6. RATIO, PROPORTION AND DIRECT VARIATION

In this chapter let us see how we use arithmetic in our day-to-day life directly or indirectly.

6.1. Introduction :

Some information about Ishwarya and Krithika are given below:

S.No.	Informations	Ishwarya	Krithika
1.	Age	17 years	15 years
2.	Height	136 cm	123 cm
3.	Weight	31 Kg	29 Kg
4.	Quantity of drinking water	5 Litres	3 Litres
5.	Studying Time	4 hours	3 hours
6.	Playing Time	2 hours	2 hours
7.	No. of note books used	13	14
8.	Speed of cycling	10 Km/hr	15 Km/hr

From the above table we can compare their information easily. Ratio is used to compare two quantities of the same kind.

From the above table we can easily find out

1. Ratio of their ages **17 : 15**
2. Ratio of their Height **136 : 123**
3. Ratio of their Weight **31 : 29**
4. Ratio of their Quantity of drinking water **5 : 3**
5. Ratio of their study hours **4 : 3**
6. Ratio of their Playing hours **2 : 2**
7. Ratio of their No.of notebooks used **13 : 14**
8. Ratio of their Speed of cycling. **10 : 15**

6.2. Ratio:

- Ratio is a comparison of two quantities of same units.
- The ratio of two quantities **a** and **b** is written as **a : b** . It is read as " a is to b"
  The symbol **":"** is read as **" is to"**
- The ratio of b and a is written as **b : a.**
- It is understood that **a : b** is different from **b : a.**
- When compared the units of a and b must be the same.
- The units of a and b are always positive.

For Example : If 1 m and 90 cm are given, we can compare only after converting them into same units.

(i.e) after converting 1m as 100cm, we compare it with 90cm and write the ratio as 100 : 90.

Comparison of bigger numbers may be difficult. It is necessary to reduce them into their lowest terms. We write the ratios as fractions and reduce them into their lowest terms.

Example : 1

S.No.	Quantity	Ratio form	Fractional form	Reduced form
1	Ratio of 15 men and 10 women	15 : 10	$\frac{15}{10}$	3 : 2
2	Ratio of 500 gm and 1 Kg	500 : 1000	$\frac{500}{1000}$	1 : 2
3	Ratio of 1 m 25 cm and 2 m	125 : 200	$\frac{125}{200}$	5 : 8

Example : 2

1 A student has 11 notes books and 7 textbooks. Find the ratio of the notebooks to that of the text books.

Solution: Number of note books = 11

Number of text books = 7

Ratio of the notebooks to the text books = 11 : 7

Example : 3

The cost of a pen is Rs.8 and the cost of a pencil is Rs. 2.50

Find (1) The ratio of the cost of a pen to that of a pencil

(2) The ratio of the cost of a pencil to that of a pen.

Solution: The cost of a pen = Rs.8.00 = 8.00x 100 = 800 paise

The cost of a pencil = Rs.2.50 = 2.50 x100 = 250 paise

S.No.	Quantity	Ratio form	Fractional form	Reduced form
1.	Ratio of the cost of a pen to that of a pencil	800:250	$\frac{800}{250}$	16:5
2.	Ratio of the cost of a pencil to that of a pen	250:800	$\frac{250}{800}$	5:16

Example : 4

In a Village of 10,000 people, 4,000 are Government Employees and the remaining are self-employed. Find the ratio of.

i) Government employees to people of the village.

ii) Self employed to people of the village

iii) Government employees to self employees.

Solution:

Number of people in the village = 10,000

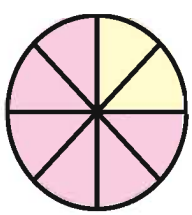
Number of Government employees = 4,000

$\therefore$ Self employed = 10,000 – 4,000 = 6,000

S.No.	Quantity	Ratio form	Fractional form	Lowest form of the Ratio.
1.	Government employees to people of the village	4000:10000	$\frac{4000}{10000}$	2:5
2.	Self employed to people of the village.	6000:10000	$\frac{6000}{10000}$	3:5
3.	Government employees to self employed.	4000:6000	$\frac{4000}{6000}$	2:3

6.3. Equivalent ratios:-

Let us divide an apple into eight equal parts and share it among two people in the ratio 6 : 2



6 : 2 can be simplified as 3 : 1

So, 6 : 2 and 3 : 1 are equal.

Hence like equivalent fractions we can say this as equivalent ratios

So, in the ratio a : b if the terms 'a' and 'b' are multiplied by the same non zero number, we get equivalent ratios.

Example : 5

Write any 5 equivalent ratios for 5 : 7

Solution:

Given ratio = 5 : 7

The ratio in fractional form = $\frac{5}{7}$

The equivalent fractions of $\frac{5}{7}$ are $\frac{10}{14}$, $\frac{15}{21}$, $\frac{20}{28}$, $\frac{25}{35}$, $\frac{55}{77}$

$\therefore$ the equivalent ratios of 5 : 7 are

10 : 14, 15 : 21, 20 : 28, 25 : 35 and 55 : 77

Exercise : 6.1

1) Say whether the following are true or false

i) The ratio of 4 pens to 6 pens is 4 : 6

ii) In a class of 50 students, the ratio between 30 girls and 20 boys is 20 : 30

iii) 3 : 2 and 2 : 3 are equivalent ratios

iv) 10 : 14 is an equivalent ratio of 5 : 2

2) Choose the correct answer:

i) The fractional form of 3 : 4 is ----------

(1) $\frac{4}{3}$ (2) $\frac{3}{4}$ (3) $\frac{1}{3}$ (4) 3.4

ii) The equivalent fraction of 7 : 8 is - - - - - - -

(1) 14:16 (2) 8:9 (3) 6:7 (4) 8:7

iii) Simplified form of 16 : 32 - - - - -

(1) $\frac{16}{32}$ (2) $\frac{32}{16}$ (3) 1:2 (4) 2:1

iv) If 2 : 3, 4 : _ are equivalent ratios, then the missing term is

(1) 2 (2) 3 (3) 4 (4) 6

v) The ratio of 1 cm to 2 mm is

(1) 1:20 (2) 20:1 (3) 10:2 (4) 2:10

3) Simplify the following ratios:

(i) 20:45 (ii) 100:180 (iii) 144:216

4) Write 4 equivalent ratios for the following:

(i) 3:5 (ii) 3:7 (iii) 5:9

5) Write the ratio of the following and simplify:

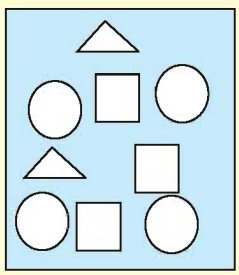
(i) The ratio of 81 to 108 ii) The ratio of 30 minutes to 1 hour and 30 minutes.

(iii) The ratio of 60 cm to 1.2 m

6) Seema's monthly income is Rs.20,000 and her savings is Rs.500 Find the ratio of
   i) the monthly income to the savings
   ii) the monthly income to the expenses
   iii) savings to the expenses.

7) Out of 50 students in a class, 30 are boys. Find the ratio of
   i) Boys to the total number of students
   ii) Girls to the total number of students
   iii) Boys to the Girls

8) From the given figure, find the ratio of
   i) Number of triangles to Number of circles
   ii) Number of circles to Number of squares
   iii) Number of triangles to Number of squares
   iv) Number of circles to total number of figures.
   v) Number of triangles to total number of figures.
   vi) Number of squares to total number of figures.



6.4. Proportion:-

If the simplified form of two ratios are equal, they form a proportion.
We use "=" or ": :" to denote a proportion.
If a, b, c, d are in proportion, then a : b = c : d or a: b :: c : d

Example : 6

1. Show that the ratios (i) 2 : 3, 8 : 12, (ii) 25 : 45, 35 : 63 are in proportion.

Solution:

	Ratio form	Fractional form	Simplified form
i.	2:3	$\frac{2}{3}$	2:3
	8:12	$\frac{8}{12}=\frac{2}{3}$	2:3

∴ 2:3, 8:12 are in proportion

ii.	25:45	$\frac{25}{45}=\frac{5}{9}$	5:9
	35:63	$\frac{35}{63}=\frac{5}{9}$	5:9

∴ 25:45, 35:63 are in proportion.

Note: In the above example, multiply 45 by 35 and 25 by 63
We get 25 x 63 = 45 x 35 = 1575.

