ \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

$$\begin{array}{r|l} 5 & 625 \\ \hline 5 & 125 \\ \hline 5 & 25 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

Learning Target 4.2

1. (i) F (ii) F (iii) F (iv) T
 (v) F (vi) F (vii) T

2. (i) $\frac{2 \times -28}{5 \times -28} = \frac{-56}{-140}$

(ii) $\frac{2 \times 77}{5 \times 77} = \frac{154}{385}$

(iii) $\frac{2 \times -375}{5 \times -375} = \frac{-750}{-1875}$

(iv) $\frac{2 \times 250}{5 \times 250} = \frac{500}{1250}$

(v) Do yourself.

3. (i) $\frac{5}{6}$ and $\frac{7}{9}$

LCM of 6 and 9 is 18.

$$\frac{5}{6}, \frac{7}{9} = \frac{5 \times 3, 7 \times 2}{18} = \frac{15}{18}, \frac{14}{18}$$

(ii) Do yourself.

(iii) $\frac{4}{5}, \frac{17}{20}, \frac{23}{40}$ and $\frac{11}{16}$

LCM of 5, 20, 40 and 16 is 80.

$$= \frac{4 \times 16, 17 \times 4, 23 \times 2, 11 \times 5}{80} = \frac{64, 68, 46, 55}{80}$$

$$= \frac{64}{80}, \frac{68}{80}, \frac{46}{80}, \frac{55}{80}$$

4. Do yourself.

5. (i) $\frac{-9}{12}$ and $\frac{8}{-12}$

Because numerators are not equal.

Therefore $\frac{-9}{12} \neq \frac{8}{-12}$

(ii) $\frac{-16}{20}$ and $\frac{20}{-25}$

LCM of 20 and 25 is 100.

$$= \frac{-16 \times 5, -20 \times 4}{100} = \frac{-80, -80}{100}$$

or $\frac{-80}{100}, \frac{-80}{100}$

Clearly $\frac{-80}{100} = \frac{-80}{100}$

Therefore, $\frac{-16}{20} = \frac{20}{-25}$

(iii) Do yourself.

(iv) $\frac{-8}{-14}$ and $\frac{13}{21}$

LCM of 14 and 21 is 42.

$$= \frac{8 \times 3, 13 \times 2}{42} = \frac{24}{42}, \frac{26}{42}$$

$$\frac{24}{42} \neq \frac{26}{42}$$

[∵ Numerators are not equal]

Therefore $\frac{-8}{-14} \neq \frac{13}{21}$

6. (i) $-\frac{4}{11}, \frac{3}{11} \Rightarrow \frac{3}{11} > \frac{-4}{11} \quad \therefore 3 > -4$

(ii) $-\frac{5}{8}, \frac{-3}{4}$

LCM of 4 and 8 is 8.

$$= \frac{-5 \times 1, -3 \times 2}{8} = \frac{-5}{8}, \frac{-6}{8} \Rightarrow \frac{-5}{8} > \frac{-6}{8}$$

(iii) Do yourself. (iv) $\frac{-4}{9}, \frac{-3}{-7}$

LCM of 7 and 9 is 63.

$$\frac{(-4) \times 9, -3 \times 7}{63} = \frac{-36, -21}{63} = \frac{-36}{63}, \frac{-21}{63}$$

Hence, $\frac{3}{7} > \frac{-4}{9}$

7. (i) $\frac{-4}{7}, \frac{5}{-7} = \frac{-4}{7}, \frac{-5}{7} \Rightarrow \therefore -5 < -4 \Rightarrow \therefore \frac{-5}{7} < \frac{-4}{7}$

(ii) Do yourself. (iii) $\frac{16}{-5}, \frac{3}{1}$

LCM of 5 and 1 is 5.

$$= \frac{-16, 3 \times 5}{5} = \frac{-16}{5}, \frac{15}{5}$$

$\therefore -16 < 15 \Rightarrow \therefore \frac{-16}{5} < \frac{15}{5}$

(iv) Do yourself.

8. (i) $\frac{3}{-2}, \frac{3}{8}, \frac{-7}{4}, \frac{1}{10}$

LCM of 2, 4, 8 and 10 is 40.

$$\frac{-3 \times 20, 3 \times 5, -7 \times 10, 1 \times 4}{40} = \frac{-60}{40}, \frac{15}{40}, \frac{-70}{40}, \frac{4}{40}$$

$$= \frac{-60}{40}, \frac{15}{40}, \frac{-70}{40}, \frac{4}{40}$$

$$= \frac{-3}{2}, \frac{3}{8}, \frac{-7}{4}, \frac{1}{10}$$

(ii) Do yourself.

9. (i) $\frac{-7}{2}, \frac{2}{-3}, \frac{5}{6}, \frac{2}{3}$

LCM of 2, 3, 6 is 6.

$$\frac{-7 \times 3, -2 \times 2, 5 \times 1, 2 \times 2}{6} = \frac{-21}{6}, \frac{-4}{6}, \frac{5}{6}, \frac{4}{6}$$

$$= \frac{-21}{6}, \frac{-4}{6}, \frac{5}{6}, \frac{4}{6}$$

$$= \frac{-7}{2}, \frac{-2}{3}, \frac{5}{6}, \frac{2}{3}$$

(ii) Do yourself.

10. (i) $>$ (ii) $<$ (iii) $=$ (iv) $>$
 11. (i) $\left| \frac{-2}{3} \right| = \frac{2}{3}$ (ii) $\left| \frac{5}{-7} \right| = \frac{5}{7}$ (iii) $\left| \frac{2}{9} \right| = \frac{2}{9}$ (iv) $\left| \frac{-5}{-8} \right| = \frac{5}{8}$

12. (i) $\left| \frac{2}{5} - \frac{8}{9} \right|$

LCM of 5 and 9 is 45.

$$\left| \frac{9 \times 2 - 8 \times 5}{45} \right| = \left| \frac{18 - 40}{45} \right| = \left| \frac{-22}{45} \right| = \frac{22}{45}$$

(ii) $\left| \frac{7}{3} - \left(\frac{-8}{15} \right) \right| = \left| \frac{7}{3} + \frac{8}{15} \right|$ LCM of 3 and 15 is 15.

$$= \left| \frac{7 \times 5 + 8}{15} \right| = \left| \frac{35 + 8}{15} \right| = \left| \frac{43}{15} \right| = 2 \frac{13}{15}$$

(iii) $\left| -10 - \left(\frac{10}{-3} \right) \right| = \left| -10 + \frac{10}{3} \right| = \left| \frac{-30 + 10}{3} \right| = \left| \frac{-20}{3} \right|$

$$= \frac{20}{3} = 6 \frac{2}{3}$$

Apply Your Mind!

1. (c) 2. (d) 3. (d) 4. (c)
 5. (a) 6. (d)



5. Operations on Rational Numbers

Learning Target 5.1

1. (i) $\frac{7}{13} + \frac{(-6)}{13} = \frac{7-6}{13} = \frac{1}{13}$

(ii), (iii) Do yourself.

(iv) $\frac{-23}{28} + \frac{5}{-28} = \frac{-23}{28} + \frac{-5}{28} = \frac{-23+(-5)}{28}$
 $= \frac{-23-5}{28} = \frac{-28}{28} = -1$

2. (i) $\frac{-6}{8} + \frac{2}{3}$

The LCM of 8 and 3 is 24.

$$= \frac{-6 \times 3 + 2 \times 8}{24} = \frac{-18 + 16}{24} = \frac{-2}{24} = \frac{-1}{12}$$

(ii), (iii) Do yourself.

$$(iv) \frac{-7}{26} + \frac{-11}{39}$$

The LCM of 26 and 39 is 78.

$$\begin{aligned} &= \frac{(-7) \times 3 + (-11) \times 2}{78} \\ &= \frac{-21 + (-22)}{78} = \frac{-21 - 22}{78} = \frac{-43}{78} \end{aligned}$$

$$3. (i) \frac{4}{11} + \frac{-5}{8} = \frac{-5}{8} + \frac{4}{11}$$
$$\frac{32 - 55}{88} = \frac{-55 + 32}{88} \Rightarrow \frac{-23}{88} = \frac{-23}{88} \Rightarrow \text{LHS} = \text{RHS}$$

(ii), (iii), (iv) Do yourself.

$$4. (i) \frac{-3}{4} + \left(\frac{2}{5} + \frac{-4}{7} \right) = \left(\frac{-3}{4} + \frac{2}{5} \right) + \frac{-4}{7}$$
$$\frac{-3}{4} + \frac{(14 - 20)}{35} = \frac{(-15 + 8)}{20} + \frac{-4}{7}$$
$$\frac{-3}{4} - \frac{6}{35} = \frac{-7}{20} - \frac{4}{7}$$
$$\frac{-105 - 24}{140} = \frac{-49 - 80}{140}$$
$$\frac{-129}{140} = \frac{-129}{140} \Rightarrow \text{LHS} = \text{RSH}$$

(ii), (iii), (iv) Do yourself.

$$5. (i) \frac{2}{5} + \frac{8}{3} + \frac{-11}{15} + \frac{4}{5} + \frac{-2}{3}$$

LCM of 3, 5 and 15 is 15.

$$\begin{aligned} &= \frac{2 \times 3 + 8 \times 5 + (-11) + 4 \times 3 + (-2) \times 5}{15} \\ &= \frac{6 + 40 - 11 + 12 - 10}{15} = \frac{37}{15} \end{aligned}$$

(ii) Do yourself.

$$6. (i) \text{ The additive inverse of } \frac{1}{4} \text{ is } \frac{-1}{4}.$$

$$(ii) \text{ The additive inverse of } \frac{-3}{4} \text{ is } \frac{3}{4}.$$

$$(iii) \text{ The additive inverse of } \frac{-7}{-9} \text{ is } \frac{-7}{9}.$$

$$(iv) \text{ The additive inverse of } \frac{16}{-15} \text{ is } \frac{16}{15}.$$

7. (i) $0 + \frac{9}{11} = \frac{9}{11}$

(ii), (iii), (iv) Do yourself.

Learning Target 5.2

1. (i) F (ii) T (iii) T (iv) T

2. (i) $\frac{13}{15} - \frac{12}{25}$

LCM of 15 and 25 is 75.

$$= \frac{13 \times 5 - 12 \times 3}{75} = \frac{65 - 36}{75} = \frac{29}{75}$$

(ii), (iii) Do yourself.

(iv) $\frac{-6}{13} - \frac{-7}{15} = \frac{-6}{13} + \frac{7}{15}$

The L.C.M. of 13 and 15 is 195.

$$= \frac{(-6) \times 15 + 7 \times 13}{195} = \frac{-90 + 91}{195} = \frac{1}{195}$$

3. (i) $\frac{7}{8} - \frac{5}{8} = \frac{7-5}{8} = \frac{2}{8} = \frac{1}{4}$

$$\frac{5}{8} - \frac{7}{8} = \frac{5-7}{8} = \frac{-2}{8} = \frac{-1}{4} = \frac{1}{4} \neq -\frac{1}{4}$$

(ii) Do yourself. (iii) $\frac{8}{33} - \frac{5}{22}$

The LCM of 22 and 33 is 66.

$$= \frac{8 \times 2 - 5 \times 3}{66} = \frac{16 - 15}{66} = \frac{1}{66}$$

$$\frac{5}{22} - \frac{8}{33} = \frac{15 - 16}{66} = \frac{-1}{66}$$

$$\Rightarrow \frac{1}{66} \neq \frac{-1}{66}$$

4. Let the other number be x.

$$x + \frac{-15}{7} = -8$$

$$x - \frac{15}{7} = -8 \quad \Rightarrow \quad x = -8 + \frac{15}{7}$$

$$x = \frac{-56 + 15}{7} = \frac{-41}{7}$$

5. Suppose we add $\frac{a}{b}$ to $\frac{-7}{8}$ to make it $\frac{5}{9}$

$$\begin{aligned}\frac{a}{b} + \frac{-7}{8} &= \frac{5}{9} \\ \frac{a}{b} &= \frac{5}{9} + \frac{7}{8} = \frac{40+63}{72} = \frac{\mathbf{103}}{\mathbf{72}}\end{aligned}$$

6. Suppose we subtract $\frac{a}{b}$ from $\frac{26}{33}$ to make it $\frac{-5}{11}$

$$\begin{aligned}\frac{26}{33} - \frac{a}{b} &= \frac{-5}{11} \quad \Rightarrow \quad \frac{26}{33} + \frac{5}{11} = \frac{a}{b} \\ \frac{26+5 \times 3}{33} &= \frac{a}{b} \\ \Rightarrow \quad \frac{a}{b} &= \frac{26+15}{33} = \frac{\mathbf{41}}{\mathbf{33}}\end{aligned}$$

7. (i) $\left(\frac{-8}{9} - \frac{11}{4}\right) - \frac{-4}{12}, \frac{-8}{9} - \left(\frac{11}{4} - \frac{-4}{12}\right)$

$$\begin{aligned}\text{LHS} &= \left(\frac{-8 \times 4 - 11 \times 9}{36}\right) + \frac{4}{12} \\ &= \frac{-32 - 99}{36} + \frac{4}{12} \\ &= \frac{-32 - 99 + 12}{36} = \frac{-119}{36}\end{aligned}$$

$$\begin{aligned}\text{RHS} &= \frac{-8}{9} - \left(\frac{11}{4} - \frac{-4}{12}\right) = \frac{-8}{9} - \left(\frac{11}{4} + \frac{4}{12}\right) \\ &= \frac{-8}{9} - \left(\frac{11 \times 3 + 4 \times 1}{12}\right) = \frac{-8}{9} - \left(\frac{33+4}{12}\right) \\ &= \frac{-8}{9} - \frac{37}{12} = \frac{-8 \times 4 - 37 \times 3}{36} \\ &= \frac{-32 - 111}{36} = \frac{-143}{36}\end{aligned}$$

Thus, **LSH** \neq **RHS**

(ii) Do yourself.

8. (i) $\frac{-2}{3} + \frac{5}{9} - \frac{-7}{6} = \frac{-2}{3} + \frac{5}{9} + \frac{7}{6}$

The LCM of 3, 6 and 9 is 18.

$$\begin{aligned}&= \frac{-2 \times 6 + 5 \times 2 + 7 \times 3}{18} \\ &= \frac{-12 + 10 + 21}{18} = \frac{31 - 12}{18} = \frac{\mathbf{19}}{\mathbf{18}}\end{aligned}$$

(ii), (iii), (iv) Do yourself.

$$9. \text{ (i) } \frac{-4}{13} - \frac{-3}{26} = \frac{-4}{13} + \frac{3}{26} = \frac{(-4) \times 2 + 3 \times 1}{26} = \frac{-8+3}{26} = \frac{-5}{26}$$

$$\text{(ii) } \frac{-5}{14} + x = -1$$

$$\frac{-5}{14} + 1 = -x \quad \Rightarrow \quad \frac{5}{14} - 1 = x$$

$$\Rightarrow \quad x = \frac{5-14}{14} = \frac{-9}{14}$$

$$\text{(iii) } \frac{-7}{9} + x = 3$$

$$x = 3 + \frac{7}{9}$$

$$x = \frac{27+7}{9} = \frac{34}{9}$$

$$\text{(iv) } x + \frac{15}{23} = 4$$

$$x = 4 - \frac{15}{23}$$

$$x = \frac{4 \times 23 - 15}{23} = \frac{92 - 15}{23} = \frac{77}{23}$$

Learning Target 5.3

$$1. \text{ (i) } \frac{3}{11} \text{ by } \frac{2}{5} \Rightarrow \frac{3}{11} \times \frac{2}{5} = \frac{6}{55} \quad \text{(ii), (iii) Do yourself.}$$

$$\text{(iv) } \frac{25}{-9} \text{ by } \frac{3}{-10} = \frac{25}{-9} \times \frac{3}{-10} = \frac{75}{90} = \frac{5}{6}$$

(v) Do yourself.

$$\text{(vi) } \left(\frac{9}{-11} \right) \text{ by } \frac{22}{-27} = \frac{9}{-11} \times \frac{22}{-27} = \frac{9}{11} \times \frac{22}{27} = \frac{2}{3}$$

(vii), (viii) Do yourself.

$$2. \text{ (i) } \frac{3}{20} \times \frac{4}{5} = \frac{3}{25} \quad \text{(ii) Do yourself.}$$

$$\text{(iii) } \frac{-9}{8} \times \frac{-16}{3} = \frac{9}{8} \times \frac{16}{3} = 3 \times 2 = 6$$

(iv) Do yourself.

$$3. \text{ (i) } \frac{4}{15} \times \frac{9}{5} \times \frac{50}{3} = 4 \times 2 = 8 \quad \text{(ii) Do yourself.}$$

$$\begin{aligned} \text{(iii) } & \left(\frac{-3}{2} \times \frac{4}{5} \right) + \left(\frac{9}{5} \times \frac{-10}{3} \right) - \left(\frac{1}{2} \times \frac{3}{4} \right) \\ & = \frac{-6}{5} + \frac{(-6)}{1} - \frac{3}{8} = \frac{-6}{5} - \frac{6}{1} - \frac{3}{8} \end{aligned}$$

$$\begin{aligned}
 &= -\left(\frac{6}{5} + \frac{6}{1} + \frac{3}{8}\right) = -\left(\frac{48 + 240 + 15}{40}\right) \\
 &= \frac{-303}{40} = -7 \frac{23}{40}
 \end{aligned}$$

(iv) Do yourself.