If a : b and c : d are in proportion then a x d = b x c
The proportion is written as a : b :: c : d
If 4 numbers are in proportion, the product of extremes is equal to the product of means.

Example : 7

Show that 12 : 9, 4 : 3 are in proportion.
Solution : The product of the extremes = 12 x 3 = 36
The product of the means = 9 x 4 = 36
∴ 12 : 9, 4 : 3 are in proportion
(i.e) 12 : 9 :: 4 : 3

Example : 8

Find the missing term in 3 : 4 = 12 : ____
Solution :
The product of the extremes = The product of the means
Therefore 3 x _____ = 4 x 12; By dividing both the sides by 3
we get the missing term = 4 x 4 =16

Example : 9

If the cost of a book is Rs.12, find the ratio of 2, 5, 7 books to their cost.
What do you observe from this ?

No. of books	Total cost	Ratio	Fractional form	Simplified Form
2	2x12 = 24	2:24	$\frac{2}{24}$	1:12
5	5x12 = 60	5:60	$\frac{5}{60}$	1:12
7	7x12 = 84	7:84	$\frac{7}{84}$	1:12

From the table above, we find that the ratio of the number of books to the cost of books are in proportion.

6.5. DIRECT VARIATION:-

Two quantities are said to be in direct variation if an increase (or decrease) in one quantity results in increase (or decrease) in the other quantity. (i.e) If two quantities vary always in the same ratio then they are in direct variation.

Example : 10

Shabhana takes 2 hours to travel 35 km. How much distance she would have travelled in 6 hours?

Solution: When time increases the distance also increases.

Therefore, they are in direct variation

$2 : 6 = 35 : \square$

missing term $= \frac{6 \times 35}{2} = 105$

Shabana has travelled 105 km in 6 hours.

Time (hrs)	Distance (km)
2	35
6	?

Example : 11

The cost of uniforms for twelve students is Rs.3,000. How many students can get uniforms for Rs.1250.

Solution:

No. of students	Cost of the uniform. Rs.
12	3,000
?	1,250

When money spent decreases the number of uniforms also decreases.

They are in direct variation

$12 : \square = 3000 : 1250$

Missing term $= \frac{12 \times 1250}{3000} = 5$

5 students can be given uniforms for Rs.1,250.

Example : 12

In a village of 1,21,000 people the ratio of men to women is 6 : 5

Find the number of men and women?

Solution: Number of people in the village = 1,21,000

Ratio of men to women = 6 : 5

Total number of parts = 6 + 5 = 11

Parts	No. of people
11	121000
6	?
5	?

11 parts = 1,21,000

∴ 1 part = $\frac{1,21,000}{11}$ = 11,000

∴ Number of men in the village = 6 x 11,000 = 66,000

Number of women in the village = 5 x 11,000 = 55,000

Exercise 6 . 2

1) State whether the following ratios are in proportion.

i	1:5	and	3:15	(Yes / No)
ii	2:7	and	14:4	(Yes / No)
iii	2:9	and	18:81	(Yes / No)
iv	15:45	and	25:5	(Yes / No)
v	30:40	and	45:60	(Yes / No)

2) Choose the correct answer

i) Which of the following pair of ratios form a proportion.

1) 3:4, 6:8 2) 3:4, 8:6 3) 4:3, 6:8 4) 4:8, 6:3

ii) Find the missing term if 2: 5 =_____: 50

1) 10 2) 20 3) 30 4) 40

iii) If the cost of 6 balls is Rs.30 then the cost of 4 balls is

1) Rs.5 2) Rs.10 3) Rs.15 4) Rs.20

iv) If 5,6,10, _____ form a proportion (in the same order), the missing term is

1) 60 2) 50 3) 30 4) 12

v) When you divide 100 in the ratio 3 : 2, we get ------

1) 30, 20 2) 60, 40 3) 20, 30 4) 40, 60

3) Sarath buys 9 cricket bats for Rs.1,350. How much will Manoj spend to buy 13 cricket bats at the same rate.

4) Rahim and Bhashir decides to share the gift money of a competition in the ratio 7 : 8. If they receive Rs.7,500, find the share of each.

5) There are 1,00,000 voters in a city. If the ratio of male to female voters is 11 : 9, find the number of men and women voters in the city.

6) If a person reads 20 pages from a book in 2 hours, how many pages will he read in 8 hours at the same speed?

7) If 15 people can repair a road of length 150 metres, how many people are needed to repair a road of length 420 metres.

8) The scale of a graph is 1 cm = 200 km. (The distance 1 cm in the graph denotes 200 km in actual length). What would be the length of 3600 km on the graph?

Points to remember:

- The comparison of two quantities of the same unit is called ratio.
- When the terms of a ratio are multiplied by the same number, we get equivalent ratios.
- The equality of two ratios is called a proportion.
- In a proportion, the product of extremes = product of means.
- If two quantities vary always in the same ratio, then they are in direct variation.

7. METRIC MEASURES

7.1 INTRODUCTION

Find how many kilograms are there in 1padi.

Priyas's grand mother said, "There is not even one padi of rice in the house. Buy some rice when you are back from school". Priya asked her teacher "We measure rice using Kilogram but, what is one padi of rice?" Many students in the class said that they have also heard about this. The teacher explained "when India was ruled by the British, the measures used by the Britishers and the ancient Indians were in practice. But, after Independence it was decided to use only Metric measures throughout the country and people started using the same".

"Why did we change to metric? What is the speciality about it?" asked Nilavan.

The teacher thought for a while and said "Everybody has a scale with you isn't it? It is marked with inches on one side and centimetres on the other side. You all know about this. 12 inches make a feet.

Moreover 100 cm make one metre.

Which is easier?

Students screamed "feet, Metre".

Teacher formed the following table.

Measurement of length			
British tradition		Metric Measure	
12 inches	1 feet	10 Millimetre	1 Centimetre
660 feet	1 furlong	100 Centimetre	1 Metre
8 furlong	1 Mile	1000 Metre	1 Kilometre

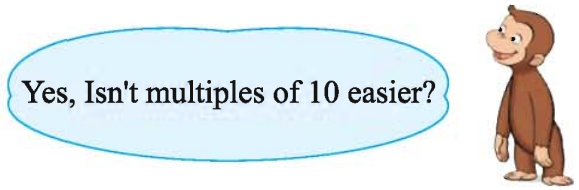
Teacher asked "Which is easier among these two measures? Students answered "Metric measures" in a loud voice.

Measurement of weight			
British tradition		Metric Measure	
28 grams	= 1 Ounce	1000 Milligram	= 1 Gram
16 Ounce	= 1 Pound	1000 Grams	= 1 Kilogram
2000 Pound	= 1 tonne	1000 Kilograms	= 1 tonne

Again the teacher questioned "Which is easier?". The children answered Metric measures.

Measurement of Volume			
British tradition		Metric Measure	
29 ml	= 1 liquid ounce	1000 Milli litre	= 1 litre
20 liquid ounce	= 1 pint	1000 litre	= 1 Kilo litre
2 pints	= 1 quart		
4 quarts	= 1 gallon		

Before the teacher could question, the children screamed out "Metric measures".



7.1.1 MEASURES – REVISION

Most of the measures used us in our day-to-day life are based on business – that is to purchase goods from the shop. Some goods are got in numbers. For Example :, 4 Choclates, 5 Mysorepaks, 2 Ice creams, 6 Bananas. But, we buy cloth using measurement of length. Vegetables, rice, dal are the provisions bought using measurement of weight. Liquids like milk and oil are bought using measurement of volume.

Usually we measure length in metres, weight in grams and volume in litres.

- Stretch out your hands to show the measurement of 1 metre.
- List out the goods that weight more or less 1 gram.
- Take any bottle and check whether it can be filled with one litre of water.

When we measure the distance between the school and your house metre is a small unit, whereas when you measure the length of a pencil metre is a big unit.

Likewise to purchase rice, gram is a very small unit. But it is a big unit when you buy gold.

To measure water in a pot, litre is a big unit. But it is a smaller unit while measuring water in a pond.

Though the measures 1 metre, 1 gram, 1 litre are easily understood by every one, they are not sufficient to measure in all situations. So, we use higher and lower multiples of these units. They are usually in powers of 10 or fractions with denominators in powers of 10.

Metric Measures

1000 Metre	= 1 Kilometre
100 Metre	= 1 Hectametre
10 Metre	= 1 Decametre
1 Metre	
$\frac{1}{10}$ Metre	= 1 Decimetre
$\frac{1}{100}$ Metre	= 1 Centimetre
$\frac{1}{1000}$ Metre	= 1 Millimetre

Likewise try to frame tables for grams and litres.

Here the measures hectametre, decametre and decimetre are not very much in use in our day-to-day life.

Kilometre, Metre, Centimetre and Millimetre are used to measure length. Kilogram and gram are used to measure weight. Kilolitre and litre are used to measure volume.

Exercise 7.1

1. Which is better unit to measure a bucket of water? (Litre/Millilitre).
2. What is the approximate weight of an egg?
3. What is the approximate length of a snake guard?
4. What is the approximate time you require to cover a distance of 1 Kilometre by walk?

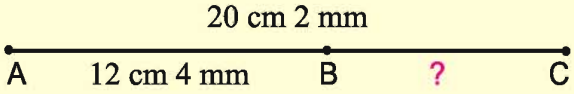
7.2 PROBLEMS INVOLVING MEASURES

Any measure is a number. So it can be added, subtracted, multiplied and divided.

If the quantities are in two different units convert them to the lower unit and continue with the four operations – addition, subtraction, multiplication and division.

Example : 1

Three points A,B,C are in the same straight line. If AB = 12 cm 4 mm; AC = 20 cm 2 mm. Find BC = ?



Solution:

AC = 20 cm2mm = (20 x 10)mm + 2 mm = 202 mm
AB = 12 cm4 mm = (12 x 10)mm + 4 mm = 124 mm
BC = AC – AB = 202 mm – 124 mm = 78 mm
= 7 cm 8 mm

10mm = 1cm

Example : 2

If 200 ml of milk is required for a child, how many litres of milk are required for a class containing 40 children.

Solution:

One child requires 200 ml.
Therefore, for 40 children 40 x 200 = 8000 ml.
(i.e) 8 litres of milk is required.

1000 ml = 1 litre

Example : 3

350 grams of rice is required for one day meal in our house. I bought 5 kilograms of rice. How long will it last.

5 Kilogram = 5000 grams

5000 ÷ 350 = 14, Remainder 100

∴ after 14 days, 100 grams of rice will be left.

So, the rice will last for 14 days.

```
350)5000(14
    350
   1500
   1400
    100
```

Exercise 7.2

1. Fill in the blanks

i) 1 cm = _____ mm ii) 3 km = _____ m

iii) 1.5 m = _____ cm iv) 750 m = _____ km

v) 5 cm 3 mm = _____ mm

2. Convert into Lower unit

i) 4 km 475 m

ii) 10 m 35 cm

iii) 14 cm 7 mm

3. What is the length of the cloth required for 12 shirts, if the shirt requires 2 m 25 cm?

4. A person has three rods measuring 3 m 2 cm, 2 m 15 cm, 7 m 25 cm. If all the three rods are joined, find the length of the single rod obtained.

5. Fill in the blanks

i) 2000 g = _____ kg ii) 7 kg = _____ g

6. Convert the following into the lower unit

i) 10 g 20 cg ii) 3 kg 4 g

7. Salim has 3 iron balls each weighing 4 kg 550 g; 9 kg 350 g; 4 kg 250 g. What is the total weight of all the three iron balls.

8. If the weight of one iron chair is 5 kg 300 g, find the weight of 7 such chairs.

9. If Sugar weighing 100 kg is filled equally in bags of 500 g each, how many such bags are required.

10. Two vessels contain water measuring 14 *l* 750 *ml* and 21 *l* 250 *ml* each. What is the total quantity of water?

11. There is 75 *l* of gingely oil in Jamal's shop. He sold 37 *l* 450 *ml*. Find the quantity of gingely oil left.

12. A flask contains 250 *ml* of acid. How many litres of acid is there in 20 such flasks?

8. MEASURES OF TIME

INTRODUCTION :

Let us observe our activities from morning to evening.

We fix certain timings for morning routines, going to school, studying, playing etc., Our ancestors used to calculate time by just looking at the sun, to perform their duties. But that would not be possible during cloudy days and rainy seasons.

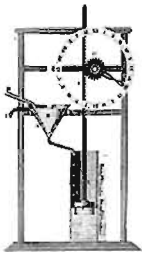
In olden days, they used many different clock instruments to find time. Egyptians used shadow clock, Britishers used candle clock, Chinese used rope clock, Europeans used oil clock and Indians used water clock. Sand clock was used by many other countries.

Shadow Clock

Candle Clock

Sand Clock

Water Clock



Rope Clock

In course of time mechanized clocks were introduced by rectifying the faults in these clocks. As time is very important in our life, it is necessary to learn about time.

6.1 UNITS OF TIME

Seconds, minute, hour, day, week, month and year are the units of time. Let us learn about these units now:

1 minute	= 60 Seconds
1 hour	= 60 minutes = 60 x 60seconds
	= 3600 Seconds
1 day	= 24 hours = 1440 minutes (24 x 60)
	= 86,400 seconds (24 x 60 x 60)

60 seconds = 1 minute

1 Sec $= \frac{1}{60}$ minute

60 minutes = 1 hour

1 minute $= \frac{1}{60}$ hour

Example : 1

Convert 120 Seconds into minutes

Solution:

120 seconds = 120 x $\frac{1}{60} = \frac{120}{60}$ = 2 minutes

$\therefore$ 120 Seconds = 2 minutes

$\because$ 60 seconds = 1 minute

1 second $= \frac{1}{60}$ minute

Example : 2

Convert 360 minutes into hours

Solution :

360 minutes = $360 \times \frac{1}{60} = \frac{360}{60} = 6$ hours

$\therefore$ 360 minutes = 6 hours.

60 minutes = 1 hour

$\therefore$ 1 minute = $\frac{1}{60}$ hour

Example : 3

Convert 3 hours 45 minutes into minutes

Solution: 1 hour = 60 minutes

3 hours = 3 x 60 = 180 minutes

$\therefore$ 3 hours and 45 minutes = 180 minutes + 45 minutes

= 225 minutes.

Example : 4

Convert 5400 seconds into hours

Solution: 5400 Seconds = $5400 \times \frac{1}{3600}$ hour = $\frac{9}{6} = \frac{3}{2} = 1\frac{1}{2}$ hours.

$\therefore$ 5400 seconds = $1\frac{1}{2}$ hours.

Do it yourself

1) Convert the duration of the lunch break into seconds.
2) Convert Play time in the evening into hours.

Example : 5

Convert 2 hours 30 minutes 15 seconds into seconds.

Solution

1 hour = 3600 seconds $\Rightarrow$ 2 hours = 2 x 3600 = 7200 seconds

1 minute = 60 seconds $\Rightarrow$ 30 minutes = 30 x 60 = 1800 seconds

$\therefore$ 2 hours 3 minutes 15 seconds = 7200 + 1800 + 15

= 9015 seconds.

We normally denote time from 12 mid-night to 12 noon as a.m. (Ante meridian) and the time from 12 noon to 12 mid-night is noted as p.m. (Post meridian).

Note : We denote 4 hours and 30 minutes as 4 : 30 (or) 4.30. Even though we are using the decimal point it is not a usual decimal number.

9:00 hours in the morning is denoted as 9.00 a.m. and 4.30 hours in the evening is denoted as 4.30 p.m.

Exercise 8.1

1. Fill in the blanks
   - **i)** 1 hour = _____ minutes
   - **ii)** 24 hours = _____ day
   - **iii)** 1 minute = _____ seconds
   - **iv)** 7 hours and 15 minutes in the morning is denoted as ----------
   - **v)** 3 hours and 45 minutes in the evening is denoted as ----------

2. Convert into seconds
   - i) 15 minutes ii) 30 minutes 12 seconds
   - iii) 3 hours 10 minutes 5 seconds
   - iv) 45 minutes 20 seconds

3. Convert into minutes
   - i) 8 hours ii) 11 hours 50 minutes
   - iii) 9 hours 35 minutes iv) 2 hours 55 minutes

4. Convert into hours :
   - i) 525 minutes ii) 7200 seconds
   - iii) 11880 seconds iv) 3600 seconds

8.2 Railway time :

Observe the following table :
Have you seen a table like this anywhere else?