$$\begin{aligned}
 4. \left(\frac{2}{9} + \frac{-3}{11}\right) \times \left(\frac{5}{2} + \frac{7}{8}\right) &= \left(\frac{2 \times 11 - 9 \times 3}{99}\right) \times \left(\frac{20 + 7}{8}\right) \\
 &= \frac{22 - 27}{99} \times \frac{27}{8} = \frac{-5 \times 27}{99 \times 8} = \frac{-15}{88}
 \end{aligned}$$

$$\begin{aligned}
 5. \left(\frac{-3}{2} - \frac{4}{15}\right) \times \left(\frac{3}{4} - \frac{7}{12}\right) &= \left(\frac{-3 \times 15 - 4 \times 2}{30}\right) \times \left(\frac{9 - 7}{12}\right) \\
 &= \left(\frac{-45 - 8}{30}\right) \times \left(\frac{2}{12}\right) = \frac{-53}{30} \times \frac{2}{12} = \frac{-53}{180}
 \end{aligned}$$

$$\begin{aligned}
 6. (i) \left(\frac{12}{8} \times \frac{16}{10}\right) + \left(\frac{-3}{9} \times \frac{18}{-16}\right) &= \frac{12}{5} + \frac{3}{8} = \frac{12 \times 8 + 3 \times 5}{40} \\
 &= \frac{96 + 15}{40} = \frac{111}{40}
 \end{aligned}$$

(ii) Do yourself.

$$\begin{aligned}
 (iii) \left(\frac{-4}{15} \times \frac{-5}{-8}\right) - \left(\frac{3}{5} \times \frac{6}{-15}\right) + \left(\frac{5}{-8} \times \frac{16}{15}\right) \\
 &= \frac{-1}{6} + \frac{6}{25} - \frac{2}{3} = -\left(\frac{1}{6} + \frac{2}{3}\right) + \frac{6}{25} \\
 &= -\left(\frac{1}{6} + \frac{2}{3}\right) + \frac{6}{25} = -\left(\frac{1+4}{6}\right) + \frac{6}{25} \\
 &= \frac{-5}{6} + \frac{6}{25} = \frac{-125 + 36}{150} = \frac{-89}{150}
 \end{aligned}$$

(iv) Do yourself.

$$7. 3 \frac{5}{7} \times 16 \frac{1}{2} = \frac{26}{7} \times \frac{33}{2} = \frac{13 \times 33}{7} = ₹ 61 \frac{2}{7}$$

$$8. \text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$65 \frac{1}{3} = \frac{x}{6 \frac{1}{2}} \quad \Rightarrow \quad \frac{196}{3} = \frac{x}{\frac{13}{2}}$$

$$\Rightarrow \frac{196}{3} = \frac{2x}{13} \quad \Rightarrow \quad x = 424 \frac{2}{3} \text{ km}$$

Learning Target 5.4

1. (i) T (ii) F (iii) T (iv) T
(v) T (vi) F (vii) T (viii) F

2. Verify the property

$$x \times y = y \times x$$

(i) $x = \frac{-1}{5}, y = \frac{2}{7}$

$$\frac{-1}{5} \times \frac{2}{7} = \frac{2}{7} \times \frac{-1}{5} = \frac{-2}{35} = \frac{-2}{35}$$

(ii), (ii), (iv) Do yourself.

3. Verify the property

$$a \times (b \times c) = (a \times b) \times c$$

(i) $a = \frac{1}{3}, b = \frac{-2}{3}, c = \frac{4}{3}$

$$\frac{1}{3} \times \left(\frac{-2}{3} \times \frac{4}{3} \right) = \left(\frac{1}{3} \times \frac{-2}{3} \right) \times \frac{4}{3}$$

$$\frac{1}{3} \times \frac{-2}{3} \times \frac{4}{3} = \frac{1}{3} \times \frac{-2}{3} \times \frac{4}{3}$$

$$\frac{-8}{27} = \frac{-8}{27}$$

(ii), (iii), (iv) Do yourself.

4. Verify the property

$$a \times (b + c) = (a \times b) + (a \times c)$$

(i) $a = \frac{5}{6}, b = \frac{-3}{4}, c = \frac{7}{8}$

$$\frac{5}{6} \times \left(\frac{-3}{4} + \frac{7}{8} \right) = \left(\frac{5}{6} \times \frac{-3}{4} \right) + \left(\frac{5}{6} \times \frac{7}{8} \right)$$

$$\frac{5}{6} \times \left(\frac{-6+7}{8} \right) = \left(\frac{-5}{8} \right) + \frac{35}{48}$$

$$\frac{5}{6} \times \frac{1}{8} = \frac{-5}{8} + \frac{35}{48}$$

$$\frac{5}{48} = \frac{35-30}{48} \Rightarrow \frac{5}{48} = \frac{5}{48}$$

(ii) Do yourself.

5. $x \times (y - z) = x \times y - x \times z$

(i) $x = \frac{1}{2}, y = \frac{3}{4}, z = \frac{-4}{5}$

$$\frac{1}{2} \times \left(\frac{3}{4} - \frac{-4}{5} \right) = \frac{1}{2} \times \frac{3}{4} - \frac{1}{2} \times \left(\frac{-4}{5} \right)$$

$$\frac{1}{2} \times \left(\frac{15+16}{20} \right) = \frac{3}{8} + \frac{4}{10}$$

$$\frac{31}{40} = \frac{15+16}{40} \Rightarrow \frac{31}{40} = \frac{31}{40}$$

(ii) Do yourself.

6. (i) Multiplicative inverse of 15 is $\frac{1}{15}$.

(ii) Multiplicative inverse of -16 is $-\frac{1}{16}$.

(iii) Multiplicative inverse of $\frac{5}{6}$ is $\frac{6}{5}$.

(iv) Multiplicative inverse of $\frac{3}{7} \times \frac{4}{7}$ is $\frac{21}{4}$.

7. (i) $\left(\frac{1}{-4} \right)^{-1} = -4$

(ii) $\left(\frac{-4}{6} \times \frac{3}{5} \right)^{-1} = \left(\frac{-2}{5} \right)^{-1} = \frac{5}{-2}$

(iii) $\left(\frac{-7}{3} \right)^{-1} = \frac{3}{-7}$

Learning Target 5.5

1. (i) F (ii) F (iii) F (iv) T

(v) T

2. (i) $\frac{-4}{6} \div \frac{3}{2} = \frac{-4}{6} \times \frac{2}{3} = \frac{-4}{9}$ (ii) Do yourself.

(iii) $\frac{-15}{7} \div \frac{-30}{1} = \frac{-15}{7} \times \frac{1}{-30} = \frac{1}{14}$

(iv) $-25 \div \left(\frac{-5}{6} \right) \Rightarrow \frac{-25}{1} \times \frac{6}{-5} = 30$

(v) Do yourself.

(vi) $\left(\frac{-16}{35} \right) \div \left(\frac{-15}{14} \right) = \frac{-16}{35} \times \frac{14}{-15} = \frac{16 \times 14}{35 \times 15} = \frac{224}{525} = \frac{32}{75}$

(vii) Do yourself.

(viii) $\left(\frac{-7}{12} \right) \div \left(\frac{-2}{3} \right) = \frac{-7}{12} \times \frac{3}{-2} = \frac{7}{8}$

3. Let the other number be x .

$$-\frac{4}{15} \times x = \frac{-8}{9}$$

$$x = \frac{-8}{9} \times \frac{15}{-4} \Rightarrow x = \frac{10}{3}$$

$$4. x \times \frac{-15}{28} = \frac{-5}{7}$$

$$x = \frac{-5}{7} \times \frac{28}{-15} \Rightarrow x = \frac{4}{3}$$

5. Verify that $(x \div y) \times z \neq x \div (y \times z)$

Taking $x = \frac{8}{15}, y = \frac{2}{3}, z = \frac{4}{10}$

$$\left(\frac{8}{15} \div \frac{2}{3}\right) \times \frac{4}{10} \neq \frac{8}{15} \div \left(\frac{2}{3} \times \frac{4}{10}\right)$$

$$\left(\frac{8}{15} \times \frac{3}{2}\right) \times \frac{4}{10} \neq \frac{8}{15} \div \frac{4}{15}$$

$$\frac{8}{25} \neq 2$$

6. (i) $\frac{13}{5} \div \frac{26}{15} = \frac{26}{15} \div \frac{13}{5}$

$$\frac{13}{5} \times \frac{15}{26} = \frac{26}{15} \times \frac{5}{13} \Rightarrow \frac{3}{2} \neq \frac{2}{3}$$

(ii), (iii) Do yourself.

(iv) $\frac{-6}{15} \div \frac{7}{30} = \frac{7}{30} \div \frac{-6}{15}$

$$\frac{-6}{15} \times \frac{30}{7} = \frac{7}{30} \times \frac{15}{-6}$$

$$\frac{-12}{7} \neq \frac{7}{-12}$$

7. Sum = $\frac{65}{13} + \frac{5}{7}$ Subtract = $\frac{65}{13} - \frac{5}{7}$

$$= 5 + \frac{5}{7}$$

$$= 5 - \frac{5}{7}$$

$$= \frac{40}{7}$$

$$= \frac{35-5}{7} = \frac{30}{7}$$

Divide = $\frac{40}{7} \div \frac{30}{7} = \frac{40}{7} \times \frac{7}{30} = \frac{4}{3}$

8. Sum = $\frac{13}{5} + \frac{-6}{15}$

$$= \frac{13}{5} - \frac{6}{15} = \frac{13}{5} - \frac{2}{5}$$

$$= \frac{11}{5}$$

Product = $\frac{-29}{7} \times \frac{1}{-2} = \frac{29}{14}$

Divide = $\frac{11}{5} \div \frac{29}{14}$

$$= \frac{11}{5} \times \frac{14}{29} = \frac{154}{145}$$

$$9. \frac{-35}{6} \div x = \frac{-15}{2}$$

$$\frac{35}{6} \times \frac{1}{x} = \frac{15}{2}$$

$$x = \frac{35 \times 2}{6 \times 15} \Rightarrow x = \frac{7}{9}$$

$$10. \text{ Cost of per meter cloth} = \frac{65\frac{1}{2}}{3\frac{2}{5}} = \frac{\frac{131}{2}}{\frac{17}{5}} = \frac{131}{2} \times \frac{5}{17}$$

$$= \frac{655}{34} = ₹ 19\frac{9}{34}$$

$$11. \text{ Length of cloth required for each pair} = \frac{60}{25} = 2.4 \text{ metre.}$$

$$12. (i) \frac{9}{8} \div x = \frac{6}{5}$$

$$\frac{9}{8} \times \frac{1}{x} = \frac{6}{5}$$

$$8 \times 6 \times x = 9 \times 5$$

$$x = \frac{9 \times 5}{6 \times 8} = \frac{15}{16}$$

(ii), (iii) Do yourself.

$$(iv) (-15) \div x = \frac{-6}{5}$$

$$-15 \times \frac{1}{x} = \frac{-6}{5} \Rightarrow -6 \times x = 5 \times -15$$

$$x = \frac{5 \times 15}{6} \Rightarrow x = \frac{25}{2}$$

$$13. \text{ Verify } (x \times y)^{-1} = x^{-1} \times y^{-1}$$

$$(i) x = \frac{11}{23}, y = \frac{-17}{5}$$

$$\left(\frac{11}{23} \times \frac{-17}{5}\right)^{-1} = \left(\frac{11}{23}\right)^{-1} \times \left(\frac{-17}{5}\right)^{-1}$$

$$\frac{23}{11} \times \frac{5}{-17} = \frac{23}{11} \times \frac{5}{-17}$$

(ii) Do yourself.

Learning Target 5.6

- | | | | |
|----------|--------|---------|----------|
| 1. (i) T | (ii) T | (iii) T | (iv) T |
| (v) F | (vi) T | (vii) T | (viii) F |
| (ix) F | (x) F | | |

2. The rational number between -5 and $-4 = \frac{-5-4}{2} = \frac{-9}{2}$
3. The rational number between -7 and $-6 = \frac{-7-6}{2} = \frac{-13}{2}$

Now a rational number between $\frac{-13}{2}$ and -6 .

$$\frac{1}{2} \left\{ \frac{-13}{2} - 6 \right\} = \frac{1}{2} \left\{ \frac{-25}{2} \right\} = \frac{-25}{4}$$

A rational number between $\frac{-13}{2}$ and -7 .

$$\frac{1}{2} \left\{ \frac{-13}{2} - 7 \right\} = \frac{1}{2} \left\{ \frac{-27}{2} \right\} = \frac{-27}{4}$$

The desired rational numbers are $\frac{-27}{4}, \frac{-13}{2}, \frac{-25}{4}$.

4. The rational number between -1 and 1

$$= \frac{-1+1}{2} = \frac{0}{2} = 0; -1 < 0 < 1$$

Now a rational number between -1 and 0 .

$$= \frac{1}{2} \{-1 + 0\} = \frac{-1}{2} \Rightarrow -1 < \frac{-1}{2} < 0 < 1$$

A rational number between 0 and $1 = \frac{0+1}{2} = \frac{1}{2}$

$$-1 < -\frac{1}{2} < 0 < \frac{1}{2} < 1$$

A rational number between $\frac{1}{2}$ and $0 = \frac{\frac{1}{2} + 0}{2} = \frac{1}{4}$

$$-1 < -\frac{1}{2} < 0 < \frac{1}{4} < \frac{1}{2} < 1$$

A rational number between 0 and $\frac{1}{2} = \frac{0 - \frac{1}{2}}{2} = \frac{-1}{4}$

$$-1 < \frac{-1}{2} < \frac{-1}{4} < 0 < \frac{1}{4} < \frac{1}{2} < 1$$

The desired rational numbers are $\frac{-1}{2}, \frac{-1}{4}, 0, \frac{1}{4}, \frac{1}{2}$.

5. 4 rational numbers between $\frac{3}{4}$ and $\frac{2}{3}$, firstly equating the denominator of both, we get $\frac{9}{12}$ and $\frac{8}{12}$.

$\frac{8}{12} < \frac{9}{12}$, the rational number could be $\frac{8+9}{12 \times 2} = \frac{17}{24}$, equating denominator of both, we get $\frac{16}{24} < \frac{17}{24} < \frac{18}{24}$ other is $\frac{17+18}{24 \times 2} = \frac{35}{48}$, another is $\frac{16+17}{24 \times 2} = \frac{33}{48}$ another is $\frac{33+34}{48 \times 2} = \frac{67}{96}$.
 The desired four rational numbers are $\frac{17}{24}$, $\frac{35}{48}$, $\frac{33}{48}$ and $\frac{23}{32}$.

□

6. Exponents and Powers

Learning Target 6.1

1. (i) T (ii) T (iii) T (iv) F
 (v) T (vi) F

2. (i) $\left(\frac{3}{7}\right)^2 = \frac{3 \times 3}{7 \times 7} = \frac{9}{49}$ (ii) Do yourself.

(iii) $\left(\frac{-2}{3}\right)^4 = \frac{-2 \times -2 \times -2 \times -2}{3 \times 3 \times 3 \times 3} = \frac{16}{81}$

3. (i) $\left(\frac{3}{5}\right)^4 \times \left(\frac{1}{3}\right)^3 = \frac{3 \times 3 \times 3 \times 3 \times 1 \times 1 \times 1}{5 \times 5 \times 5 \times 5 \times 3 \times 3 \times 3} = \frac{3}{625}$

(ii) Do yourself.

(iii) $\left(\frac{1}{3}\right)^4 \div \left(\frac{1}{9}\right)^6 = \frac{1 \times 1 \times 1 \times 1}{3 \times 3 \times 3 \times 3} \times \frac{9 \times 9 \times 9 \times 9 \times 9 \times 9}{1 \times 1 \times 1 \times 1 \times 1 \times 1}$
 $= \frac{6561}{1} = 6561$

(iv) $(-2)^5 \div \left(\frac{-1}{3}\right)^3 = (-2)^5 \times \left(\frac{-3}{1}\right)^3$
 $= -2 \times -2 \times -2 \times -2 \times -2 \times -3 \times -3 \times -3$
 $= 32 \times 27 = 864$

4. (i) $\left(\frac{3}{4}\right)^3 \times \left(\frac{2}{3}\right)^2 = \frac{3 \times 3 \times 3 \times 2 \times 2}{4 \times 4 \times 4 \times 3 \times 3} = \frac{3}{16}$

(ii) $\left(-\frac{1}{2}\right)^3 \times 2^3 \times \left(\frac{3}{4}\right)^2 = \frac{-1}{8} \times 8 \times \frac{9}{16} = \frac{-9}{16}$

(iii) $\left[\left(\frac{1}{2}\right)^2 - \left(\frac{1}{4}\right)^3\right] \times 2^3 = \left[\frac{1}{4} - \frac{1}{64}\right] \times 8 = \frac{15}{64} \times 8 = \frac{15}{8}$

$$(iv) (3^2 - 2^2) \div \left(\frac{1}{5}\right)^2 = (9 - 4) \div \frac{1}{5 \times 5}$$

$$5 \div \frac{1}{25} = 5 \times \frac{25}{1} = \mathbf{125}$$

$$5. (i) \frac{1}{243} = \frac{1}{3^5} = \left(\frac{1}{3}\right)^5 \quad (ii) \frac{-16}{729} = -\left(\frac{4}{27}\right)^2$$

$$(iii) \frac{-625}{14641} = -\left(\frac{5}{11}\right)^4 \quad (iv) \frac{-2401}{-256} = \frac{2401}{256} = \left(\frac{7}{4}\right)^4$$

$$6. (i) (-3)^5 = -243 \quad (ii) \text{ Do yourself.}$$

$$\text{Reciprocal} = \frac{-1}{243}$$

$$(iii) \left(-\frac{1}{5}\right)^8 \div \left(\frac{1}{5}\right)^2 = \left(+\frac{1}{5}\right)^6 = \frac{1}{15625}$$

$$\text{Reciprocal} = \mathbf{15625}$$

$$(iv) \left(\frac{3}{7}\right)^3 \times \left(\frac{7}{3}\right)^5 = \left(\frac{3}{7}\right)^3 \times \left(\frac{3}{7}\right)^{-5} = \left(\frac{3}{7}\right)^{-2} = \left(\frac{7}{3}\right)^2 = \frac{49}{9}$$

$$\text{Reciprocal} = \frac{9}{49}$$

$$7. (i) \quad \begin{aligned} 2^3 \times 2^4 &= 2^x \\ 2^{3+4} &= 2^x \quad \Rightarrow \quad 2^7 = 2^x \\ x &= \mathbf{7} \end{aligned}$$