Sl.No	Train Number	Name of the Train	Place of Departure	Destination	Departure Time	Arrival Time
1.	2633	Kanyakumari Express	Egmore	Kanyakumari	17.25 hrs.	6.30 hrs.
2.	2693	Muthunagar Express	Egmore	Tuticorin	19.45hrs.	6.15hrs
3.	6123	Nellai Express	Egmore	Nagercoil	19.00 hrs	8.10hrs.
4.	2637	Pandian Express	Egmore	Madurai Junction	21.30 hrs	6.15 hrs.
5.	6177	Rock Fort Express	Egmore	Trichirappalli	22.30 hrs	5.25 hrs.
6.	2635	Vaigai Express	Egmore	Madurai	12.25 hrs	20.10 hrs.
7.	2605	Pallavan Express	Egmore	Trichirappalli	15.30 hrs	20.50 hrs.

Observe the timing given in the above table. How many hours are there in a day ?
Ans : 24 hours.

We generally call 24 hour clock time as railway time. Railway timings are not expressed in a.m. and p.m.. All timings are expressed as just hours. In the above table, departure time and arrival time of some expresses are more than 12.00 hours. While converting these hours into ordinary timings we should subtract 12 from the hours column.

Shall we learn to convert timings ?

Example : 6

1. Convert into railway timings

(i) 8.00 a.m. (ii) 10.25 p.m. (iii) 12 noon.

Solution

(i) 8.00 a.m. = 8.00 hours.

(ii) 10.25 p.m. = 10.25
+ 12.00

= 22.25 hours.

(iii) 12.00 noon = 12.00 hours

2. Express in ordinary timings

(i) 23.10 hours (ii) 24 hours

(iii) 9.20 hours.

Solution

i) 23.10 hours = 23.10 - 12.00 = 11.10p.m.

ii) 24 hours = 24.00 = 12.00midnight

iii) 9.20 hours = 9.20 a.m.

Do it yourself

List your daily routines in railway timings and convert them into ordinary timings.

Exercise : 8.2

1. Express in railway timings
   (i) 6.30 a.m. (ii) 12.00 midnight (iii) 9.15 p.m. (iv) 1.10 p.m.
2. Express in ordinary timings
   (i) 10.30 hours (ii) 12.00 hours. (iii) 00.00 hours. (iv) 23.35 hours

8.4 Calculating time interval

Deepa said to her friend Jancy that she studied for 3 hours from 8.00 a.m. to 11.00 a.m. How did Deepa calculate the duration of time as 3 hours ?

Example : 7

Find the duration of time from 4.00 a.m. to 4.00 p.m.

Solution : 4.00 p.m. = 4 hrs. 00 min + 12 hrs. 00 min.
= 16 hrs. 00 min = 16 hrs.

∴ duration of time = 4.00 p.m. – 4.00 a.m.
= 16.00 hrs - 4.00 hrs. = 12 hours.

Example : 8

Cheran Express departs from Chennai at 22.10 hours and reaches Salem at 02.50 hours the next day. Find the journey time.

Solution :

Arrival at Salem	=02.50 hrs.
Departure time from Chennai (Previous day)	=22.10 hrs.
Journey time	= (24.00 – 22.10) + 2.50 = 1.50 + 2.50 = 4.40

∴ Journey time = 4 hours 40 minutes.

Example : 9

A boy went to school at 9.00 a.m. After school, he went to his friends house and played. If he reached back home at 5.30 p.m., find the duration of time he was out of his house.

Solution :

Starting time from home	= 9.00 a.m.
Duration between starting time and 12.00 noon	= 12.00 – 9.00
	= 3.00 hours.
Reaching time (home)	= 5.30 p.m.
∴ Duration of time he was out of his house	= 3.00+5.30 = 8.30 hours.

Exercise : 8.3

1. Calculate the duration of time
   (i) from 3.30 a.m. to 2.15 p.m. (ii) from 6.45 a.m. to 5.30 p.m.

2. Nellai Express departs from Tirunelvelli at 18.30 hours and reaches Chennai Egmore at 06.10 hours. Find the running time of the train.

3. Sangavi starts from her uncle's house at 10.00 hours and reaches her house at 1.15 p.m. What is the duration of time to reach her house?

LEAP YEAR

Rama was celebrating his birth day happily. His friend Dilip was sitting aloof at a corner. Rama asked Dilip "why are you sad?" Dilip replied "I can't invite you every year for my birth day". When Rama asked 'why', Dilip said "I can celebrate my birth day only once in 4 years". Rama exclaimed "Why is that so ?"

"Because my birthday falls on 29th February" replied Dilip.

Satish asked "29th February ! what are you talking Dilip ? But February has only 28 days". "Yes Satish, usually it is 28 days. But once in 4 years February has 29 days. We call that year as a leap year. There are 366 days in a leap year and 365 days in an ordinary year" Dilip said.

"Why do we have an extra day in a leap year ?.

"I don't know. Let us find out from our teacher" replied Dilip.

Both went to meet their teacher and expressed their doubt.The teacher explained the reason as follows:

You know that the earth takes one year to make one complete revolution around the sun and 365 days make 1 year. But in fact the earth takes 365.25 days to make one revolution. So this extra 0.25 day is added in February once in 4 years (0.25 x 4 = 1). Such a year is known as leap year. So February has 29 days in a leap year.

Find it yourself

1. Which century are we in ?
2. Which is a millennium year ?

1 day	= 24 hours
1 week	= 7 days
1 year	= 12 months
1 year	= 365 days
1 leap year	= 366 days
10 years	= 1 decade
100 years	= 1 century
1000 years	= 1 millennium

How will you identify a leap year ?

A year which is exactly divisible by 4 is a leap year.

But the years which are multiples of 100, should be exactly divisible by 400 to be a leap year.

The years 1900, 1800, 1700, 1500 or not leap years why ?

Because, These Numbers leave remainders when we divide by 400.

But 1200, 1600, 2000, 2400 are all leap years as they leave no remainder when divided by 400

Example : 10

Which of the following are leap years?

(i) 1400 (ii) 1993 (iii) 2800 (iv) 2008

Solution : **(i)** Divide 1400 by 400

1400 ÷ 400 gives

Quotient 3, Remainder 200

$$400 \overline{)\,1400}\ 3,\ 1200,\ 200$$

∴ 1400 is not a leap year

(ii) Divide 1993 by 4

$$\begin{array}{r} 498 \\ 4\overline{)\,1993} \\ 16 \\ \hline 39 \\ 36 \\ \hline 33 \\ 32 \\ \hline 1 \end{array}$$

1993 ÷ 4 gives Quotient 498, remainder 1

∴ 1993 is not a leap year.

(iii) Divide 2800 by 400

$$\begin{array}{r} 7 \\ 400\overline{)\,2800} \\ 2800 \\ \hline 0 \end{array}$$

2800 ÷ 400 Quotient = 7, Remainder =0

∴ 2800 is a leap year

(iv) Divide 2008 by 4

$$\begin{array}{r} 502 \\ 4\overline{)\,2008} \\ 20 \\ \hline 08 \\ 08 \\ \hline 0 \end{array}$$

2008 ÷ 4 Quotient = 502, Remainder = 0

∴ 2008 is a leap year.

Example : 11

Find the number of days from 15th August to 27th October.

Solution :

There are 31 days in August.

Number of days in August = 31-14 = 17 days

Number of days inSeptember = 30 days

Number of days in October = 27 days

Total = 74 days.

Note :

Since it is given from 15th August" Subtract 14 days (Prior to 15th) from 31 (The total number of days of the month)

Example : 12

Convert 298 days into weeks.

Solution : 298 days = $\frac{298}{7}$ weeks

∴ 298 days = 42 weeks and 4 days.

1 week = 7 days.

1 day= $\frac{1}{7}$ week

Example : 13

Find the number of days between 12th January 2004 and 7th March 2004.

Solution :

Find whether the given year is a leap year or not.

2004 ÷ 4

Quotient: 501, remainder =0.

∴ 2004 is a leap year and has 29 days in February.

Number of days in January = 31-12 = 19 days.
Number of days in February = 29 days
Number of days in March = 6 days.
Total number of days = 54 days.

∴ Number of days between 12th January 2004 and 7th March 2004 are 54 days.

Exercise : 8.4

1.Fill in the blanks.

(i) 1 week = _____days.

(ii) In a leap year, February has_____days.

(iii) 3 days =_____ hours.

(iv) 1 year =_____months.

(v) 1 hour =_____seconds.

2.Which of the following are leap years ?

(i) 1992 (ii) 1978 (iii) 2003 (iv)1200 (v) 1997

3.Find the number of days from 4th January 1996 to 8th April 1996

4.Convert into weeks.

(i) 328 days (ii) 175 days.

Activity :

Divide the class into different groups. Ask them to compare their ages and find out the eldest. Compare all the groups and find the eldest and youngest in the class.

Points to remember:

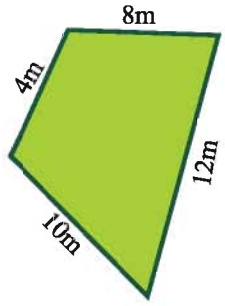
- Seconds, minutes, hours, day, week, month and year are the units of time.
- 12.00 midnight to 12.00 noon is forenoon.
- 12 .00 noon to 12.00 mid night is afternoon.
- 12 hours in forenoon and 12 hours in afternoon together gives 24 hours of railway timings.
- An ordinary year has 365 days. But a leap year has 366 days.

9. Perimeter and Area

9.1 Perimeter

Introduction:

Rahman is a farmer. He has to fence his field.



What length of the barbed wire I should buy to fence my field?

Can you help Rahman?
Total length of the boundaries should be found.
The length of each boundary is given in the figure.

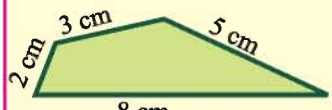
I found the answer
I should buy 8 m + 12 m + 10 m + 4 m = 34 m barbed wire.

The perimeter of a closed figure is the total measure of the boundary.

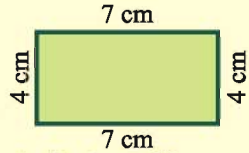
Example : 1

Find the perimeter of the following shapes.

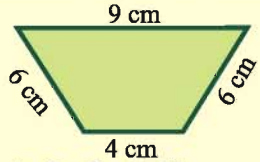
Perimeter of the shape = Sum of the measure of all the sides.



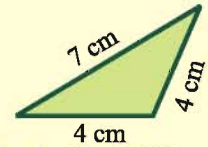
8 + 5 + 3 + 2 = 18 cm



4 + 7 + 4 + 7 = 22 cm



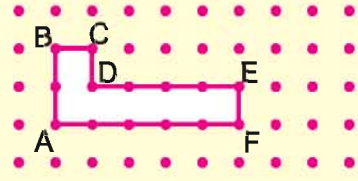
4 + 6 + 9 + 6 = 25 cm



4 + 4 + 7 = 15 cm

Example : 2

The distance between two consecutive points is 1 unit.
Find the perimeter of ABCDEF.



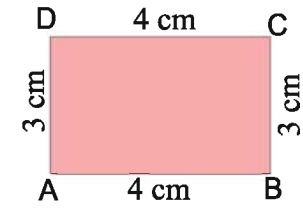
Solution:
The distance between A to B is 2 units. In the same way,

adding the lengths of all the sides, we get 2 + 1 + 1 + 4 + 1 + 5 = 14 units.

∴ The perimeter of the given figure = 14 units

9.1.1 Perimeter of a rectangle and a square

We can find the perimeter of a rectangle ABCD easily as 4 + 3 + 4 + 3 = 14 cm



But in general, the perimeter of rectangles with different lengths and breadths is length + breadth + length + breadth

Perimeter of a rectangle = 2 x length + 2 x breadth
= 2 (length + breadth)
= 2 (l + b) units
where 'l' denotes the length and
'b' denotes the breadth.

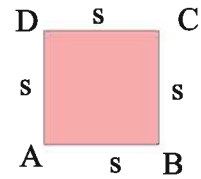
We use the first letters 'l' of length and 'b' of breadth in the formula
Perimeter of a rectangle = 2 (l+b) units
We can denote length and breadth by any other letters also.

Example : 3

Find the perimeter of a rectangle, whose length is 5 cm and breadth is 3 cm.
Solution:
Perimeter of a rectangle = 2 (length + breadth)
= 2 (5 + 3) = 2 x 8 = 16 cm

Perimeter of a square

Every square is a rectangle whose length and breadth are equal.
Perimeter of a square = 2 x side + 2 x side
= 4 x side
= 4s units 's' is the side.



We use the first letter 's' of the word 'side' to denote the side.

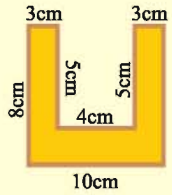
Example : 4

Find the perimeter of a square whose side is 20 cm.
Perimeter of a square = 4 x side = 4 x 20 = 80 cm

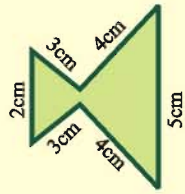
Exercise 9.1

1. Find the perimeter of the following shapes.

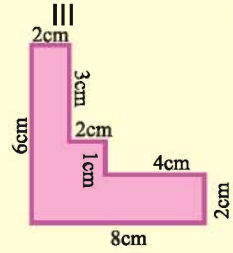
I



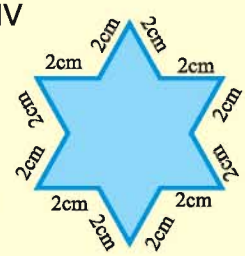
II



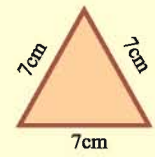
III



IV



V



2. Find the perimeter of the following figure.

(Take the distance between any to consecutive points as 1 unit)

3. Draw different shapes with perimeter 8 units in the following doted sheet.
(Take the distance between any to consecutive points as 1 unit)

4. Find the perimeter of a rectangle of length 4 cm and breadth 7 cm.

5. The perimeter of a square is 48 cm. Find its side .

9.2 Area

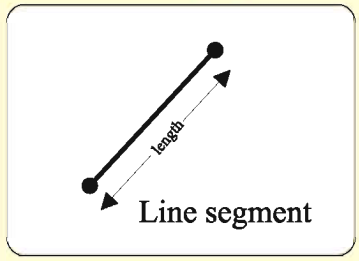
Introduction:

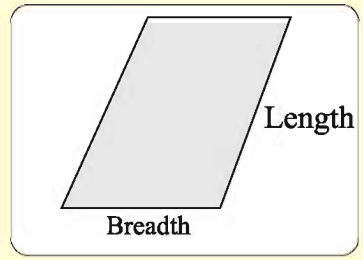
In the figure, look at the books on the table. Every book occupies a space. There is no space for the fourth book. The space that each book occupies is the area of that book.

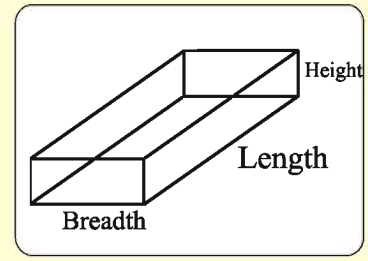
The area of an object is the space occupied by it on a plane surface.

Only two dimensional and three dimensional objects will have area.

Example : 5



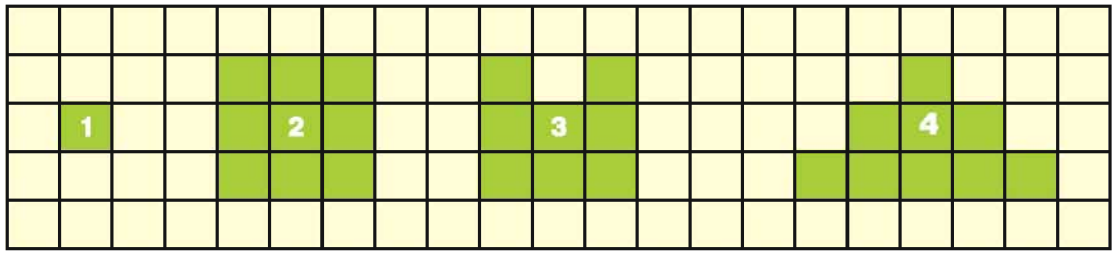




Line segment	Newspaper	Cardboard box
Only one dimension	Two dimensions	Three dimensions
No Area	Can you find its area?	The box has 6 surfaces. We can find the area of each surface.

How to calculate the area?

Count the number of green coloured squares in each of the following shapes.



Shape 1 = 1 square, Shape 2 = 9 squares,
Shape 3 = 8 squares, Shape 4 = 9 squares.

Look at shape 1

The square of side 1 unit is called "Unit square".

The area occupied by it is 1 square unit (1 sq. unit).

Area of unit square = 1 unit x 1 unit = 1 sq. unit.