(ii), (iii) Do yourself.

$$(iv) \quad \begin{aligned} (-4)^9 \div (-4)^3 &= (-4)^x \\ (-4)^{9-3} &= (-4)^x \\ (-4)^6 &= (-4)^x \quad \Rightarrow \quad x = \mathbf{6} \end{aligned}$$

$$(v) \frac{8^{13}}{8^{19}} = \frac{1}{8^x}$$

By cross multiplication, we get

$$8^{13+x} = 8^{19}$$

$$\Rightarrow 13 + x = 19$$

$$\Rightarrow x = 19 - 13 = \mathbf{6}$$

$$(vi) (-4)^{11} \div (-4)^{15} = \frac{1}{(-4)^x}$$

$$(-4)^{11-15} = \frac{1}{(-4)^x}$$

$$\begin{aligned} (-4)^{-4} &= \frac{1}{(-4)^x} & \Rightarrow & \frac{1}{(-4)^4} = \frac{1}{(-4)^x} \\ \Rightarrow & & & x = 4 \end{aligned}$$

Learning Target 6.2

1. (i) $3.27 \times 10^6 = \mathbf{3270000}$
 (ii), (iii) Do it yourself.
 (iv) $3.127 \times 10^{-7} = \mathbf{0.0000003127}$
 (v) Do it yourself.
2. (i) $476000 = \mathbf{4.76 \times 10^5}$
 (ii) $8460 \times 10^3 = \mathbf{8.46 \times 10^6}$
 (iii) $0.00025 = \mathbf{2.5 \times 10^{-4}}$
 (iv) $\frac{4}{100000} = \frac{4}{10^5} = \mathbf{4 \times 10^{-5}}$
 (v) $3246 = \mathbf{3.246 \times 10^3}$
3. (i) $6.5 \times 10^{-6} = \mathbf{0.0000065}$
 (ii) Do yourself.
 (iii) $5.6146929 \times 10^7 = \mathbf{56146929}$
 (iv), (v) Do yourself.
4. (i) $980000000, n = 8 = \mathbf{9.8 \times 10^8}$
 (ii), (iii) Do yourself.
 (iv) $10700000000, n = 9 = \mathbf{10.7 \times 10^9}$
5. (i) $1050000 = \mathbf{1.05 \times 10^6}$
 (ii) $1353000000 = \mathbf{1.353 \times 10^9}$
 $1361000000 = \mathbf{1.361 \times 10^9}$
 (iii) $1027000000 = \mathbf{1.027 \times 10^9}$
 $531200000 = \mathbf{5.312 \times 10^8}$
 $495800000 = \mathbf{4.958 \times 10^8}$
 (iv) $\frac{1}{1000000} = \frac{1}{10^6} = \mathbf{1 \times 10^{-6}}$

Apply Your Mind!

- | | | | |
|--------|--------|--------|--------|
| 1. (a) | 2. (a) | 3. (c) | 4. (a) |
| 5. (a) | 6. (b) | | |



7. Algebraic Expressions

Learning Target 7.1

1. (i) 3 (ii) $\frac{-7}{2}$ (iii) 5 (iv) -1
2. (i) x^2 (ii) x (iii) xy^2 (iv) xyz
(v) x^4
3. (i) $\frac{3}{5}$ (ii) -7 (iii) $\frac{1}{2}$ (iv) 1
4. (i) binomial (ii) trinomial (iii) monomial (iv) trinomial
(v) binomial
5. (i) $-2x^2, x^2, 3x^2, -15x^2$ (ii) $-5ab, ab, -ab, 2ab$
(iii) $mn, -mn, 2mn, -2mn$ (iv) $xy^2, -xy^2, 2xy^2, -2xy^2$
(v) $px, -px, 2px, -2px$.

Learning Target 7.2

1. (i) $7x \times 5x^2 = 35x^3$
(ii) $-5x^3 \times 7x^2 = -35x^5$
(iii) $20x \times (-25x^2y) = -500x^3y$
(iv) $2a^2bc \times 4ab^2 = 8a^3b^3c$
(v) $\frac{5}{7} \times x^3 \times \frac{-28}{45} x^4 = \frac{-4}{9} \times x^7$
(vi) $\frac{-8}{5} a^3b \times \frac{15}{16} abc^2 = \frac{-3}{2} a^4b^2c^2$
(vii) Do yourself.
(viii) $\left(-\frac{1}{27} a^2b^2\right) \times \left(-\frac{9}{2} a^3b^2c^2\right) = \frac{1}{6} a^5b^4c^2$
(ix) $3.2x^6y^3 \times 0.5x^2y^2 = \frac{32}{10} x^6y^3 \times \frac{5}{10} x^2y^2$
 $= \frac{160}{100} x^8y^5 = \frac{8}{5} x^8y^5 = 1.6x^8y^5$
(x) $x^{-6} \times x^7 \times (-2x) = -2x^{-6+7+1} = -2x^2$
(xi) $(-2x^2) \times (7x^2) \times (6x^3) = -84x^7$
Put $x = 1$ in both sides
 $(-2 \times 1^2) (7 \times 1^2) (6 \times 1^3) = -84 \times 1$
 $-84 = -84$ Hence proved.

$$\begin{aligned} \text{(xii) } 2ab \times (-5a^2) \times (-4.4a^2b) \\ = 44a^{2+1+2}b^{1+1} = \mathbf{44a^5b^2} \end{aligned}$$

$$\begin{aligned} \text{When } a = -1, b = 2 \\ = 44 \times (-1)^5 \times (2)^2 = -44 \times 4 = \mathbf{-176} \end{aligned}$$

$$\begin{aligned} \text{(xiii) } a = 1, b = 2 \\ = (5a^6) (-10ab^2) (-2a^2b^3) \\ = 100a^{6+2+1}b^{2+3} = 100a^9b^5 \\ = 100 \times (1)^9 \times (2)^5 = 100 \times 1 \times 32 = \mathbf{3200} \end{aligned}$$

$$\begin{aligned} \mathbf{2.} \text{ (i) } a^7 \times a^{10} \times a^{-3} a^{7+10-3} &= a^{7+7} = \mathbf{a^{14}} \\ \text{(ii) } x^{-5} \times (-2x^3) \times 7x^5 &= -14x^{-5+3+5} = \mathbf{-14x^3} \end{aligned}$$

Learning Target 7.3

$$\begin{aligned} \mathbf{1.} \text{ (i) } 5a(a^2 + a + 3) &= 5a \times a^2 + 5a \times a + 5a \times 3 \\ &= \mathbf{5a^3 + 5a^2 + 15a} \end{aligned}$$

(ii) Do yourself.

$$\begin{aligned} \text{(iii) } 0.1a(0.01a + 0.0016) &= \frac{1}{10} a \left(\frac{a}{100} + \frac{16}{10000} \right) \\ &= \frac{\mathbf{a^2}}{\mathbf{1000}} + \frac{\mathbf{16a}}{\mathbf{100000}} \end{aligned}$$

$$\mathbf{2.} \text{ (i) } (3x + 5) \times 7x = 3x \times 7x + 5 \times 7x = \mathbf{21x^2 + 35x}$$

(ii), (iii) Do yourself.

$$\text{(iv) } (5x^2 + 7x) \times 5x^2 = \mathbf{25x^4 + 35x^3}$$

$$\text{(v) } \left(\frac{1}{2}x - \frac{1}{3}y \right) \times 6xy = \frac{1}{2} \times 6x^2y - \frac{6}{3}xy^2 = \mathbf{3x^2y - 2xy^2}$$

$$\begin{aligned} \text{(vi) } (0.2a - 0.1b) \times 0.3ab &= 0.2a \times 0.3ab - 0.1b \times 0.3ab \\ &= \mathbf{0.06a^2b - 0.03ab^2} \end{aligned}$$

$$\begin{aligned} \mathbf{3.} \text{ (i) } (2x + 9) \times (6x + 5) &= 2x \times 6x + 6x \times 9 + 5 \times 2x + 45 \\ &= 12x^2 + 54x + 10x + 45 \\ &= \mathbf{12x^2 + 64x + 45} \end{aligned}$$

(ii), (iii) Do yourself.

$$\begin{aligned} \text{(iv) } (2.5a + 2.3b) \times (2.5a - 2.3b) &= (2.5a)^2 - (2.3b)^2 \\ &= \mathbf{6.25a^2 - 5.29b^2} \end{aligned}$$

$$\mathbf{4.} \text{ (i) } a(a - b) + b(a - b) = a^2 - ab + ab - b^2 = \mathbf{a^2 - b^2}$$

(ii) Do yourself.

$$\begin{aligned} \text{(iii) } a(a^2 + 1) + b(b^2 + 1) - (a + b) &= a^3 + a + b^3 + b - a - b \\ &= \mathbf{a^3 + b^3} \end{aligned}$$

(iv) Do yourself.

$$\begin{aligned}
 5. \quad (i) \quad (2x - 5) \times (7 + 4x) &= 2x \times 7 - 35 + 2x \times 4x - 5 \times 4x \\
 &= 14x - 35 + 8x^2 - 20x \\
 &= \mathbf{8x^2 - 6x - 35}
 \end{aligned}$$

$$\begin{aligned}
 \text{If} \quad (x = 2) &= 8(2)^2 - 6(2) - 35 \\
 &= 8 \times 4 - 12 - 35 \\
 &= 32 - 12 - 35 = \mathbf{-15}
 \end{aligned}$$

(ii), (iii) Do yourself.

$$\begin{aligned}
 (iv) \quad (p^2 - q^2)(p - q) &= \mathbf{p^3 - pq^2 - p^2q + q^3} \\
 \text{If} \quad p = 2, q = 0 &= (2)^3 - (2) \times 0 - (2)^2 \times 0 + 0 = 8
 \end{aligned}$$

$$\begin{aligned}
 6. \quad (i) \quad (2x + 3y)(4x^2y + 5xy^2) \\
 &= 8x^3y + 12x^2y^2 + 10x^2y^2 + 15xy^3 \\
 &= \mathbf{8x^3y + 22x^2y^2 + 15xy^3}
 \end{aligned}$$

$$\begin{aligned}
 (ii) \quad (a^5 + 5)(b^3 + 3) + 4 &= a^5b^3 + 5b^3 + 3a^5 + 15 + 4 \\
 &= \mathbf{a^5b^3 + 5b^3 + 3a^5 + 19}
 \end{aligned}$$

$$\begin{aligned}
 (iii) \quad (a + bcd)(a^3 + b^3c^3d^3) \\
 &= \mathbf{a^4 + ab^3c^3d^3 + a^3bcd + b^4c^4d^4}
 \end{aligned}$$

$$\begin{aligned}
 (iv) \quad (t^2 + s^3)(t^2 - s^3) &\text{ is of the form } (a + b)(a - b) = a^2 - b^2 \\
 &= (t^2)^2 - (s^3)^2 = \mathbf{t^4 - s^6}
 \end{aligned}$$

$$7. \quad (i) \quad -x^2yz(xy^2z - x^2z) = -x^3y^3z^2 + x^4yz^2$$

$$\begin{aligned}
 \text{If } x = -1, y = 1, z = 2 \\
 &= -(-1)^3(1)^3(2)^2 + (-1)^4(1)(2)^2 \\
 &= 1 \cdot 1 \cdot 4 + 1 \cdot 1 \cdot 4 = 4 + 4 = 8
 \end{aligned}$$

(ii) Do yourself.

$$\begin{aligned}
 8. \quad (i) \quad (1.5x - 4y)(1.5x + 4y + 3) \\
 &= 1.5x + (1.5x + 4y + 3) - 4y(1.5x + 4y + 3) \\
 &= 2.25x^2 + 6xy + 4.5x - 6xy - 16y^2 - 12y \\
 &= \mathbf{2.25x^2 - 16y^2 + 4.5x - 12y}
 \end{aligned}$$

(ii) Do yourself.

$$\begin{aligned}
 9. \quad (i) \quad (3x + 4)(2x - 3) + (5x - 4)(x + 2) \\
 &= 3x(2x - 3) + 4 \\
 &= (2x - 3) + 5x(x + 2) - 4(x + 2) \\
 &= 6x^2 - 9x + 8x - 12 + 5x^2 + 10x - 4x - 8 \\
 &= \mathbf{11x^2 + 5x - 20}
 \end{aligned}$$

(ii) Do yourself.

$$\begin{aligned}
\text{(iii)} \quad & (x^2 - 5x + 6)(2x - 3) - (3x^2 + 4x - 5)(x - 2) \\
& = 2x(x^2 - 5x + 6) - 3(x^2 - 5x + 6) - x(3x^2 + 4x - 5) \\
& \qquad \qquad \qquad + 2(3x^2 + 4x - 5) \\
& = 2x^3 - 10x^2 + 12x - 3x^2 + 15x - 18 - 3x^3 - 4x^2 \\
& \qquad \qquad \qquad + 5x + 6x^2 + 8x - 10 \\
& = (2x^3 - 3x^3) + (-10x^2 - 3x^2 - 4x^2 + 6x^2) \\
& \qquad \qquad \qquad + (12x + 15x + 5x + 8x) - 18 - 10 \\
& = \mathbf{-x^3 - 11x^2 + 40x - 28}
\end{aligned}$$

$$\begin{aligned}
\mathbf{10.} \quad \text{(i)} \quad & (x + 2y) \times (2x - 9y + 7) \\
& = 2x^2 - 9xy + 7x + 4xy - 18y^2 + 14y \\
& = \mathbf{2x^2 - 18y^2 - 5xy + 7x + 14y}
\end{aligned}$$

(ii), (iii) Do yourself.

$$\begin{aligned}
\text{(iv)} \quad & (a + b + c) \times (a^3 - b^3) \\
& = \mathbf{a^4 - ab^3 + a^3b - b^4 + a^3c - cb^3}
\end{aligned}$$

$$\begin{aligned}
\mathbf{11.} \quad \text{(i)} \quad & (x + y)(x^2 - xy + y^2) \\
& = x(x^2 - xy + y^2) + y(x^2 - xy + y^2) \\
& = x^3 - x^2y + xy^2 + x^2y - xy^2 + y^3 \\
& = \mathbf{x^3 + y^3}
\end{aligned}$$

$$\begin{aligned}
\text{(ii)} \quad & x^2 + (3x - y)(3x + y + y^2) \\
& = x^2 + 9x^2 + 3xy + 3xy^2 - 3xy - y^2 - y^3 \\
& = \mathbf{10x^2 - y^2 - y^3 + 3xy^2}
\end{aligned}$$

$$\begin{aligned}
\text{(iii)} \quad & x(x + y^2 + z) + y^2(x + y + z) - z(z + y^2) \\
& = x^2 + xy^2 + zx + xy^2 + y^3 + y^2z - zx - zy^2 \\
& = \mathbf{x^2 + 2xy^2 + y^3}
\end{aligned}$$

12. (i) We put $x = 1$, $y = 1$ and $z = 2$

LHS

$$\begin{aligned}
(x + y)(x^2 - xy + y^2) &= (1 + 1)(1^2 - 1 \times 1 + 1^2) \\
&= 2 \times (1 - 1 + 1) = 2 \times 1 = 2
\end{aligned}$$

RHS

$$x^3 + y^3 = 1^3 + 1^3 = 1 + 1 = 2$$

LHS = RHS

(ii), (iii) Do yourself.

Learning Target 7.4

1. (i) $4x + 6 = 4 \times 3 + 6 = 12 + 6 = \mathbf{18}$

(ii) $-6y + 4 = -6 \times -2 + 4 = 12 + 4 = \mathbf{16}$

(iii), (iv) Do yourself.

2. (i) $5a^3 + 2a^2 - 3 = 5 \times -2^3 + 2 \times -2^2 - 3$

$$= 5 \times -8 + 2 \times 4 - 3$$

$$= -40 + 8 - 3 = -\mathbf{35}$$

(ii), (iii), (iv) Do yourself.

3. (i) $m^2 + 3mn - n^2$

$$2^2 + 3 \times 2 \times -1 - (-1)^2$$

$$4 - 6 - 1 = 4 - 7 = -\mathbf{3}$$

(ii), (iii), (iv) Do yourself.

4. $5y^2 + 6y - a = 8$

$$5 \times 2^2 + 6 \times 2 - a = 8$$

$$5 \times 4 + 12 - a = 8$$

$$20 + 12 - a = 8$$

$$-a = 8 - 32$$

$$-a = -24$$

$$a = \mathbf{24}$$

5. $6m^2 - 5mn + 2b = -10$

$$6 \times 1^2 - 5 \times 1^2 \times -2 + 2b = -10$$

$$6 \times 1 + 5 \times 2 + 2b = -10$$

$$6 + 10 + 2b = -10$$

$$2b = -10 - 16$$

$$b = -\frac{26}{2} = -\mathbf{13}$$

6. (i) $8a = 35^2 - 27^2$

$$8a = (35)^2 - (27)^2$$

$$8a = (35 + 27)(35 - 27)$$

$$8a = 62 \times 8$$

$$a = \frac{62 \times 8}{8} = \mathbf{62}$$

(ii) Do yourself.

Apply Your Mind!

1. (b)

2. (b)

3. (c)

4. (a)



8. Linear Equations in One Variable

Learning Target 8.1

$$\begin{aligned}
 1. \quad & 5x - 3 = 3x - 5 \\
 & 5x - 3x = -5 + 3 \quad \Rightarrow \quad 2x = -2 \\
 & x = \frac{-2}{2} = -1
 \end{aligned}$$

$$\begin{aligned}
 2. \quad & \frac{x}{5} + 1 = \frac{1}{15} \quad \Rightarrow \quad \frac{x}{5} = \frac{1}{15} - 1 \\
 & \frac{x}{5} = \frac{1-15}{15} \quad \Rightarrow \quad \frac{x}{5} = \frac{-14}{15} \\
 & x = \frac{-14}{3}
 \end{aligned}$$

3. Do yourself.

$$\begin{aligned}
 4. \quad & \frac{x-8}{3} = \frac{x-3}{5} \\
 & 5(x-8) = 3(x-3) \\
 & 5x - 40 = 3x - 9 \quad \Rightarrow \quad 5x - 3x = -9 + 40 \\
 & 2x = 31 \quad \Rightarrow \quad x = \frac{31}{2}
 \end{aligned}$$

5. Do yourself.

$$\begin{aligned}
 6. \quad & x + 7 - \frac{16x}{3} = 12 - \frac{7x}{2} \\
 & x - \frac{16x}{3} + \frac{7x}{2} = 12 - 7 \quad \Rightarrow \quad x \left(1 - \frac{16}{3} + \frac{7}{2} \right) = 5 \\
 & x \left[\frac{6 - 32 + 21}{6} \right] = 5 \quad \Rightarrow \quad x \left(\frac{27 - 32}{6} \right) = 5 \\
 & x(-5) = 30 \\
 & x = -6
 \end{aligned}$$

7. Do yourself.

$$\begin{aligned}
 8. \quad & \frac{3t-2}{3} + \frac{2t+3}{3} = t + \frac{7}{6} \\
 & \frac{3t}{3} - \frac{2}{3} + \frac{2t}{3} + \frac{3}{3} = t + \frac{7}{6} \\
 & t - \frac{2}{3} + \frac{2t}{3} + 1 = t + \frac{7}{6}
 \end{aligned}$$

$$t + \frac{2t}{3} - t = \frac{7}{6} + \frac{2}{3} - 1$$

$$t \left(1 + \frac{2}{3} - 1 \right) = \frac{7+4-6}{6}$$

$$\frac{2}{3}t = \frac{11-6}{6} \Rightarrow \frac{2}{3}t = \frac{5}{6}$$

$$t = \frac{5}{6} \times \frac{3}{2} \Rightarrow t = \frac{5}{4}$$

9. $3(x-3) = 5(2x+1) \Rightarrow 3x-9 = 10x+5$
 $7x+14 = 0$

$\Rightarrow x = -2$

10. $15(y-4) - 2(y-9) + 5(y+6) = 0$
 $15y - 60 - 2y + 18 + 5y + 30 = 0$

$15y - 2y + 5y = 60 - 30 - 18$

$y(15-2+5) = 60-48$

$18y = 12$

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

11. Do yourself.

12. $4(3w+2) - 5(6w-1) = 2(w-8) - 6(7w-4) + 4w$

$12w + 8 - 30w + 5 = 2w - 16 - 42w + 24 + 4w$

$(12w - 30w - 2w + 42w - 4w) = -8 - 5 - 16 + 24$

$w(12+42-30-2-4) = -5$

$18w = -5 \Rightarrow w = \frac{-5}{18}$

13.

$0.25(4y-3) = 0.5y-9$

$\frac{25}{100}(4y-3) = \frac{5}{10}y-9$

$\frac{25 \times 4y}{100} - \frac{25 \times 3}{100} = \frac{5y}{10} - 9$

$y - \frac{y}{2} = -9 + \frac{3}{4}$

$\frac{y}{2} = \frac{-36+3}{4}$

$\frac{y}{2} = \frac{-33}{4}$

$y = \frac{-33}{2}$

14.

$$\begin{aligned}0.16(5x - 2) &= 0.4x + 7 \\0.16 \times 5x - 0.16 \times 2 &= 0.4x + 7 \\ \frac{16 \times 5x}{100} - \frac{16 \times 2}{100} &= \frac{4x}{10} + 7 \\ \frac{80x}{100} - \frac{4x}{10} &= 7 + \frac{32}{100} \\ x \left(\frac{8}{10} - \frac{4}{10} \right) &= \frac{732}{100} \Rightarrow \frac{4x}{10} = \frac{732}{100} \\ \Rightarrow 4x &= \frac{732}{10} \Rightarrow x = \frac{183}{10} \\ \Rightarrow x &= \mathbf{18.3}\end{aligned}$$

15.

$$\begin{aligned}2.25(2z + 8) &= 5z - 3 \\4.50z + 18.00 &= 5z - 3 \\18 + 3 &= (5 - 4.5)z \\21 &= 0.5z \\ \frac{21}{0.5} &= z \Rightarrow z = \mathbf{42}\end{aligned}$$

16.

$$\begin{aligned}x - \frac{2x}{3} + \frac{x}{2} &= 15 \\ \frac{6x - 4x + 3x}{6} &= 15 \Rightarrow 9x - 4x = 90 \\5x &= 90 \Rightarrow x = \mathbf{18}\end{aligned}$$

17.

$$\begin{aligned}\frac{x}{2} - \frac{1}{4} &= \frac{x}{3} + \frac{1}{2} \\ \frac{x}{2} - \frac{x}{3} &= \frac{1}{2} + \frac{1}{4} \Rightarrow \frac{3x - 2x}{6} = \frac{2 + 1}{4} \\ \frac{x}{6} &= \frac{3}{4} \Rightarrow x = \frac{3 \times 6}{4} = \mathbf{\frac{9}{2}}\end{aligned}$$

18.

$$\begin{aligned}2x - 3(x + 1) &= 5x - 7 \\2x - 3x - 3 &= 5x - 7 \\5x - 2x + 3x &= -3 + 7 \\6x &= 4 \\x &= \mathbf{\frac{2}{3}}\end{aligned}$$

19.

$$\begin{aligned}\frac{4z - 3}{4} - 3 &= \frac{5z - 7}{3} - 4z - 1 \\ \frac{4z}{4} - \frac{3}{4} - 3 &= \frac{5z}{3} - \frac{7}{3} - 4z - 1 \\ z - \frac{5}{3}z + 4z &= \frac{3}{4} + 3 - \frac{7}{3} - 1\end{aligned}$$

$$\frac{3z - 5z + 12z}{3} = \frac{9 + 36 - 28 - 12}{12}$$

$$\frac{10z}{3} = \frac{5}{12} \Rightarrow \frac{2z}{1} = \frac{1}{4}$$

$$\Rightarrow z = \frac{\mathbf{1}}{\mathbf{8}}$$

20. $18y + 3y - \frac{3}{5} = 21 + 5y - 2y$

$$18y + 3y - 5y + 2y = 21 + \frac{3}{5}$$

$$18y = \frac{108}{5} \Rightarrow y = \frac{108}{5 \times 18}$$

$$\Rightarrow y = \frac{\mathbf{6}}{\mathbf{5}}$$

Learning Target 8.2

- 1.** Let the one number be x and other $95 - x$.

$$x + 3 = 95 - x$$

$$2x = 95 - 3$$

$$2x = 92$$

$$x = \frac{92}{2} = 46$$

Therefore the numbers are **46** and **49**.

- 2.** Let the number be x , $x + 1$ and $x + 2$.

$$x + x + 1 + x + 2 = 24$$

$$3x + 3 = 24$$

$$3x = 24 - 3$$

$$3x = 21 = 7$$

Therefore the numbers are $7, 7 + 1, 7 + 2 = \mathbf{7, 8}$ and **9**.

- 3.** Let the number be x .

$$2x + 7 = 49$$

$$2x = 49 - 7 \Rightarrow 2x = 42$$

$$\Rightarrow x = \frac{42}{2} \Rightarrow x = \mathbf{21}$$

- 4.** Let the number be x .

$$3x - 22 = 68$$

$$3x = 68 + 22$$

$$3x = 90$$

$$\Rightarrow x = \frac{90}{3} \Rightarrow x = \mathbf{30}$$

5. Let the number be x .

$$7x - 3 = 53$$

$$7x = 56$$

$$x = 8$$

6. Let x be the number of 10 rupee note and y that of 50 rupee note.

$$\text{Given that, } 10x + 50y = 250 \quad \dots(1)$$

$$\text{and } x = y + 1 \quad \dots(2)$$

Putting the value of x from equation (2) in equation (1).

$$\text{We get, } 10(y + 1) + 50y = 250$$

$$10y + 10 + 50y = 250$$

$$60y = 240$$

$$y = \frac{240}{60} = 4$$

$$\text{From equation (2), } x = y + 1, x = 4 + 1 = 5$$

Number of 10 rupee note = **5**, Number of 50 rupee note = **4**

7. Let the breadth = x

$$\text{And Length} = 2x + 2$$

$$\text{Perimeter of rectangle} = 2 \times (l + b)$$

$$28 = 2 \times (x + 2x + 2)$$

$$14 = 3x + 2$$

$$\Rightarrow 3x = 12$$

$$\Rightarrow x = 4$$

Breadth = **4 cm**, Length = **10 cm**.

8. Let subramaniam's age = x

$$\text{Mother's age} = 6x$$

$$\text{After 5 years, } x + 5 + 20 = 6x + 5$$

$$x + 25 = 6x + 5$$

$$25 - 5 = 6x - x$$

$$20 = 5x \Rightarrow x = 4$$

4 years and $6 \times 4 =$ **24 years**.

9. Let breadth be x and length be $x + 4$.

$$\text{Perimeter of the rectangle} = 2 \times (\text{length} + \text{breadth})$$

$$84 = 2 \times (x + 4 + x)$$

$$42 = 2x + 4$$

$$42 - 4 = 2x$$

$$\Rightarrow 38 = 2x \Rightarrow x = 19$$

Breadth = **19 m** Length = **23 m**

10. Let the present age of Sheela be x .

After 15 years,

$$x + 15 = 4x$$

$$3x = 15 \Rightarrow x = 5$$

\therefore Present age of Sheela is **5 years**.

11. Let the one prize = x ; and other prize = $(63 - x)$

$$100x + (63 - x) \times 25 = 3000$$

$$100x + 1575 - 25x = 3000$$

$$75x = 1425 \Rightarrow x = \frac{1425}{75} = 19$$

$$19, 63 - 19 = 44$$

Number of 100 rupee prizes = 19, Number of 25 rupee prizes = **44**

12. Let the one = x and other prize = $(200 - x)$

$$500x + (200 - x) \times 100 = 50000$$

$$500x + 20000 - 100x = 50000$$

$$400x = 30000$$

$$\therefore x = 75, \therefore \text{Other prize} = 200 - x = 200 - 75 = 125$$

Number of 500 rupee prizes = **75** and Number of 100 rupee prizes

$$= \mathbf{125}$$

13. Let the total worth of Shanti Lal's property be x .

$$\text{Son's share} = \frac{x}{5}$$

$$\text{Daughter's share} = \frac{x}{5}$$

$$\text{Wife's share} = \frac{3x}{5}$$

$$\text{If wife's share} = 288000$$

$$288000 = \frac{3x}{5}$$

$$3x = 288000 \times 5$$

$$x = \frac{288000 \times 5}{3}$$

$$= \text{₹ } \mathbf{480000}$$

₹ 480000 is total worth of Shanti Lal.

14. Let one part = x and other part = $x + 10$.

$$\frac{x}{x + 10} = \frac{3}{5}$$

$$5x = 3x + 30$$

$$5x - 3x = 30$$

$$2x = 30$$

$$\Rightarrow x = 15$$

First part = **15** and other = **25**

Total number = $15 + 25 = 40$

15. Let the boys = x , and girls = $\frac{2x}{5}$

$$\frac{2x}{5} + x = 35 \Rightarrow \frac{2x + 5x}{5} = 35$$

$$\Rightarrow \frac{7x}{5} = 35 \Rightarrow x = \frac{35 \times 5}{7}$$

$$\Rightarrow x = \mathbf{25}$$

Boys = **25**

16. Let the distance covered by Sarita = x km
The distance covered by Julie = $(18 - x)$ km

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\frac{5}{2} = \frac{18 - x}{t}$$

$$\Rightarrow t = \frac{36 - 2x}{5}$$

And $2 = \frac{x}{t} \Rightarrow t = \frac{x}{2}$

According to the condition

$$\frac{36 - 2x}{5} = \frac{x}{2}$$

$$72 - 4x = 5x$$

$$72 = 9x$$

$$\Rightarrow x = 8$$

$$t = \frac{8}{2} = \mathbf{4 \text{ hours.}}$$

17. Let the number be x .

$$\left(x - \frac{1}{2}\right) \times 4 = 5$$

$$x - \frac{1}{2} = \frac{5}{4} \Rightarrow x = \frac{5}{4} + \frac{1}{2}$$

$$x = \frac{5 + 2}{4} = \frac{7}{4}$$

18. Do yourself.

Apply Your Mind!

1. (c) 2. (a) 3. (b) 4. (b)
5. (c) 6. (c)



9. Direct and Inverse Variations

Learning Target 9.1

1. (ii)

x	7	9	13	21	25
y	21	27	39	63	75

(i), (iii) Do yourself.

2.

Time (in minutes)	3	4	7	25	155
Height of the ballon (in metres)	36	48	84	300	1860

3. Sale

1000 ↓
100 ↓

It is a direct variation

Commission

73 ↓
 x ↓

$$\frac{1000}{100} = \frac{73}{x}$$

$$x = \frac{73}{10} = ₹ 7.30.$$

4. Children

5 ↓
40 ↓

It is a direct variation

$$\frac{x}{8} = \frac{40}{5} \Rightarrow x = \frac{40 \times 8}{5}$$

⇒

$$x = 8 \times 8 = \mathbf{64 \text{ bottles.}}$$

Bottle

8 ↓
 x ↓

5. Cost (₹)

18 ↓
36 ↓

It is a direct variation

$$\frac{x}{15} = \frac{36}{18}$$

$$\Rightarrow x = \mathbf{30 \text{ stamps.}}$$

6. Hours

$$\begin{array}{c} 5 \downarrow \\ 20 \end{array}$$

Tools

$$\begin{array}{c} 120 \downarrow \\ x \end{array}$$

It is a direct variation

$$\frac{x}{120} = \frac{20}{5}$$

$$x = \frac{120 \times 20}{5} = 24 \times 20 = 480$$

$$x = \mathbf{480 \text{ tools.}}$$

7. Time

$$\begin{array}{c} 30 \downarrow \\ 6 \end{array}$$

Words

$$\begin{array}{c} 540 \downarrow \\ x \end{array}$$

It is a direct variation

$$\frac{x}{540} = \frac{6}{30}$$

$$\Rightarrow x = \mathbf{108 \text{ words.}}$$

8. Steps

$$\begin{array}{c} 125 \downarrow \\ 315 \end{array}$$

Distance

$$\begin{array}{c} 100 \downarrow \\ x \end{array}$$

It is a direct variation

$$\frac{x}{100} = \frac{315}{125} \Rightarrow x = \frac{315 \times 100}{125}$$

$$\Rightarrow x = \mathbf{252.}$$

9. Do yourself.

10. Plastic

$$\begin{array}{c} 93 \downarrow \\ 105 \end{array}$$

Cost

$$\begin{array}{c} 1395 \downarrow \\ x \end{array}$$

It is a direct variation

$$\frac{x}{1395} = \frac{105}{93} \Rightarrow x = \frac{105 \times 1395}{93}$$

$$x = \mathbf{₹ 1575.}$$

Learning Target 9.2

1. (i) Inverse variation

(ii) Direct variation

2. (i) Possible

(ii) Possible

(iii) Not possible

(iv) Possible

3. Pumps

$$\begin{array}{c} 20 \uparrow \\ 45 \end{array}$$

Hours

$$\begin{array}{c} 12 \downarrow \\ x \end{array}$$

It is inverse variation

$$\frac{x}{12} = \frac{20}{45} \Rightarrow x = \frac{20 \times 12}{45} = \frac{4 \times 12}{9}$$
$$x = \frac{16}{3}$$

$$\Rightarrow x = 5\frac{1}{3} \text{ hours.}$$

4. (i), (ii), (iii) are possible (iv) Not possible

5. Days	Persons
40 ↑	1800 ↓
24 ↓	x ↓

It is a inverse variation

$$\frac{x}{1800} = \frac{40}{24} \Rightarrow x = \frac{1800 \times 40}{24}$$

$$x = 3000 \text{ persons.}$$

6. Do yourself.

7. Months	Persons
9 ↑	560 ↓
7 ↓	x ↓

It is a inverse variation

$$\frac{x}{560} = \frac{9}{7}$$

$$\Rightarrow x = 720 \text{ persons.}$$

Required persons = $720 - 560 = 160$ persons.

8. Time	Speed
20 ↑	12 ↓
15 ↓	x ↓

It is a inverse variation

$$\frac{x}{12} = \frac{20}{15}$$

$$\Rightarrow x = 16 \text{ km/h.}$$

9. Cost	Bats
58 ↑	39 ↓
78 ↓	x ↓

It is a inverse variation

$$\frac{x}{39} = \frac{58}{78} \Rightarrow 78 \times x = 58 \times 39$$

$$x = \frac{58 \times 39}{78} = 29$$

$$x = 29 \text{ bats.}$$

10. Do yourself.

Apply Your Mind!