We have denoted the side of a small square as 1 unit. The area of the squares of sides in mm, cm, m, km can be expressed as follows:

1 mm x 1 mm = 1 sq. mm
1 cm x 1 cm = 1 sq. cm
1 m x 1 m = 1 sq. m
1 km x 1 km = 1 sq. km

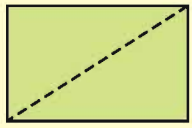
Exercise 9.2

Look at the following table. Tick(✓) the suitable unit to find the area of each.

Objects	Square cm	Square m	Square km
Hand kerchief			
A page of a book			
The door of a class room			
Area of the land surface of Chennai city			
Saree			

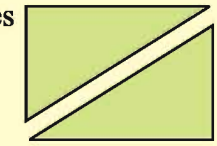
9.2.1. Area of different shapes

Activity:



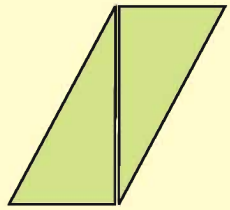
Take a rectangular piece of paper. Fold it diagonally and cut it into two triangles.

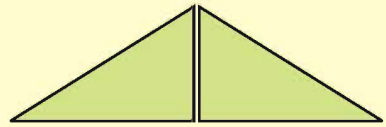
Different shapes are formed by joining the sides of the triangles in various ways.

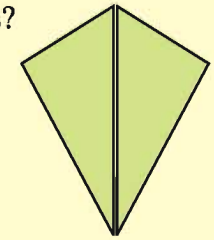


They all are in different shapes.

What can be said about their areas?







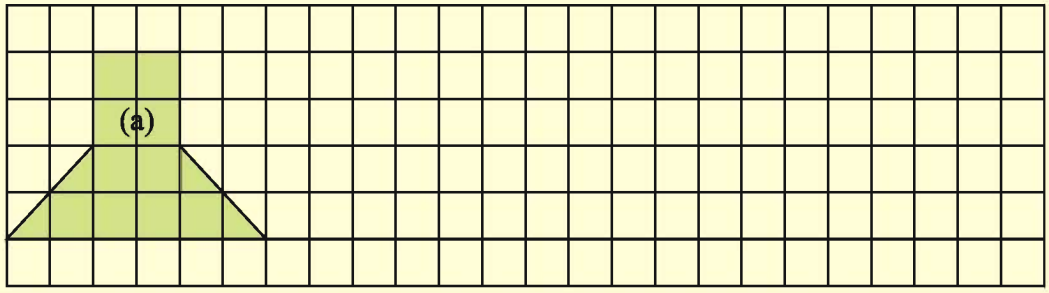
All shapes will be equal in area as they are formed with the same two pieces of a paper.

Can you form two more shapes like this?

Areas of these figures can be found by counting the number of unit squares in them.

Example : 6

Find the area of the given shape



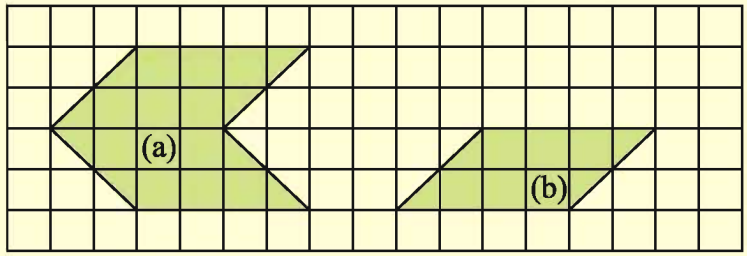
The area of each small square is 1 sq. cm.

Therefore area of the shape = 10 full squares + 4 half squares
= 10 full squares + 2 full squares
= 12 full squares
= 12 sq. cm.

A note to teacher
Give practice to draw a few more shapes on graph sheets and to find their areas.

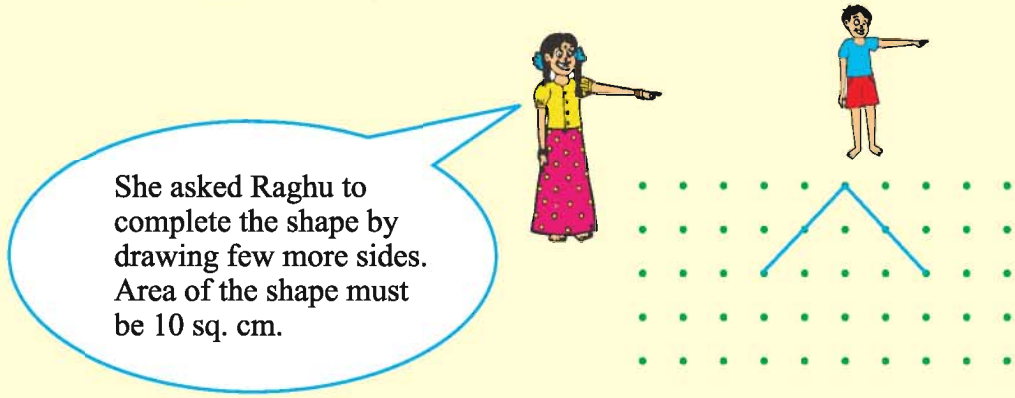
Exercise 9.3

1. Find the area of the given shapes



2. Draw two different shapes of area 10 square units on a dotted sheet.

3. Geeta drew two sides of a shape on a dotted sheet.

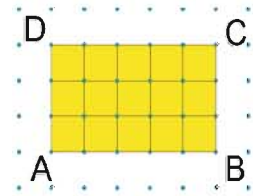


How did Raghu complete the shape? There can be many solutions for this.

In How many ways can you complete these shapes?

9.3 Area of a rectangle, square and a triangle

Area of a rectangle



The area of a rectangle connecting the dots can be found as 15 sq. units by counting the number of small squares.

How to calculate the area of the rectangle without counting the number of squares?

The length of the rectangle is the distance between A and B = 5 units
Therefore, there are 5 small squares on the line AB

The breadth of the rectangle is the distance between B and C = 3 units.
There are 3 rows of 5 squares in each.

Now the area of the rectangle = Total number of squares.
= Number of squares in 3 rows.
= 5 + 5 + 5
= 5 x 3
= length x breadth sq. units

Usually we denote length as '*l*', breadth as '*b*'
∴ Area of the rectangle = *l* x *b* sq. units

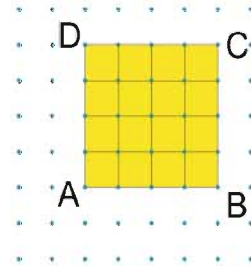
Example : 7

Find the area of a rectangle whose length is 8 cm and breadth 5 cm

Area of a rectangle = length x breadth = 8 cm x 5 cm = 40 sq. cm

Area of a square

We know that in a rectangle if the length is equal to the breadth, it is a square.They are called the sides of a square.



∴ Length = breadth = side of the square

∴ Area of a square = length x breadth
= side x side sq. units
(Formula for area of the rectangle is also suitable for area of square)

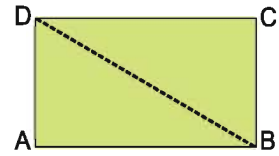
If you denote the side as 's' then the area of the square = *s* x *s* sq. units.

Example : 8

Find the area of a square of side 7 cm.

Area of a square = side x side = 7cm x 7cm = 49 sq. cm.

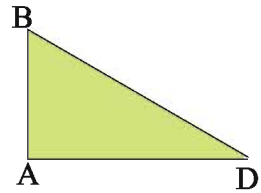
Area of a right triangle



Take a rectangular shaped card-board and cut it through a diagonal. We get 2 right triangles.

Area of a right triangle= half the area of the rectangle

$= \frac{1}{2}$ x (length x breadth) sq. units



From this you know that

Area of a rectangle = Area of two right triangles.

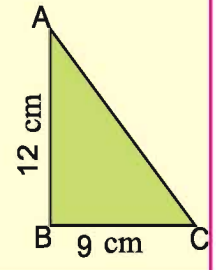
The length and breadth of the rectangle becomes the base and height of the right triangle. Length is used as the base and breadth is used as the height.

Hence, area of a right triangle = $\frac{1}{2}$ x (base x height) sq. units.

If base is denoted as 'b' and height as 'h', then the area of a right triangle = $\frac{1}{2}$ (b x h) sq.units.

Example : 9

Find the area of the following right triangle.