1. (d)

2. (c)

3. (c)

4. (b)



10. Time and Work, Time and Distance

Learning Target 10.1

1. Distance = Speed \times Time

$$= \frac{48 (8 \times 60 \times 48)}{60} = \frac{4 \times 528}{5} = \frac{2112}{5}$$

$$= \mathbf{422.4 \text{ km.}}$$

2. Speed = $\frac{\text{Distance}}{\text{Time}} = \frac{18 \times 2}{9} = \mathbf{4 \text{ km/hr.}}$

3. Time Distance
 $60 \downarrow$ $50 \downarrow$
 $12 \downarrow$ $x \downarrow$

It is a direct variation

$$\frac{x}{50} = \frac{12}{60} \Rightarrow 60 \times x = 12 \times 50$$

$$x = \frac{12 \times 50}{60} = \frac{12 \times 5}{6} = 10$$

Distance = **10 km.**

4. Speed = $\frac{\text{Distance}}{\text{Time}}$

$$6 = \frac{19.5}{t} \Rightarrow 6t = 19.5$$

$$t = \frac{195}{6 \times 10} \Rightarrow t = \mathbf{3 \frac{1}{4} \text{ hours.}}$$

5. X's one hour work = $\frac{1}{10}$

Y's one hour work = $\frac{1}{15}$

$$\text{X and Y's one hour work} = \frac{1}{10} + \frac{1}{15} = \frac{3+2}{30} = \frac{5}{30} = \frac{1}{6}$$

So, X and Y together fill the tank in **6 hrs.**

6. A's one day's work = $\frac{1}{8}$

B's one day's work = $\frac{1}{12}$

C's one day's work = $\frac{1}{15}$

$$\begin{aligned} \therefore (A + B + C)\text{'s one day's work} &= \frac{1}{8} + \frac{1}{12} + \frac{1}{15} \\ &= \frac{15 + 10 + 8}{120} = \frac{33}{120} = \frac{11}{40} \end{aligned}$$

The complete work finished in **$3\frac{7}{11}$ days.**

7. Ram and Arjun's one day's work = $\frac{1}{12}$

Arjun's one day's work = $\frac{1}{30}$

$$\begin{aligned} \text{Ram's one day's work} &= \frac{1}{12} - \frac{1}{30} \\ &= \frac{5 - 2}{60} = \frac{3}{60} = \frac{1}{20} \end{aligned}$$

Ram alone finish the work in **20 days.**

8. X's one hour work = $\frac{1}{12}$

Y's one hour work = $\frac{1}{15}$

$$\text{Both X and Y's one hour work} = \frac{1}{12} + \frac{1}{15} = \frac{5+4}{60} = \frac{9}{60} = \frac{3}{20}$$

Hence, X and Y together can finish the work in **6 hours 40 minutes.**

9. to 11. Do yourself.

12. Persons

$$\begin{array}{c} 50 \uparrow \\ 75 \downarrow \end{array}$$

Days

$$\begin{array}{c} 18 \downarrow \\ x \uparrow \end{array}$$

$$\frac{x}{18} = \frac{50}{75}$$

$$\Rightarrow x = \frac{50 \times 18}{75} = 2 \times 6 = \mathbf{12 \text{ days.}}$$

13. Do yourself.

14. When a train crosses a tree, entire length of the train passes the tree, i.e., a distance of 270 m is covered.

$$\text{Speed} = \frac{40.5 \times 5}{18} \text{ m/s} = \frac{45}{4} \text{ m/s}$$

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\frac{45}{4} = \frac{270}{t} \Rightarrow t = \frac{270 \times 4}{45}$$

$$t = \mathbf{24 \text{ seconds.}}$$

15. to 16. Do yourself.

$$\mathbf{17.} \text{ Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$80 = \frac{x}{4.5} \Rightarrow 80 = \frac{10 \times x}{45}$$

$$x = \frac{45 \times 80}{10} = 45 \times 8$$

$$\Rightarrow x = 360 \text{ km.}$$

$$\text{Again Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{360}{3} = \mathbf{120 \text{ km/hr.}}$$

$$\mathbf{18.} \text{ Speed} = \frac{55 \times 5}{18} = \frac{275}{18}$$

To cross the platform, the train will have to cover $(250 + 520) \text{ m}$
 $= 770 \text{ m}$

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}} = \frac{770 \times 18}{275} = \mathbf{50.4 \text{ seconds.}}$$

Apply Your Mind!

1. (c)

2. (d)

3. (a)

4. (d)



11. Application of Percentage

Learning Target 11.1

$$\mathbf{1.} \text{ (i) } \frac{b \times \frac{1}{2}}{100} = 50 \Rightarrow b = 2 \times 50 \times 100 = \mathbf{\text{₹ } 10000}$$

(ii) Do yourself.

$$\text{(iii) } \frac{3.4 \times b}{100} = 68 \Rightarrow b = \frac{68 \times 100}{3.4} = \mathbf{\text{₹ } 2000}$$

2. Let the school opened for x day, then

$$\frac{x \times 90}{100} = 216$$

$$90 \times x = 216 \times 100$$

$$x = \frac{216 \times 100}{90} = 240$$

$$x = \mathbf{240 \text{ days.}}$$

3. Let the monthly income be x , then

$$x \times \frac{15}{100} = 600 \quad \Rightarrow \quad 15 \times x = 600 \times 100$$

$$x = \frac{600 \times 100}{15} \quad \Rightarrow \quad x = \mathbf{4000}$$

$$x = \mathbf{₹ 4000.}$$

4. Do yourself.

5. The population of the town in 2020 be x .

$$\frac{5 \times x}{100} = 8820 \quad \Rightarrow \quad x = \frac{8820 \times 100}{5}$$

$$x = \mathbf{176400.}$$

6. Let Kishan's monthly salary be x .

Spend on food = 30%

Donates = 3%

Then total spent in percentage = $(30 + 3) = 33\%$

$$x \times \frac{33}{100} = 2310$$

$$x \times 33 = 2310 \times 100$$

$$x = \frac{2310 \times 100}{33}$$

$$x = \mathbf{₹ 70 \times 100 = ₹ 7000}$$

7. Let the school strength be x .

$$x \times \frac{8}{100} = 160$$

$$x = \mathbf{2000}$$

The new strength = $2000 + 160 = \mathbf{2160.}$

8. Let the total number of matches played by the team during the year be x .

$$\text{Then } \frac{x \times 60}{100} = 12$$

$$x = \frac{12 \times 100}{60} = \frac{100}{5} = \mathbf{20.}$$

9. Do yourself.

10. Let Manjul's income be x .

$$\text{Monika's income} = \frac{x \times 60}{100} = \frac{3x}{5}$$

$$x + \frac{3x}{5} = \frac{8x}{5}$$

\therefore If Monika's income is $\frac{8x}{5}$ then Manjul's income = $\frac{3x}{5}$

\therefore Monika's income is one then Manjul's income = $\frac{3x \times 5}{5 \times 8x}$

\therefore Monika's income is 100 then Manjul's income = $\frac{100 \times 3x \times 5}{5 \times 8x}$

$$= \frac{100 \times 3}{8} = \frac{300}{8} = \frac{75}{2} = \mathbf{37.5\%}.$$

11. Do yourself.

12. If total number of students is 100, number of girls are = 60.

Number of boys = 40.

If number of girls = 60, then total number of students = 100.

If number of girls = 1, then total number of students = $\frac{100}{60}$.

If number of girls = 690, then total number of students

$$= \frac{100}{60} \times 690 = 1150.$$

Total number of students = **1150**

Number of boys = 40% of total number of students

$$= \frac{40}{100} \times 1150$$

Number of boys = **460**.

Learning Target 11.2

1.

Purchased	Overhead expenses	Cost price	Selling price	Profit	Loss	Profit %	Loss %
(i) ₹ 240	₹ 10	₹ 250	₹ 235	—	₹ 15	—	6
(ii) ₹ 370	₹ 80	₹ 450	₹ 540	₹ 90	—	₹ 20	—
(iii) ₹ 3000	₹ 100	₹ 3100	₹ 3038	—	₹ 62	—	2
(iv) ₹ 28000	₹ 2000	₹ 30000	₹ 36000	₹ 6000	—	20	—
(v) ₹ 400	₹ 500	₹ 900	₹ 972	₹ 72	—	8	—

2. Cost price includes the over head charges also.

Therefore, $CP = ₹(70000 + 5000) = 75000$

$$SP = 67500$$

$$SP < CP$$

$$\text{Loss} = CP - SP$$

$$= 75000 - 67500 = ₹ 7500$$

$$\text{Loss \%} = \frac{\text{Loss} \times 100}{CP} = \frac{7500 \times 100}{75000}$$

$$= \frac{100}{10} = \mathbf{10\%}.$$

3. Cost price includes the over head charges also.

Therefore, $CP = ₹(15 + 5) = ₹ 20$

$$SP = ₹ 24$$

$$SP > CP$$

$$\text{Profit} = SP - CP = 24 - 20 = 4$$

$$\text{Profit \%} = \frac{\text{Profit} \times 100}{CP} = \frac{4 \times 100}{20} = \frac{100}{5} = \mathbf{20\%}.$$

4. Cost price includes the overhead charges also.

Therefore, $₹(150 \times 20 + 200) = ₹(3000 + 200) = ₹ 3200$

$$SP = (150 \times 12 \times 2.40) = ₹ 4320$$

$$SP > CP$$

$$\text{Profit} = ₹(4320 - 3200) = ₹ 1120$$

$$\text{Profit \%} = \frac{1120 \times 100}{3200} = \mathbf{35\%}.$$

5. Let the CP be ₹ x .

Then

$$SP = ₹ 990$$

$$\text{Profit} = \frac{x \times 10}{100} = \frac{x}{10}$$

$$SP = x + \frac{x}{10} = \frac{11x}{10}$$

$$\frac{11x}{10} = 990$$

$$\Rightarrow x = \frac{990 \times 10}{11} \Rightarrow x = ₹ \mathbf{900}.$$

6. to 7. Do yourself.

8. Let the CP be ₹ x , then

$$SP = ₹ 10240$$

$$\text{Loss} = \frac{x \times 20}{100} = ₹ \frac{x}{5}$$

$$SP = x - \frac{x}{5} = ₹ \frac{4x}{5}$$

Then

$$\frac{4x}{5} = 10240$$

or

$$x = \frac{10240 \times 5}{4} = ₹ \mathbf{12800}$$

9. Let the CP be ₹ x , then

$$SP = ₹ 240$$

$$\text{Loss} = \frac{x \times 20}{100} = \frac{x}{5}$$

$$SP = x - \frac{x}{5} = \frac{4x}{5}$$

$$\frac{4x}{5} = 240 \quad \Rightarrow \quad x = ₹ 300$$

$$CP = ₹ 300 \text{ and S.P.} = ₹ 360$$

$$\text{Profit} = SP - CP$$

$$= ₹ (360 - 300) = ₹ 60$$

$$\text{Profit \%} = \frac{\text{Profit} \times 100}{CP} = ₹ \frac{60 \times 100}{300} = \mathbf{20\%}$$

10. SP = ₹ 135.

If new SP = ₹ 165

$$\text{Gain \%} = ?$$

$$\text{Loss \%} = \frac{CP - SP}{CP} \times 100$$

$$\frac{10}{100} = \left(1 - \frac{₹ 135}{\text{C.P.}} \right)$$

$$\frac{₹ 135}{CP} = 1 - \frac{1}{10} = \frac{9}{10}$$

$$CP = ₹ \frac{135 \times 10}{9} = 15 \times 10 = ₹ 150$$

$$SP = ₹ 165$$

$$\text{Profit} = SP - CP = ₹ 165 - 150 = ₹ 15$$

$$\text{Profit \%} = \frac{\text{Profit}}{CP} \times 100 = \frac{₹ 15 \times 100}{₹ 150} = \mathbf{10\%}$$

11. SP = ₹ 198, gain = 10%

Then

$$\begin{aligned} CP &= \frac{100}{100 + \text{Profit \%}} \times SP \\ &= ₹ \frac{100 \times 198}{110} = ₹ 180 \end{aligned}$$

Second calculator, SP = ₹ 198, Loss = 10%

$$\begin{aligned} \text{CP} &= \frac{100}{100 - \text{Loss}\%} \times \text{SP} \\ &= \frac{100}{100 - 10} \times ₹ 198 = ₹ \frac{100 \times 198}{90} \\ &= ₹ 10 \times 22 = ₹ 220 \end{aligned}$$

Total SP = ₹ 198 × 2 = ₹ 396

CP = ₹ (180 + 220) = ₹ 400

CP > SP

Loss = ₹ (400 - 396) = ₹ 4

$$\text{Loss \%} = \frac{\text{Loss} \times 100}{\text{CP}} = \frac{4 \times 100}{400} = \frac{100}{100} = 1$$

Loss = 1%.

12. CP = ₹ 960, profit = 5%

$$\begin{aligned} \text{SP} &= \frac{100 + \text{Profit}\%}{100} \times \text{CP} \\ &= \frac{100 + 5}{100} \times 960 = \frac{105 \times 960}{100} \\ &= ₹ \frac{100800}{100} = ₹ 1008. \end{aligned}$$

Again Subramaniam sold it to Mukul at a profit of 10%

$$\begin{aligned} \text{SP} &= \frac{100 + \text{Profit}\%}{100} \times \text{CP} \\ &= \frac{100 + 10}{100} \times 1008 = \frac{110 \times 1008}{100} \\ &= ₹ \frac{110880}{100} = ₹ \mathbf{1108.80}. \end{aligned}$$

13. SP = 150, Loss % = 4%

$$\begin{aligned} \text{CP} &= \frac{100}{100 - \text{Loss}\%} \times \text{SP} \\ &= \frac{100}{100 - 4} \times 150 = ₹ \frac{100}{96} \times 150 \\ &= ₹ 156.25 \end{aligned}$$

Again

$$\begin{aligned} \text{SP} &= \frac{100 + \text{Profit}\%}{100} \times \text{CP} \\ \text{SP} &= \frac{100 + 20}{100} \times 156.25 \\ &= \frac{120 \times 156.25}{100} = ₹ \mathbf{187.50}. \end{aligned}$$

14. CP = 200, Profit = 30%

$$\begin{aligned} \text{SP} &= \frac{100 + \text{Profit}\%}{100} \times \text{CP} \\ &= \frac{100 + 30}{100} \times \text{CP} = \frac{130 \times 200}{100} = ₹ 260 \end{aligned}$$

Cost price of 20 oranges

$$\begin{aligned} &= ₹ 20 \times 2 = ₹ 40 \\ \text{CP} &= 40, \text{Profit} = 5\% \\ \text{SP} &= \frac{100 + \text{Profit}\%}{100} \times \text{CP} \\ &= \frac{(100 + 5)}{100} \times ₹ 40 \\ &= ₹ \frac{105 \times 40}{100} = ₹ 10.5 \times 4 = ₹ 42 \end{aligned}$$

Cost of remaining oranges

$$\begin{aligned} \text{CP} &= 80 \times 2 = 160 \\ \text{SP} &= (260 - 42) = ₹ 218 \\ \text{SP} &> \text{CP} \\ \text{Profit} &= ₹ (218 - 160) = ₹ 58 \\ \text{Profit}\% &= \frac{\text{Profit} \times 100}{\text{CP}} = \frac{58 \times 100}{160} = \mathbf{36.25\%}. \end{aligned}$$

Learning Target 11.3

1. (i) $P = ₹ 500, R = 12\%, T = 2$ years

$$\begin{aligned} \text{SI} &= \frac{P \times R \times T}{100} \\ &= \frac{500 \times 12 \times 3}{100} = ₹ \mathbf{180}. \end{aligned}$$

(ii), (iii) Do yourself.

(iv) $P = ₹ 560, \text{Time} = \frac{73}{365}$ years, $\text{SI} = ₹ 14$

$$R = \frac{\text{SI} \times 100}{P \times T} = \frac{14 \times 100 \times 365}{560 \times 73} = \mathbf{12.5\%}.$$

(v) Do yourself.

(vi) $P = ₹ 720, R = 4\%, \text{SI} = ₹ 72$

$$\begin{aligned} \text{Time} &= \frac{\text{SI} \times 100}{R \times P} = \frac{72 \times 100}{4 \times 720} \\ &= \frac{100}{40} = 2\frac{1}{2} \text{ years} \end{aligned}$$

$$\text{Amount} = P + \text{SI} = ₹ 720 + ₹ 72 = ₹ \mathbf{792}.$$

2. (i), (ii) Do yourself.

$$(iii) P = ₹ 600, R = 2\%, T = \frac{20}{12} = \frac{5}{3} \text{ years}$$

$$SI = \frac{P \times R \times T}{100} = \frac{600 \times 2 \times 5}{3 \times 100} = ₹ 20$$

$$\begin{aligned} \text{Amount} &= P + SI \\ &= ₹ (600 + 20) = ₹ \mathbf{620}. \end{aligned}$$

3. (i), (ii) Do yourself.

$$(iii) SI = ₹ 12600,$$

$$R = 18\% \text{ per annum}$$

$$P = 10000$$

$$T = \frac{SI \times 100}{P \times R} = \frac{12600 \times 100}{10000 \times 18}$$

$$= \mathbf{7 \text{ Years.}}$$

4. (i) $SI = ₹ 36, R = 3\%$ and $T = 3$ years

$$P = \frac{SI \times 100}{R \times T} = \frac{36 \times 100}{3 \times 3} = ₹ \mathbf{3400}.$$

(ii), (iii) Do yourself.

5. (i) $P = ₹ 500, SI = ₹ 150, T = 4$ years

$$R = \frac{SI \times 100}{P \times T} = \frac{150 \times 100}{500 \times 4}$$

$$= \frac{30}{4} = \mathbf{7.5\%}.$$

(ii) Do yourself.

$$(iii) P = 700, SI = ₹ 168, T = \frac{16}{12} \text{ years}$$

$$R = \frac{SI \times 100}{P \times T}$$

$$= \frac{168 \times 100 \times 12}{700 \times 16} = \mathbf{18\%}.$$

6. $P = ₹ 7200, R = 15\%, T = 4\frac{1}{2}$ years = $\frac{9}{2}$ years

$$SI = \frac{P \times R \times T}{100}$$

$$= \frac{7200 \times 15 \times 9}{2 \times 100} = 36 \times 15 \times 9$$

$$= 4860$$

$$A = SI + P$$

$$= 4860 + 7200 = ₹ \mathbf{12060}.$$

7. to 9. Do yourself.