Solution:

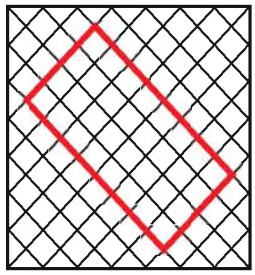
Area of a right triangle = $\frac{1}{2}$ x base x height

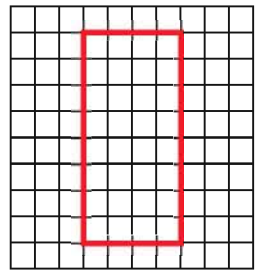
Base of triangle = 9 cm

Height = 12 cm

$\therefore$ Area of a right triangle = $\frac{1}{2}$ x 9 x 12 = 54 sq.cm.

Which of the following shapes has greater area?



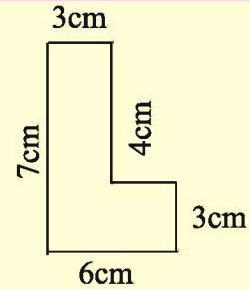


Area of both the shapes are equal. We get the second shape by rotating the first shape.

The area of the shapes do not change when they are rotated or moved from their places.

Example : 10

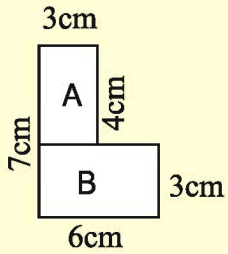
Find the area of the following shape.



Solution: There are three methods to solve this problem

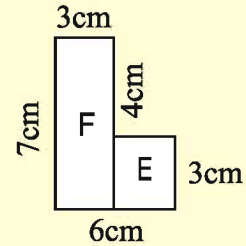
I method

Area of (A) = 4 x 3 = 12 sq. cm.
Area of (B) = 6 x 3 = 18 sq. cm.
Therefore, area of the shape = 30 sq. cm.



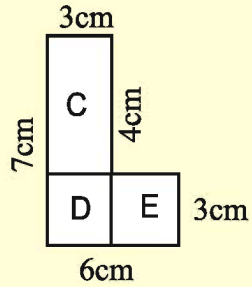
II method

Area of (F) = 7 x 3 = 21 sq. cm.
Area of (E) = 3 x 3 = 9 sq. cm.
Therefore, area of the shape = 30 sq. cm.



III method

Area of (C) = 4 x 3 = 12 sq. cm.
Area of (D) = 3 x 3 = 9 sq. cm.
Area of (E) = 3 x 3 = 9 sq. cm.
Therefore, area of the shape = 30 sq. cm.



It is enough to find the area of the shape by any one method.

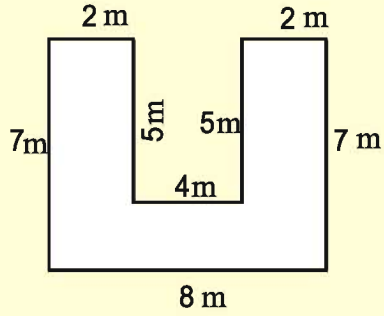
Exercise 9.4

1. Fill in the blanks:

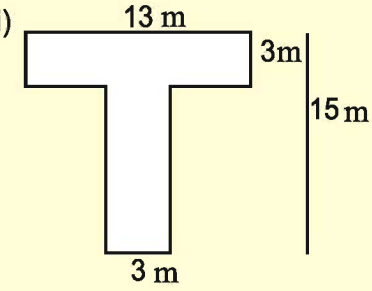
S.No	Length of the rectangle (l)	Breadth of the rectangle (b)	Perimeter of the rectangle	Area of the rectangle
(i)	7 cm	5 cm	-	-
(ii)	10 cm	-	28 m	-
(iii)	-	6m	-	72 sq.m
(iv)	9m	-	-	63 sq.m

2. Find the area of the following shapes.

(i)

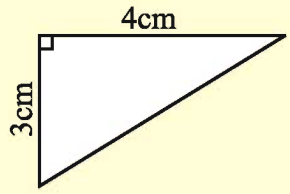


(ii)

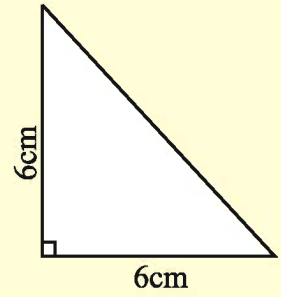


3. Find the area of the following right triangles

(i)



(ii)



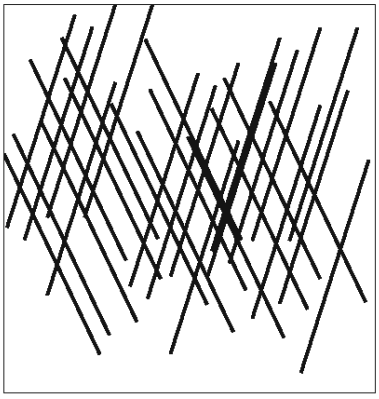
Pints to Remember

1. The Perimeter of a closed figure is the total measure of the boundary.
2. The Perimeter of a rectangle = 2 x $(l + b)$ units.
3. The Perimeter of a Square = 4 x s units.
4. The area of an object is the space occupied by it on a plane surface.
5. The area of a rectangle = l x b sq. units.
6. The area of a square = s x s sq. units.
7. The area of a right angled triangle = $\frac{1}{2}$ x (base x height).
8. The area of a shape do not change when they are rotated or move from their places.

10. POINT, LINE, LINE SEGMENT AND PLANE

Vani and Selvi started playing with a few long sticks. When it was Selvi's turn she had to take one stick without disturbing the other sticks. She loses her game even if there is a slight shake in the other sticks. Oh! What a different game.

Many questions arose in the mind of the third person who was observing this game. Try to answer the following questions.



- All those sticks are line segments – what can be done with these?
- If these line segments are arranged close to each other. How far can it be extended? Which is the longest line in the world?
- If a lamp post is fixed in our Village, how high will it be? How far will it go piercing the sky? If it is sent piercing the earth, will it come through the other side?
- What do we get finally if we keep breaking the sticks?
- Railway tracks and electric wire above our heads do not touch each other however far they are extended. They keep moving in a very friendly manner. Do they meet anywhere?
- Using line segments tower shaped figures can be formed? Can we form a circle?

Geometry is a branch of Mathematics which answers such type of questions. Geometry gives the idea of various shapes and figures.

We know about different kinds of lines. Some are small and some are big. Some meet each other but some do not meet. Few lines keep extending. The length of small lines can be measured. Is there a small line without any length? If so, its length should be 0 cm! Such a line can be consider as a point.

So, a line is made up of many points.

We can name

i) A line with definite length as line segment

ii) Which extends indefinitely on both directions as lines

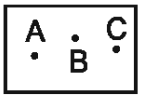
iii) Which extends indefinitely in one direction as a ray.

10.1 POINTS

Point is not something new to us. You would have seen Rangoli designs being drawn using points either everyday or during festival seasons such as Pongal etc.

A point indicates a definite position.

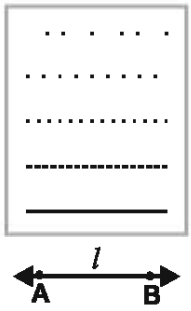
A point is smaller than a tip of a pencil or a pen used by us. Therefore a point has no length, breadth, height or thickness.



Points are usually denoted by capital letters A, B, C and so on.

10.2 LINE

Observe the given figure carefully. As the space in between the points decreases they join to form a line. A line is a set of points closely arranged without gap.



Mark points A, B on a sheet of paper using a scale draw a line passing through these points. This is a straight line.

It is represented as $\overleftrightarrow{AB}$ or line l.

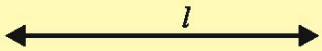
When we represent a straight line as $\overline{AB}$ it means

(i) The line passes through the points A, B.

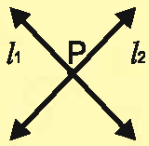
(ii) The line extends on either side of A and B.

Observe the names given for the following straight lines.

This is $\overleftrightarrow{PQ}$ or a straight line PQ



This is a straight line l



Lines l_1 and l_2 are two straight lines passing through the point P.

Do it yourself

- Draw a straight line XY.
- Draw a straight line and mark three points A, B, C.
- Draw 3 straight lines passing through the point R.

10.3 RAY

A ray starts from a fixed point and extends indefinitely in the other direction.

A Ray is denoted as $\overrightarrow{AB}$

1. Starting point of the ray is A.
2. The ray passes through the points A, B.
3. The ray extends through the point B.

Do it yourself

1) Draw a ray XY.