10. Let P be x , $R = 10\%$, $T = 4$ years, $A = ₹ 2520$

$$A = \text{S.I.} + P$$

$$2520 - x = \text{S.I.}$$

$$= \frac{\text{S.I.} \times 100}{R \times T}$$

$$x = \frac{(2520 - x) \times 100}{10 \times 4}$$

$$4x = 25200 - 10x$$

$$14x = 25200 \Rightarrow x = \frac{25200}{14}$$

$$x = ₹ \mathbf{1800}.$$

11. Do yourself.

12. Let P be x , $R = 9\%$, $\text{SI} = 594$, $T = 3$ years

$$P = \frac{\text{SI} \times 100}{R \times T} = \frac{594 \times 100}{9 \times 3}$$

$$= 22 \times 100 = ₹ \mathbf{2200}.$$

Learning Target 11.4

1. $P = ₹ 1500$, $A = ₹ 2655$, $\text{SI} = A - P = ₹ 1155$, $T = \frac{7}{2}$ years

$$\begin{aligned} R &= \frac{\text{SI} \times 100}{P \times T} \\ &= \frac{1155 \times 100 \times 2}{1500 \times 7} = \frac{2310}{105} = \mathbf{22\%}. \end{aligned}$$

2. Let P be x and amount = $\frac{7x}{4}$

$$\text{SI} = \text{Amount} - \text{Principal}$$

$$= \frac{7x}{4} - x = \frac{3x}{4}$$

$$P = x, \text{SI} = \frac{3x}{4}, T = 6 \text{ years}$$

$$R = \frac{\text{SI} \times 100}{P \times T} = \frac{3x \times 100}{4 \times x \times 6} = \mathbf{12.5\%}.$$

3. Do yourself.

4. Let $P = x$, $A = 2x$, $\text{SI} = 2x - x = x$, $R = \frac{25}{2}\%$, $T = ?$

$$T = \frac{\text{SI} \times 100}{P \times R}$$

$$= \frac{x \times 100 \times 2}{x \times 25} = \mathbf{8 \text{ years}}.$$

5. to 6. Do yourself.

7. $P = ₹ 4500, T = 1 \text{ years}, A = ₹ 5265$

$$SI = ₹ (5265 - 4500) = ₹ 765$$

$$R = ?$$

$$R = \frac{SI \times 100}{P \times T}$$

$$= \frac{765 \times 100}{4500 \times 1} = \frac{765}{45} = 17\%$$

For Sanjiv

$$P = ₹ 4500, T = 3, R = 17\%, SI = ?$$

$$SI = \frac{P \times R \times T}{100} = \frac{4500 \times 17 \times 3}{100}$$

$$= ₹ 2295$$

$$\text{Amount} = \text{Principal} + \text{SI}$$

$$= ₹ 4500 + ₹ 2295 = ₹ \mathbf{6795}.$$

8. Do yourself.

Apply Your Mind!

1. (a)

2. (d)

3. (d)

4. (c)

5. (b)

6. (d)

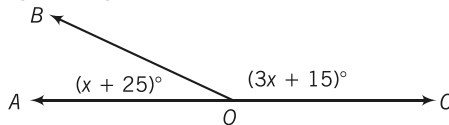
7. (c)



12. Lines and Angles

Learning Target 12.1

1. (i) In the given figure,



We know that

$$(x + 25)^\circ + (3x + 15)^\circ = 180^\circ \quad (\because \text{straight angle})$$

$$4x + 40 = 180$$

$$x = \frac{140}{4} = \mathbf{35^\circ}$$

Thus, value of x is 35° .

(ii) $\angle AOB = ?$

From the (i) part we know that $x = 35^\circ$.

Then, value of

$$\begin{aligned} \angle AOB &= (x + 25)^\circ \\ &= (35 + 25)^\circ = \mathbf{60^\circ}. \end{aligned}$$

Thus,

$$\angle AOB = 60^\circ$$

(iii) $\angle BOC = ?$

From the (i) part we know that $x = 35^\circ$

$$\begin{aligned}\angle BOC &= 3x + 15 \\ &= 3 \times 35 + 15 = 120^\circ\end{aligned}$$

Alternate

From (ii) we know $\angle O = 60^\circ$

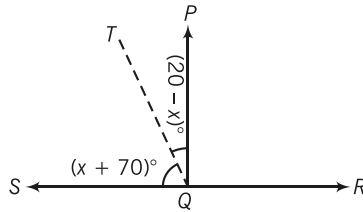
And we also know

$$\begin{aligned}\angle AOB + \angle BOC &= 180^\circ \\ \angle BOC &= 180^\circ - \angle AOB \\ &= 180^\circ - 60^\circ = \mathbf{120^\circ}.\end{aligned}$$

Thus,

$$\angle BOC = 120^\circ.$$

2. In the given figure we know that



$$\begin{aligned}\Rightarrow \quad \angle PQS + \angle PQR &= 180^\circ \\ \Rightarrow \quad (x + 70)^\circ + (20 - x)^\circ + \angle PQR &= 180^\circ \\ \Rightarrow \quad 90^\circ + \angle PQR &= 180^\circ \\ \Rightarrow \quad \angle PQR &= 180^\circ - 90^\circ \\ \Rightarrow \quad \angle PQR &= \mathbf{90^\circ}.\end{aligned}$$

Thus, $\angle PQR$ is 90° .

3. (i) supplementary (ii) complementary
 (iii) supplementary (iv) supplementary
 (v) complementary (vi) complementary

4. Do yourself.

5. Do yourself.

6. If angles $(x + 4)^\circ$ and $(2x - 7)^\circ$ are complementary angles.

Then,

$$\begin{aligned}(x + 4)^\circ + (2x - 7)^\circ &= 90^\circ \\ \Rightarrow \quad 3x - 3 &= 90 \\ 3x &= 93^\circ \\ x &= \mathbf{31^\circ}.\end{aligned}$$

7. Let the required angles be $2x$ and $7x$.

Then, $2x + 7x = 180^\circ$

$$\Rightarrow \quad 9x = 180^\circ \Rightarrow x = \frac{180^\circ}{9} = 20^\circ$$

So, required angle $2x = 2 \times 20 = \mathbf{40^\circ}$

and $7x = 7 \times 20 = 140^\circ$

Thus, 40° and 140° are the required angles.

8. (i) Let the two equal angles be x and x .

Then, according to question

$$\Rightarrow x + x = 90^\circ \Rightarrow 2x = 90^\circ \Rightarrow x = 45^\circ$$

Thus, 45° is the required angle.

- (ii) Let the equal angles be x .

Then, $x + x = 180^\circ$

$$\Rightarrow 2x = 180^\circ$$

$$x = 90^\circ$$

Thus, 90° is the required angle.

Thus, measure of $\angle EFC$ is 80° .

9. (i) $y = 135^\circ$ (vertically opposite angles)

$$y + x = 180^\circ \quad (\text{linear pair})$$

$$\Rightarrow x = 180^\circ - 135^\circ = 45^\circ$$

$$z = x \quad (\text{vertically opposite})$$

$$\Rightarrow z = 45^\circ.$$

Thus, values of x , y and z are 45° , 135° and 45° respectively.

- (ii) $31^\circ + y = 90^\circ$ (linear pair)

$$\Rightarrow y = 90^\circ - 31^\circ = 59^\circ$$

$$z = y \quad (\text{vertically opposite})$$

$$\Rightarrow z = 59^\circ$$

$$x = 31^\circ \quad (\text{vertically opposite})$$

Thus, values of x , y and z are 31° , 59° and 59° respectively.

- (iii) Proceed as (i) and (ii).

10. (i) $139^\circ + 39^\circ = 178^\circ$.

So, pair of angles are not supplementary.

- (ii) Do yourself.

$$(iii) \frac{3}{10} \times 90^\circ + \frac{4}{15} \times 180^\circ$$

$$27^\circ + 48^\circ = 75^\circ$$

So, pair of angles are not supplementary..

- (iv) $2x^\circ + 65^\circ + 115^\circ - 2x^\circ = 180^\circ$

So, pair of angles are supplementary.

11. Let angles be $2x$, $3x$ and $7x$.

According to question,

$$2x + 3x + 7x = 180^\circ$$

$$12x = 180^\circ$$

$$x = 15$$

Then, angles are

$$2x = 2 \times 15 = \mathbf{30^\circ}$$

$$3x = 3 \times 15 = \mathbf{45^\circ}$$

$$7x = 7 \times 15 = \mathbf{105^\circ}.$$

Thus, required angles are 30° , 45° and 105° .

- 12.** Given that $(3x + 18^\circ)$ and $(2x + 25^\circ)$ are supplementary.

Then,

$$3x + 18^\circ + 2x + 25^\circ = 180^\circ, 5x + 43^\circ = 180^\circ$$

$$5x = 137^\circ, x = \mathbf{27.4^\circ \text{ or } 27^\circ 24'}.$$

Thus, value of x is 27.4° .

- 13.** Given that

$$10\% \text{ of } x + 40\% \text{ of } 2x = 90^\circ$$

$$\frac{x \times 10}{100} + \frac{2x \times 40}{100} = 90^\circ$$

$$\frac{x}{10} + \frac{4x}{5} = 90^\circ$$

$$9x = 900^\circ$$

$$x = \mathbf{100^\circ}.$$

Thus, value of x is 100° .

- 14.** Let the angles be x and $5x$.

Then,

$$x + 5x = 90^\circ$$

$$6x = 90^\circ$$

$$x = \mathbf{15^\circ}.$$

So, angles are $x = 15^\circ$ and $5x = 5 \times 15^\circ = \mathbf{75^\circ}$.

- 15.** Do yourself.

- 16.** Proceed as Q. No. 13.

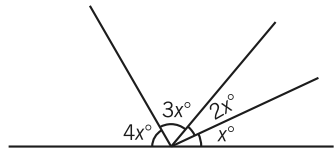
- 17.** In the given figure

$$x + 2x + 3x + 4x = 180^\circ$$

$$10x = 180^\circ$$

$$x = \mathbf{18^\circ}.$$

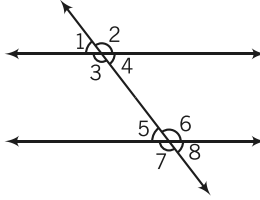
Now its supplement = $180^\circ - 18^\circ$
 $= \mathbf{162^\circ}.$



Thus, value of angle x is 18° and its supplement is 162° .

Learning Target 12.2

1. (i) $\angle 3$ and $\angle 6$ are interior alternate angles.
- (ii) $\angle 2$ and $\angle 4$ are adjacent angles.
- (iii) $\angle 3$ and $\angle 7$ are corresponding angles.
- (iv) $\angle 2$ and $\angle 7$ are exterior alternate angles.
- (v) $\angle 4$ and $\angle 6$ are allied or co-interior angles.
- (vi) $\angle 1$ and $\angle 8$ are exterior alternate angles.
- (vii) $\angle 1$ and $\angle 5$ are corresponding angles.

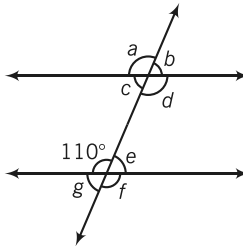


(viii) $\angle 1$ and $\angle 4$ are vertically opposite angles.

(ix) $\angle 5$ and $\angle 7$ are adjacent angles.

2. Do yourself.

3. $a = d$ (vertically opposite angles)



$d = f$ (corresponding angles)

$f = 110^\circ$ (vertically opposite angles)

$\therefore a = d = f = 110^\circ$

$e + 110^\circ = 180^\circ$ (co-interior angles)

$\therefore e = 180^\circ - 110^\circ = 70^\circ$

$b = c$ (vertically opposite angles)

$b = e$ (corresponding angles)

$e = g$ (vertically opposite angles)

$\therefore b = c = e = g = 70^\circ$.

Hence, $a = 110^\circ, b = 70^\circ, c = 70^\circ, d = 110^\circ, e = 70^\circ,$
 $f = 110^\circ$ and $g = 70^\circ$

4. Proceed as Q. No. 3.

5. (i) Given angles are $(2x + 6)^\circ$ and $(3x + 54)^\circ$ are co-interior angles.

We know that pair of parallel lines cut by transversal line, pair of co-interior angles are supplementary

$$\therefore 2x + 6 + 3x + 54 = 180^\circ$$

$$\Rightarrow 5x = 180 - 60 = 120^\circ$$

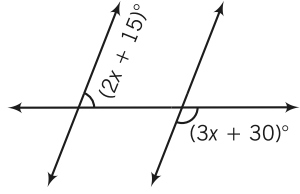
$$\Rightarrow x = \frac{120^\circ}{5} = 24^\circ.$$

Thus, value of x is 24° .

(ii) From the figure $(2x + 15^\circ)$ and $(3x + 30^\circ)$ are co-interior angles.

\therefore Co-interior angles are supplementary.

$$\begin{aligned} 2x + 15 + 3x + 30 &= 180^\circ \\ \Rightarrow 5x + 45 &= 180^\circ \\ \Rightarrow 5x &= 180^\circ - 45 \\ &= 135^\circ \\ \Rightarrow x &= \frac{135^\circ}{5} = 27^\circ \end{aligned}$$



Thus, value of x is 27° .

6. In the figure (i),

$a = b$ (corresponding angles)

$b = c$ (vertically opposite angles)

$a = c$ (alternate angles)

$\therefore \mathbf{a = b = c}$

Thus, $\angle a$, $\angle b$ and $\angle c$ are equal.

In the figure (ii),

$x = y$ (vertically opposite angles)

$y = l$ (alternate angles)

$x = l$ (corresponding angles)

$l = n$ (vertically opposite angles)

$n = r$ (corresponding angles)

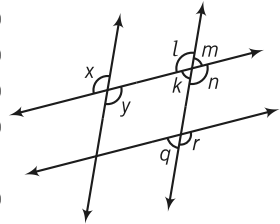
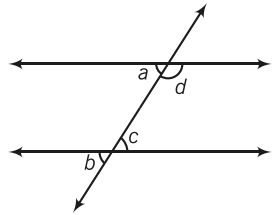
$\therefore x = y = l = n = r$

Again $m = k$ (vertically opposite angles)

$k = q$ (corresponding angles)

$\therefore \mathbf{m = k = q}$

Thus, $\angle m$, $\angle k$ and $\angle q$ are equal.

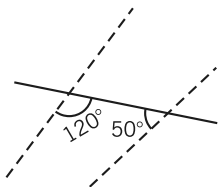


7. (i) In figure, If lines are parallel, then

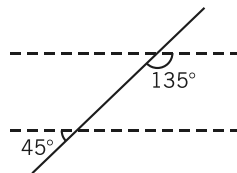
$$120^\circ + 50^\circ = 180^\circ \quad (\text{Because of co-interior angles})$$

$$\Rightarrow 170^\circ \neq 180^\circ$$

But it is not true.



(i)



(ii)

Thus, there are not parallel lines.

(ii) In figure (ii)

Let $\angle 1 = 45^\circ$ (vertically opposite angles)

and $\angle 2 = 135^\circ$ (co-interior angles)

Lines will be parallel if

$$\angle 1 + \angle 2 = 180^\circ \quad (\text{Because of co-interior angles})$$

$$45^\circ + 135^\circ = 180^\circ$$

$$180^\circ = 180^\circ$$

Which is true.

Thus, there are parallel lines.

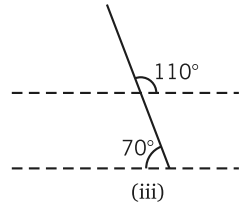
(iii) In figure (iii)

Lines will be parallel if corresponding angles are equal then if

$$120^\circ = 130^\circ$$

Which is not true.

Thus, there are not parallel lines.



(iv) In figure (iv).

Let $\angle 1 = 110^\circ$ (vertically opposite angles)

and $\angle 2 = 70^\circ$

Lines parallel

then $\angle 1 + \angle 2 = 180^\circ$

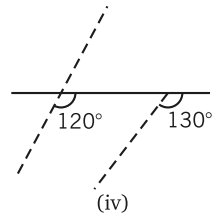
(Because of co-interior angles)

$$110^\circ + 70^\circ = 180^\circ$$

$$180^\circ = 180^\circ$$

Which is true.

Thus, lines are parallel.



(v) In figure (v)

$$\angle 1 + 100^\circ = 180^\circ$$

$$\angle 1 = 180^\circ - 100^\circ$$

$$\angle 1 = 80^\circ$$

(Linear pair)

l_1 and l_2 are parallel if $\angle 1 = 70^\circ$

but $80^\circ \neq 70^\circ$

Which is not true.

Thus, l_1 and l_2 will be parallel.

Again, l_3 and l_5 will be parallel if,

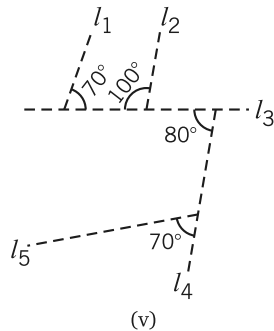
$$80^\circ = 70^\circ$$

Which is not true.

Thus, l_3 and l_5 are not parallel.

But $\angle 1 = 80^\circ$

$\Rightarrow 80^\circ = 80^\circ$



(corresponding angles)

(Alternate angles)

Which is true.

Thus, l_2 and l_4 are parallel.

(vi) Lines are parallel

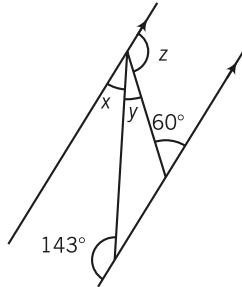
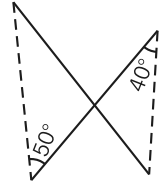
If alternate angles are equal

$$\Rightarrow 50^\circ = 40^\circ$$

Which is not true.

Thus, lines are not parallel.

8. (i) From the figure



$$\therefore z + 60^\circ = 180^\circ \quad (\because \text{co-interior angles are supplementary})$$

$$\Rightarrow z = 180^\circ - 60^\circ = \mathbf{120^\circ}$$

$$x + y = 60^\circ$$

(\because Alternate interior angles are equal)

$$y + z = 143^\circ$$

(\because Alternate interior angles are equal)

$$\Rightarrow y = 143^\circ - 120^\circ = \mathbf{23^\circ}$$

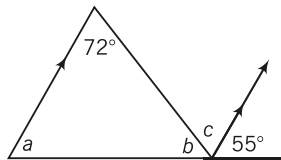
Now, $x + y = 60^\circ$

$$x + 23^\circ = 60^\circ$$

$$x = 60^\circ - 23^\circ = \mathbf{37^\circ}$$

Thus, measure of angles x , y and z are 37° , 23° and 120° respectively.

(ii) From the figure



$$\angle a = \mathbf{55^\circ} \quad (\because \text{corresponding angles})$$

In the triangle sum of interior angles

$$72^\circ + a + b = 180^\circ$$

$$72^\circ + 55^\circ + b = 180^\circ$$

$$b = 180^\circ - 127^\circ = \mathbf{53^\circ}$$

Now, $b + c + 55^\circ = 180^\circ$ (Linear pair)

$$53^\circ + c + 55^\circ = 180^\circ$$

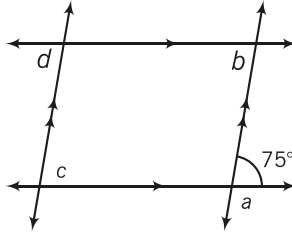
$$c + 108^\circ = 180^\circ$$

$$c = 180^\circ - 108^\circ$$

$$c = \mathbf{72^\circ}$$

Thus, measure of angles a , b and c are 55° , 53° and 72° respectively.

(iii) From the figure



$$75^\circ + a = 180^\circ$$
 (Linear pair)

\Rightarrow

$$a = 180^\circ - 75^\circ = \mathbf{105^\circ}$$

$$b = \mathbf{75^\circ}$$
 (Alternate interior angles)

\therefore

$$d = b = 75^\circ$$
 (Corresponding angles)

\therefore

$$d = c = \mathbf{75^\circ}$$
 (Alternate interior angles)

9. Proceed as Q. No. 7.

Apply Your mind!

1. (b)

2. (c)

3. (d)

4. (a)

5. (c)

6. (a)



13. Centroid, Orthocentre, Incentre and Circumcentre of a Triangle

Learning Target 13.1

1. (ii) Yes

2. Point C

3. (i) Yes

(ii) Outside

4. Yes, $DR = RE$, FR is a median of the $\triangle DEF$

5. Do it yourself.

6. Do it yourself

7. No

8. Yes

9. Yes

10. (i) line segment, perpendicular
 (ii) Orthocentre (iii) Outside (iv) AC and BC (v) AC
 (vi) Concurrent (vii) Centroid (viii) AB (ix) Interior.

Learning Target 13.2

1. Do it yourself. 2. No 3. Yes
 4. Yes, 5. Do it yourself. 6. Do it yourself.
 7. (i) Concurrent (ii) Perpendicular bisectors (iii) Concurrent
 (iv) Angle bisector (v) Angle A



14. Visualizing Solid Shapes

Learning Target 14.1

Do it yourself.

Learning Target 14.2

Do it yourself.

Apply Your Mind!

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



15. Quadrilateral

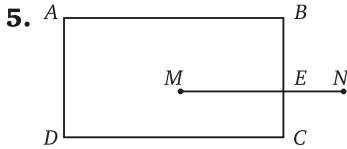
Learning Target 15.1

1. $\triangle ACD$, $\triangle ACB$, two triangles
 2. Four triangles, $\triangle AOB$, $\triangle BOC$, $\triangle COD$, $\triangle DOA$
 3. (i) Four— PQ and QR , QR and RS , RS and SP , SP and PQ
 (ii) Two— PQ and RS , PS and QR
 (iii) Four— $\angle P$ and $\angle Q$, $\angle Q$ and $\angle R$, $\angle R$ and $\angle S$, $\angle S$ and $\angle P$
 (iv) Two— $\angle P$ and $\angle R$, $\angle Q$ and $\angle S$
 4. (i) Vertices— A , B , C , D
 (ii) Angles— $\angle A$, $\angle B$, $\angle C$, $\angle D$
 (iii) Diagonals— AC and BD
 (iv) Adjacent sides— AB and BC , BC and CD , CD
 and DA , DA and AB

(v) Adjacent angles— $\angle A$ and $\angle B$, $\angle B$ and $\angle C$, $\angle C$ and $\angle D$, $\angle D$ and $\angle A$

(vi) Opposite sides— AB and CD , BC and DA

(vii) Opposite angles— $\angle A$ and $\angle C$, $\angle B$ and $\angle D$.



Yes, MN meets the quadrilateral at the point E .

Learning Target 15.2

1. By the angle sum property of a quadrilateral,

$$65^\circ + 65^\circ + 135^\circ + x = 360^\circ$$

$$x = 360^\circ - 265^\circ = 95^\circ.$$

2. Let the angle of a quadrilateral be x .

Then, all four angles are x

By the angle sum property of a quadrilateral

$$x + x + x + x = 360^\circ \Rightarrow 4x = 360^\circ \quad x = 90^\circ$$

3. Do it yourself.

4. Let $\angle A = \angle B = \angle C = x$

$$\angle D = 150^\circ \text{ (Given)}$$

By the angle sum property of a quadrilateral.

$$\angle A + \angle B + \angle C + \angle D = 360^\circ$$

$$x + x + x + 150^\circ = 360^\circ \Rightarrow 3x = 360^\circ - 150^\circ$$

$$x = \frac{210^\circ}{3} = 70^\circ.$$

So,

$$\angle A = \angle B = \angle C = 70^\circ$$

5. By the angle sum property of a quadrilateral,

$$125^\circ + 135^\circ + 60^\circ + 75^\circ = 395^\circ \neq 360^\circ$$

No, sum of the four angles is greater than 360°

6. Let the angles of a quadrilateral are $3x$, $5x$, $7x$ and $9x$.

By the angle sum property of a quadrilateral

$$3x + 5x + 7x + 9x = 360^\circ$$

$$\Rightarrow 24x = 360^\circ$$

$$\Rightarrow x = 15^\circ$$

\therefore The angles of the quadrilateral are :

$$3 \times 15 = 45^\circ, 5 \times 15 = 75^\circ,$$

$$7 \times 15 = 105^\circ,$$

$$9 \times 15 = 135^\circ$$

7. By the angle sum property of a quadrilateral,

$$\angle A + \angle B + \angle C + \angle D = 360^\circ.$$

$$\angle A + \angle B = 360^\circ - (100^\circ + 50^\circ) = 210^\circ \dots (i)$$

In $\triangle APB$ $\angle PAB + \angle PBA + \angle APB = 180^\circ$

[By the angle sum property of triangle]

$$\frac{\angle A}{2} + \frac{\angle B}{2} + \angle APB = 180^\circ$$

$$[\because \angle PAB = \frac{\angle A}{2}, \angle PBA = \frac{\angle B}{2}]$$

$$\frac{1}{2}[\angle A + \angle B] + \angle APB = 180^\circ$$

$$\angle APB = 180^\circ - \frac{1}{2} \times 210^\circ \quad [\text{From eq. (i)}]$$

$$\angle APB = 75^\circ$$

8. Do it yourself.

9. Do it yourself.

□

16.

Circle

Exercise 16.1

1. Do it yourself.

2. Do it yourself.

3. $\angle ADB = \angle ACB$

[Angles formed in the same segment are equal]

Hence, $\angle ADB = 60^\circ$

4. Do it yourself.

5. Do it yourself.

6. In $\triangle APD$,

$$\angle PAD + \angle PDA + \angle APD = 180^\circ$$

[By the angle sum property of a triangle]

$$60^\circ + 45^\circ + \angle APD = 180^\circ \Rightarrow \angle APD = 75^\circ$$

$\angle ACD = \angle APD$ [Angles formed in the same segment are equal]

$$\angle ACD = 75^\circ$$

7. We know that the angle in a semicircle is a right angle.

$$\therefore \angle BCA = 90^\circ, \text{ and } \angle BAC = 60^\circ.$$

$$\angle ABC + \angle BCA + \angle BAC = 180^\circ$$

[By the angle sum property of a triangle]

$$\angle ABC = 180^\circ - (90 + 60^\circ) = 30^\circ$$

8. Do it yourself.

9. $AB = AC$ (Given)

$$\angle ABC = \angle ACB$$

[By Isosceles triangle property]

$$\angle ACB = 55^\circ$$

In $\triangle ABC$,

$$\angle ABC + \angle ACB + \angle BAC = 180^\circ$$

[By the angle sum property of a \triangle]

$$55^\circ + 55^\circ + \angle BAC = 180^\circ$$

$$\angle BAC = 70^\circ$$

$$\angle BDC = \angle BAC$$

[Angles formed in the same segment are equal]

10. Do it yourself.



17.

Polygon

Learning Target 17.1

1. Do it yourself.
2. Do it yourself.
3. Do it yourself.
4. The point A is neither in the exterior nor in the interior of $\triangle ABC$. In fact, the point A lies on the boundary of $\triangle ABC$.
5. (i) and (iii)
6. (i) Yes (ii) Yes (iii) Its diagonals are \overline{AC} and \overline{BD} (iv) diagonal \overline{AC} is in the interior and diagonal \overline{BD} is in the exterior of quadrilateral $ABCD$.
7. (i) Quadrilateral (ii) Triangle (iii) Hexagon (iv) Octagon.
8. It has two diagonals; these are \overline{PR} and \overline{QS} .
9. (i) $\overline{KL}, \overline{MN}; \overline{LM}, \overline{NK}$ (ii) $\angle K, \angle M; \angle L, \angle N$ (iii) $\overline{KL}, \overline{LM}; \overline{LM}, \overline{MN}$ (iv) $\angle K, \angle L; \angle L, \angle M$.
10. (i) Closed (ii) 3 sided (iii) 5 sided (iv) Octagon.
11. (i) irregular (ii) regular (iii) regular (iv) regular

Learning Target 17.2

1. (i) Linear (ii) Curvilinear (iii) Linear.
2. Do it yourself.
3. (i) $n = 9$ sides \Rightarrow sum of interior angles of polygon
 $= (9 - 2) \times 180^\circ = 1260^\circ$
(ii), (iii) Do it yourself.

4. (i) Sum of the interior angles of polygon = $(n - 2) \times 180^\circ$

$$1440^\circ = (n - 2) \times 180^\circ \Rightarrow n - 2 = \frac{1440^\circ}{180^\circ} = 8 \Rightarrow n = 10$$

(ii) Do it yourself.

5. Do it yourself.

6. (i) Given number of sides $n = 6$

$$\begin{aligned} \text{Each interior angle of the 6 sided polygon} &= \frac{(n - 2) \times 180^\circ}{n} \\ &= \frac{(6 - 2) \times 180^\circ}{6} = 4 \times 30 = 120^\circ \end{aligned}$$

(ii) Do it yourself.

7. Do it yourself.

8. Let the angles of quadrilateral are $4x$, $5x$, $3x$ and $6x$.

By the angle sum property of a quadrilateral.

$$4x + 5x + 3x + 6x = 360^\circ \Rightarrow 18x = 360^\circ$$

$$x = 20^\circ$$

The angles of a quadrilateral are :

$$4 \times 20 = 80^\circ, 5 \times 20 = 100^\circ, 3 \times 20 = 60^\circ, 6 \times 20 = 120^\circ$$

9. Do it yourself.

10. Do it yourself.

$$11. (i) 160^\circ = \frac{(n - 2) \times 180^\circ}{n} \Rightarrow \frac{160^\circ}{80^\circ} = \frac{n - 2}{n}$$

$$8n = 9n - 18 \Rightarrow n = 18$$

(ii) Do it yourself.

$$12. (i) \text{ Number of sides} = \frac{360^\circ}{30^\circ} = 12$$

(ii) Do it yourself.

13. Do it yourself.

Apply Your Mind!

1. (c)

2. (b)

3. (c)

4. (d)

5. (c)



18.

Symmetry

Do it yourself.



19. Perimeter and Area

Exercise 19.1

- (i) Area of parallelogram = base \times height = $8 \times 4.5 = 36 \text{ cm}^2$
(ii), (iii) Do it yourself.
- Area of parallelogram = base \times height
$$200 \text{ cm}^2 = 12 \times \text{height}$$
$$\text{height} = \frac{200}{12} = 16.67 \text{ cm}$$
- Do it yourself.
- (i) Area of parallelogram $ABCD$ = base \times height = $6 \times 3 = 18 \text{ cm}^2$
(ii) Height corresponding to the base

$$\text{AD} = \frac{\text{Area of parallelogram ABCD}}{\text{AD}}$$
$$\text{Height} = \frac{18}{4} = 4.5 \text{ cm}$$

Learning Target 19.2

- (i) Radius = 7 cm
Circumference of the circle = $2\pi r = 2 \times \frac{22}{7} \times 7 = 44 \text{ cm}$
(ii), (iii), (iv) Do it yourself.
- (i) Area of circle = $\pi r^2 = \frac{22}{7} \times 14 \times 14 = 616 \text{ mm}^2$
(ii) Diameter = 49 m \Rightarrow Radius = $\frac{\text{Diameter}}{2} = \frac{49}{2} \text{ m}$
Area of circle = $\pi r^2 = \frac{22}{7} \times \frac{49}{2} \times \frac{49}{2} = 1886.5 \text{ m}^2$
(iii), (iv) Do it yourself.
- The tip of the hand moves in 1 hours
$$= 2\pi r = 2 \times \frac{22}{7} \times 1.4 = 8.8 \text{ m}$$
- , 5. and 6. Do it yourself.
- Outer circumference of a circular park = 396 m
$$\Rightarrow 2\pi r = 396$$
$$\Rightarrow r = \frac{396 \times 7}{2 \times 22}$$

Outer radius $r_1 = 63 \text{ m} \Rightarrow$ Inner radius = $63 - 3.5r_2 = 59.5 \text{ m}$

Area of the path = outer area – inner area

$$\begin{aligned} &= \pi r_1^2 - \pi r_2^2 = \pi[(63)^2 - (59.5)^2] \\ &= \frac{22}{7} \times (63 + 59.5)(73 - 59.5) \\ &= 1347.50 \text{ m}^2 \end{aligned}$$

- 8.** Cost of gravelling the path = $1347.50 \times 4.15 = ₹ 5592.13$

$$\text{Circumference of a truck wheel} = \frac{26.4 \text{ km}}{12000} = \frac{26.4 \times 1000}{12000}$$

$$2\pi r = 2.2 \text{ m}$$

$$r = \frac{2.2 \times 7}{2 \times 22} = 0.35 \text{ m}$$

$$\begin{aligned} \text{Diameter of the wheel} &= 2 \times \text{radius} = 2 \times 0.35 = 0.7 \text{ m} \\ &= 0.7 \times 100 = 70 \text{ cm} \end{aligned}$$

- 9.** Do it yourself.

- 10.** Circumference of circle = $\pi \times d$

$$44 = \frac{22}{7} \times d$$

$$\Rightarrow d = \frac{44 \times 7}{22} = 14 \text{ cm}$$

- 11.** Number of rotation of the wheel = $\frac{\text{Total distance}}{\text{Circumference of wheel}}$
- $$\begin{aligned} &= \frac{88 \text{ km}}{\pi \times 56 \text{ m}} \\ &= \frac{88 \times 1000 \times 100}{\frac{22}{7} \times 56} = 50000 \end{aligned}$$

- 12.** Do it yourself.

- 13.** Circumference of circle shaped wire = perimeter of rectangle
 $= 2(18.7 + 14.3) = 2 \times 33$

$$2\pi r = 66 \text{ cm} \Rightarrow r = \frac{66 \times 7}{22 \times 2} = 10.5 \text{ cm}$$

$$\text{Area of the circle} = \pi r^2 = \frac{22}{7} \times 10.5 \times 10.5 = 346.5 \text{ cm}^2$$

- 14.** Do it yourself.

- 15.** Outer circumference of the circular path = 44 m

$$2\pi r = 44 \Rightarrow r = \frac{44 \times 7}{22 \times 2}$$

$$\text{Outer radius } r_1 = 7 \text{ m}$$

$$\text{Inner radius } r_2 = 7 - 2 = 5 \text{ m}$$

Inner circumference of circular path

$$\begin{aligned} &= 2\pi r_2 = 2 \times \frac{22}{7} \times 5 = \frac{220}{7} \\ &= 31\frac{3}{7} \text{ m} \end{aligned}$$

$$\begin{aligned} \text{Area of the path} &= \text{Outer area} - \text{Inner area} = \pi r_1^2 - \pi r_2^2 \\ &= \frac{22}{7} \times (7 + 5) \times (7 - 5) \\ &= \frac{528}{7} = 75\frac{3}{7} \text{ m}^2 \end{aligned}$$

- 16.** Area of the remaining sheet = Area of circular sheet
– [2 × Area of circle + Area of rectangle]
 $= \pi \times 14^2 - [2 \times \pi \times (3.5)^2 + 3 \times 1]$
 $= \frac{22}{7} \times 196 - [2 \times \frac{22}{7} \times 12.25 + 3]$
 $= 22 \times 28 - [77 + 3]$
 $= 616 - 80 = 536 \text{ cm}^2$

17. Do it yourself.

- 18.** Radius of circular park $r_1 = \frac{84}{2} = 42 \text{ m}$

Radius of outside $r_2 = 42 + 3.50 = 45.5$

$$\begin{aligned} \text{Area of the constructing road} &= \pi r_2^2 - \pi r_1^2 = \pi [(45.5)^2 - (42)^2] \\ &= \frac{22}{7} [45.5 + 42] (45.5 - 42) \\ &= \frac{22}{7} \times 87.5 \times 3.5 \\ &= 22 \times 12.5 \times 3.5 = 962.5 \text{ m}^2 \end{aligned}$$

Cost of constructing the road = $962.5 \times 240 = ₹ 231000$

19. Do it yourself.

20. Do it yourself.

21. Circumference of a circle = 31.4

$$2\pi r = 31.4 \Rightarrow r = \frac{31.4}{2 \times 3.14} = 5 \text{ cm}$$

$$\text{Area of the circle} = \pi r^2 = 3.14 \times 5^2 = 3.14 \times 25 = 78.5 \text{ cm}^2$$

Apply Your mind!

- 1.** (a) **2.** (a) **3.** (c) **4.** (d)
5. (b) **6.** (b)



20.

Volumes and Surface Areas

Learning Target 20.1

1. **Faces** : PQRS, TUVW, PQUT, SRVW, PSWT, QRVU
Edges : PS, PQ, QR, RS, TU, UV, VW, WT, PT, SW, UQ, RV
2. $AB = CD = GH = x$, $AD = BC = EH = y$, $AE = BE = DH = z$
3. AE or BF or CG or DH 4. ABFE, BCGF, CDHG, DAEH
5. (i) BFGC (ii) ABCD, EFGH, ABFE, CDHG (iii) ABFE, ABCD
 (iv) HG, HE, HD
6. ABCD, ABFE, AEHD, vertex G, yes, these are four diagonals
 AG, BH, CE, DF
7. (i) **Cuboid** : butter box, lunch box, chalk box,
 air conditioner
 (ii) **Cube** : Ice cubes, sugar cubes, dice, cubical blocks.
8. Cube 9. Cuboid 10. (i) 6 (ii) 12 (iii) Edge
 (iv) Dimensions (v) 4 (vi) Cube (vii) 8 (viii) Vertex
 (ix) Congruent squares (x) 3 (xi) 90° (xii) 4.

Exercise 20.2

1. (i) Volume of cube = (side)³
 $(15)^3 = 3375 \text{ mm}^3$
 (ii), (iii) (iv) Do yourself.
2. (i) length = 12 cm, breadth = 10 cm, height = 8 cm
 Volume of cuboid = length \times breadth \times height
 $= 12 \text{ cm} \times 10 \text{ cm} \times 8 \text{ cm}$
 $= 960 \text{ cm}^3$
 (ii), (iii), (iv), (v), (vi) Do it yourself.
3. (i) Volume of cuboidal wood = 36 cm^3
 Length = 4 cm, Breadth = 3 cm
 Height = $\frac{\text{Volume}}{\text{Length} \times \text{Breadth}}$
 $= \frac{36}{4 \times 3} \text{ cm} = 3 \text{ cm}$
4. Do it yourself.
5. One match box volume = $4 \text{ cm} \times 2.5 \text{ cm} \times 1.5 \text{ cm}$
 Such 12 match box volume = $12 \times 4 \text{ cm} \times 2.5 \text{ cm} \times 1.5 \text{ cm}$
 $= 180 \text{ cm}^3$

6. and 7. Do it yourself.

8. Volume of cuboidal pit = $8\text{ m} \times 6\text{ m} \times 3\text{ m}$
 $= 144\text{ m}^3$

Cost of digging = $144 \times ₹ 30 = ₹ 4320$

9. Total required water of population of village = 150×4000
 $= 600000\text{ L}$

$1000\text{ L} = 1\text{ m}^3$

$600000\text{ L} = 600\text{ m}^3$

Days = $\frac{20 \times 15 \times 6}{600} = \frac{6}{2} = \mathbf{3\text{ days}}$

10. $1000\text{ L} = 1\text{ m}^3$

$50000\text{ L} = \frac{50000}{1000} = 50\text{ m}^3$

Volume of cuboid = Length \times Breadth \times Height

$50 = 2.5 \times 10 \times \text{Breadth}$

Breadth = $\frac{50}{2.5 \times 10} = \mathbf{2\text{ m}}$

11. Joined to two cubes end to end then

Length = 12 cm, Breadth = 6 cm,

Height = 6 cm

Volume of cuboid = $12 \times 6 \times 6\text{ cm}^3 = \mathbf{432\text{ cm}^3}$

12. Number of wooden crates which can be put in the godown

$= \frac{(40 \times 25 \times 15)\text{ m}^3}{(1.5 \times 1.25 \times 0.5)\text{ m}^3}$

$= \mathbf{16000\text{ crates}}$

13. Side of cube = x

Volume of cube = x^3

(i) Doubled then $2x$

Volume of cube = $(2x)^3 = 8x^3 = \mathbf{8\text{ times}}$

(ii), (iii) Do it yourself.

14. Do it yourself.

15. Number of cubical blocks = $\frac{3.60 \times 3.60 \times 3.60}{0.12 \times 0.12 \times 0.12} = \mathbf{27000\text{ blocks}}$

Learning Target 20.3

1. Surface area of cube = $6a^2$

$= 6 \times (11)^2 = 6 \times 121 = \mathbf{726\text{ cm}^2}$

(ii), (iii) Do it yourself.

2. Do it yourself.

3. Total surface area of lunch box

$$\begin{aligned} &= 2(l \times b + b \times h + h \times l) \\ &= 2(15 \times 9 + 9 \times 8 + 8 \times 15) \\ &= 2 \times 327 = \mathbf{654 \text{ cm}^2} \end{aligned}$$

4. , 5. and 6. Do it yourself.

7. Surface area = $2(l^2 + l^2 + l^2) = 6l^2 = 6 \times 15 \times 15 = 1350$

8. , 9., 10. and 11. Do it yourself.

12. Area of a brick = $2(lb + bh + hl)$

$$\begin{aligned} &= 2(22.5 \times 10 + 10 \times 7.5 + 7.5 \times 22.5) \\ &= 937.5 \text{ cm}^2 \end{aligned}$$

Number of brick which can be painted

$$\begin{aligned} &= \frac{9.375 \text{ m}^2}{937.5 \text{ cm}^2} = \frac{9.375 \times 100 \times 100 \text{ cm}^2}{937.5 \text{ cm}^2} \\ &= 100 \text{ bricks} \end{aligned}$$

13. Area of four walls = $2 \times h(l + b)$

$$= 2 \times 5 \times (10 + 8) = 180 \text{ m}^2$$

Required length of wallpaper $l \times \frac{50}{100} = \frac{180}{1}$

$$l = \frac{180 \times 100}{50} \text{ m}$$

$$l = 180 \times 2 = \mathbf{360 \text{ m}}$$

14. Do it yourself.

15. Area of four walls = $2 \times h \times (l + b)$

$$\begin{aligned} &= 2 \times 5 \times (15 + 10) \\ &= 10 \times 25 = 250 \text{ m}^2 \end{aligned}$$

Area of roof = $l \times b$

$$= 15 \times 10 = 150 \text{ m}^2$$

$$\text{Total painted area} = (250 + 150) \text{ m}^2 = \mathbf{400 \text{ m}^2}$$

Apply Your Mind!

1. (c) According to question

$$b = 2 \times h$$

$$b = 2h \text{ and } b = \frac{1}{2} \times l$$

$$2h = \frac{1}{2} l$$

$$h = \frac{1}{4} l$$

$$\text{Volume of room} = 512 \text{ m}^3$$

$$l \times b \times h = 512 \text{ m}^3$$

$$l \times \frac{1}{2}l \times \frac{1}{4}l = 512 \text{ m}^3$$

$$l^3 = 512 \times 8$$

$$l^3 = 16 \times 16 \times 2 \times 8$$

$$l^3 = 16 \times 16 \times 16$$

$$l^3 = 16^3 \Rightarrow l = \mathbf{16 \text{ m}}$$

$$\begin{aligned} \mathbf{2. (c)} \text{ Volume of wall} &= l \times b \times h && [\because 1 \text{ m} = 100 \text{ cm}] \\ &= 800 \text{ cm} \times 600 \text{ cm} \times 22.5 \text{ cm} \\ &= 10800000 \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{Volume of each brick} &= 25 \text{ cm} \times 11.25 \text{ cm} \times 6 \text{ cm} \\ &= 1687.50 \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{Required number of bricks to build a wall} &= \frac{\text{Volume of wall}}{\text{Volume of one brick}} \\ &= \frac{10800000 \text{ cm}^3}{1687.50 \text{ cm}^3} = \mathbf{6400 \text{ bricks}} \end{aligned}$$

Thus number of bricks needed to build a wall is 6400. □

21. Data Handling

Learning Target 21.1

1. (i) tables, charts (ii) fives (iii) ungrouped
(iv) X (v) median, descending
2. (i) Arrange the data in ascending order 2, 2, 3, 5, 7, 9, 9, 10, 11
Here, $n = 9$ (odd)
Median $= \frac{1}{2}(n + 1)$ th term $= \frac{1}{2}(9 + 1)$ th
 $= \frac{1}{2} \times 10$ th $= 5$ th term $= 7$

(ii), (iii) Do it yourself.
3. (i) Arrange the data in ascending order 5, 6, 7, 7, 7, 8, 9, 10, 11
obviously, 7 occurs maximum number of times
Hence, Mode = 7
(ii) Do it yourself.

4. Mean : The mean of a set of observations (ungrouped data) is equal to their sum divided by the total number of observations.

Median : For finding the median of ungrouped data, we have to arrange it in ascending or descending order of magnitude. The value of the middle-most observation represents the median of the data.

5. Mean $\bar{X} = \frac{1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10}{10} = \frac{55}{10} = 5.5$

6. , 7. and 8. Do it yourself.

9. First 15 odd number 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29

$$\begin{aligned} n &= 15 \text{ (odd)} \\ \text{median} &= \frac{1}{2}(n + 1) \text{ th} \\ \text{term} &= \frac{1}{2}(1 + 15) \text{ th} \\ \text{term} &= 8 \text{ th term} \\ \text{median} &= 15 \end{aligned}$$



Model Test Paper-I

1. (i) T (ii) F (iii) F (iv) F (v) F
 2. (i) 1 (ii) -1 (iii) 0 (iv) -3065 (v) -312
 (vi) -567

3. A farmer can put up a fence in one day = $\frac{1}{3}$ km
 A farmer can put up a fence in $6\frac{2}{3}$ days = $\frac{1}{3} \times \frac{20}{3} = \frac{20}{9}$
 $= 2\frac{2}{9}$ km

4. (i) $\frac{2}{3}$ (ii) $\frac{1}{-5}$ (iii) $\frac{1}{100}$ (iv) 1 (v) $\frac{3}{20}$

5. Charges for one unit = ₹ 4.28
 Charges for 49 units = ₹ 4.28 × 49 = ₹ 209.72

6. (i) $\frac{1 \times 5}{4 \times 5} = \frac{5}{20}$ (ii) to (v) Do it yourself.

7. (i) $\frac{-144}{-504} = \frac{-144 \div 72}{-504 \div 72} = \frac{2}{7}$
 (ii) to (iv) Do it yourself.

$$8. (i) \frac{5}{8} - \frac{7}{8} = \frac{-2}{8} = \frac{-1}{4}$$

$$\frac{7}{8} - \frac{5}{8} = \frac{2}{8} = \frac{1}{4}$$

(ii), (iii) Do it yourself.

$$9. (i) \frac{4}{15} \times \frac{9}{5} \times \frac{50}{3} = \frac{4}{5} \times \frac{3}{5} \times \frac{50}{3} = \frac{4}{25} \times \frac{50}{1} = 8$$

(ii) Do it yourself.

$$(iii) \left(\frac{-3}{2} \times \frac{4}{5}\right) + \left(\frac{9}{5} \times \frac{-10}{3}\right) - \left(\frac{1}{2} \times \frac{3}{4}\right)$$

$$= \left(\frac{-3}{1} \times \frac{2}{5}\right) + \left(\frac{3}{1} \times \frac{-2}{1}\right) - \left(\frac{3}{8}\right)$$

$$= \frac{-6}{5} - 6 - \frac{3}{8} = \frac{-48 - 240 - 15}{40} = \frac{-303}{40} = -7\frac{23}{40}$$

(iv) Do it yourself.

$$10. (i) \frac{1}{243} = \frac{1}{3 \times 3 \times 3 \times 3 \times 3} = \frac{1}{3^5} = \left(\frac{1}{3}\right)^5$$

(ii), (iii), (iv) Do it yourself.

$$11. (i) 1050000 = \mathbf{1.05} \times \mathbf{10^6}$$

$$(ii) 1353000000 = \mathbf{1.353} \times \mathbf{10^9}$$

$$1361000000 = \mathbf{1.361} \times \mathbf{10^9}$$

$$(iii) 1027000000 = \mathbf{1.027} \times \mathbf{10^9}$$

$$531200000 = \mathbf{5.312} \times \mathbf{10^8}$$

$$495800000 = \mathbf{4.958} \times \mathbf{10^8}$$

$$(iv) \frac{1}{1000000} = \frac{1}{10^6} = \mathbf{1} \times \mathbf{10^{-6}}$$

12. (i) binomial (ii) trinomial (iii) monomial

(iv) trinomial (v) binomial

13. Let the total worth of Shanti Lal's property be x

$$\text{Son's share} = \frac{x}{5}$$

$$\text{Daughter's share} = \frac{x}{5}$$

$$\text{Wife's share} = \frac{3x}{5}$$

$$\text{If wife's share} = 288000$$

$$288000 = \frac{3x}{5}$$

$$3x = 288000 \times 5$$

$$x = \frac{288000 \times 5}{3} = \mathbf{480000}$$

14. Time	Speed
20 ↑	12 ↓
15 ↓	x ↓

It is a inverse variation

$$\frac{x}{12} = \frac{20}{15}$$

$$\Rightarrow x = \mathbf{16 \text{ km/h}}$$

15. Persons	Day
6 ↓	7 ↑
21 ↓	x ↓

$$\frac{6}{21} = \frac{x}{7} \Rightarrow x = \frac{7 \times 6}{21} = 2 \text{ days}$$



Model Test Paper-II

1. The population of the town in 2020 be x

$$\frac{5 \times x}{100} = 8820$$

$$\Rightarrow x = \frac{8820 \times 100}{5}$$

$$x = \mathbf{176400}$$

2.

Purchased		Overhead expenses	Cost price	Selling price	Profit	Loss	Profit %	Loss %
(i)	₹ 240	₹ 10	₹ 250	₹ 235	—	₹ 15	—	6
(ii)	₹ 370	₹ 80	₹ 450	₹ 540	₹ 90	—	₹ 20	—
(iii)	₹ 3000	₹ 100	₹ 3100	₹ 3038	—	₹ 62	—	2
(iv)	₹ 28000	₹ 2000	₹ 30000	₹ 36000	₹ 6000	—	20	—
(v)	₹ 400	₹ 500	₹ 900	₹ 972	₹ 72	—	8	—

3. (i) Simple interest = $\frac{P \times R \times T}{100} = \frac{800 \times 6 \times 4}{100} = ₹ 192$

Amount = $800 + 192 = ₹ 992$

(ii), (iii) Do it yourself.

4. (i) $55^\circ + 125^\circ = 180^\circ$
So, pair of the angles are supplementary.
(ii) $34^\circ + 56^\circ = 90^\circ$
So, pair of the angles are complementary.
(iii), (iv), (v), (vi) Do it yourself.
5. (i) Property of corresponding angles,
(ii) Property of alternate interior angles
(iii) property of Co-interior angles are supplementary.
6. (i) Line segment, perpendicular,
(ii) Outside, (iii) AC
(iv) Concurrent (v) Centroid
7. Do it yourself.
8. (i) Four— PQ and QR , QR and RS , RS and SP , SP and PQ
(ii) Two— PQ and RS , PS and QR
(iii) Four— $\angle P$ and $\angle Q$, $\angle Q$ and $\angle R$, $\angle R$ and $\angle S$, $\angle S$ and $\angle P$
(iv) Two— $\angle P$ and $\angle R$, $\angle Q$ and $\angle S$
9. Do yourself.
10. (i) Interior points A, C, D, E, F
Exterior points = P, Q, R, S, T
(ii) Do yourself.
11. Do yourself.
12. Length of a wire = perimeter of a triangle
 $= 4.4 + 4.4 + 4.4 = 13.2$ cm
Circumference of a circle = 13.2 cm
 $2\pi r = 13.2 \Rightarrow r = \frac{13.2 \times 7}{2 \times 22} = 2.1$ cm
Area of circle = $\pi r^2 = \frac{22}{7} \times 2.1 \times 2.1 = 13.86$ cm²
13. (i) Area of the tin sheet required to make 20 such tins
 $= 2[26 \times 26 + 26 \times 45 + 45 \times 26] \times 20$
 $= 120640$ cm²
(ii) Cost of the tin sheet = $12.0640 \times 20 = ₹ 241.28$
14. (i) Arrange the data in ascending order 2, 2, 3, 5, 7, 9, 9, 10, 11
 $n = 9$ (odd)
Median = $\frac{1}{2}(n + 1)$ th
term = $\frac{1}{2}(9 + 1)$ th = 5 th term = 7
(ii), (iii) Do yourself.
15. Do it yourself. □