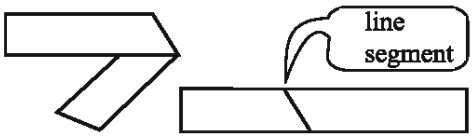
2) From a point P draw

$\overrightarrow{PA}, \overrightarrow{PB}, \overrightarrow{PC}, \overrightarrow{PD}$

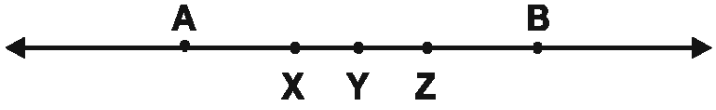
A Ray is a straight line with a starting point and extends indefinitely in one direction.

10.4 LINE SEGMENT

If a sheet of paper is folded and then opened, the folded part represents a line segment.



Mark points X, Y, Z on the straight line $\overleftrightarrow{AB}$.



Consider AX a part of the straight line, which starts at A and ends at X. So, it has a particular length. This is called as a line segment. It can be denoted as line segment AX. Few more line segments from the above figure are AY, AB, XY, XB, YB, XZ.

Therefore line segment is a part of a line. It has a starting point and an end point. A line segment has a definite length.

10.5 PLANE

Straight lines, points and rays can be represented in a sheet of paper or on the black board. Isn't it? Likewise floor, wall, black board, card board and top portion of the table are few examples for a plane.

A plane is a flat surface which extends indefinitely in all directions.

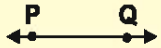
How many points are required to form a plane?

It is enough to have three points that do not lie on the same straight line.

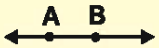
Discuss:

If 3 students hold 3 pencils with their tips in the same direction, a note book can be placed on it. Now hold all the 3 pencils in a same straight line. Will the note book stand erectly? Why?

Exercise 10.1

1. 

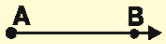
is a _____

2. 

The points on the straight line are _____

3. 

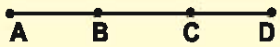
The lines $\overleftrightarrow{AB}$, $\overleftrightarrow{CD}$ intersect at a point _____

4. 

is called _____

5. 

On PQ, Q is a _____

6. 

Name the line segments in the figure. _____

10.6 RELATION BETWEEN POINTS AND LINES

Points which lie on the same straight line are called collinear points.

1. Draw a straight line passing through the points A, B

A • • B

2. Check whether you can draw a straight line passing through the points A, B, C

A •

B • • C

Draw a straight line passing through the points P, Q, R.

P • Q • R •

Do you know:

1. Sun, Moon and earth lie on the same straight line during Solar and Lunar eclipse.

2. When it is 6 o'clock, the centre point and numbers 12 and 6 lie on the same straight line.

1. You can draw a straight line passing through the two points A, B.
2. Since A, B, C are not on the same straight line, a straight line cannot be drawn.
3. A straight line can be drawn through P, Q, R, as they lie on the same straight line. P, Q, R are collinear points.

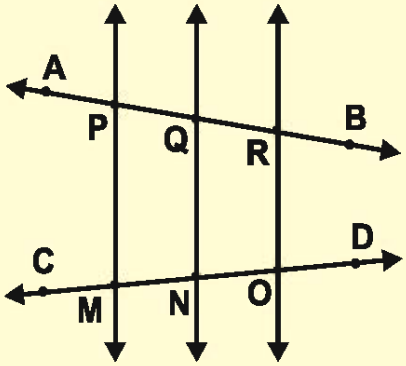
So, the following statements are true.

1. A straight line can be drawn through any two given points.

2. It is not always possible to draw a straight line passing through any 3 points.

3. But a straight line can be drawn passing through 3 collinear points .

Example : 1



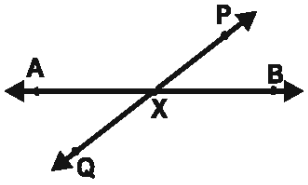
Name the collinear points from the figure?

Solution:

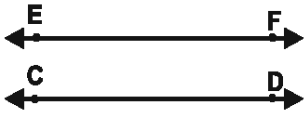
1. Collinear points on the straight line AB are P, Q, R.
2. Collinear points on the straight line CD are M, N, O.

10.6.2 PARALLEL LINES

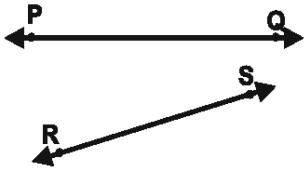
Observe the straight lines given below



Lines $\overline{AB}$, $\overline{PQ}$ meet at a point *X*. '*X*' is the point of intersection of these two straight lines. So, these lines are called intersecting lines.



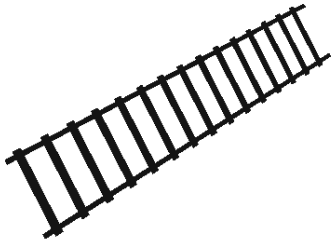
Lines $\overleftrightarrow{CD}$, $\overleftrightarrow{EF}$ do not meet each other at any point. So, they are called parallel lines.



Straight lines $\overleftrightarrow{PQ}$, $\overleftrightarrow{RS}$ do not meet each other at any point. But, they will meet at a point. Why?

- Non parallel lines intersect at a point.
- Lines which do not intersect each other are called parallel lines.

Observe a railway track

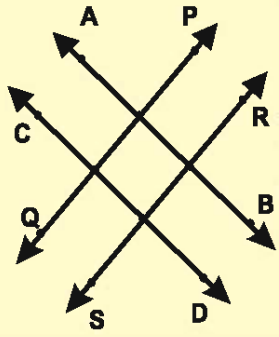


The tracks do not meet each other. Isn't? This is an example for parallel lines.

The two opposite edges of a note book are parallel lines.

Example : 2

Name the parallel lines in the figure.



Solution:

$\overline{AB}$, $\overline{CD}$ are parallel lines, $\overline{PQ}$, $\overline{RS}$ are also parallel lines. This can be denoted using the symbol $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$ and $\overleftrightarrow{PQ} \parallel \overleftrightarrow{RS}$

Do it yourself

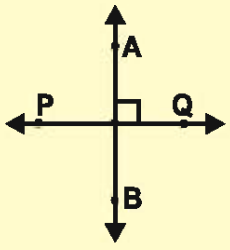
List a few examples for parallel lines from your class room.

10.6.3 PERPENDICULAR LINES

Normally, we would have seen perpendicular pillars in buildings. We would have observed that these pillars stand perpendicular to the floor. We already know these are perpendiculars.

When two lines are perpendicular lines, it is denoted by the symbol $\perp$.

Example : 3



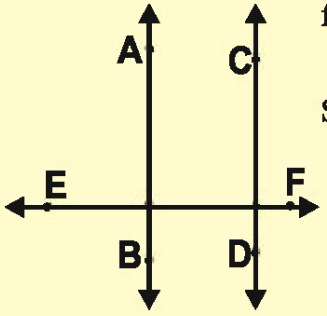
From the figure the two perpendicular lines $\overleftrightarrow{AB}$ and $\overleftrightarrow{PQ}$ can be denoted as $\overleftrightarrow{AB} \perp \overleftrightarrow{PQ}$.

Do you know:

Flag posts, Cell phone tower, Tall buildings are all perpendicular to the floor.

Example : 4

Find the parallel lines and perpendicular lines from the following figure.



Solution:

$\overleftrightarrow{AB}$, $\overleftrightarrow{CD}$ are parallel lines.

(ie) $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$.

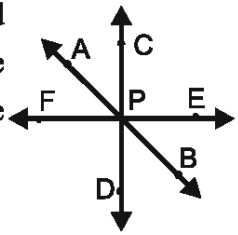
$\overleftrightarrow{AB}$, $\overleftrightarrow{EF}$ and $\overleftrightarrow{CD}$, $\overleftrightarrow{EF}$ are perpendicular lines.

(ie) $\overleftrightarrow{AB} \perp \overleftrightarrow{EF}$ and $\overleftrightarrow{CD} \perp \overleftrightarrow{EF}$

10.6.4 CONCURRENT LINES

Example : 5

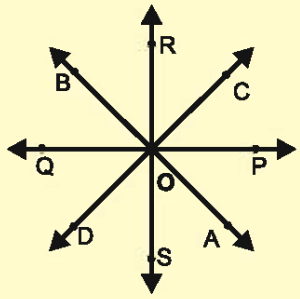
We know that two non-parallel lines intersect at a point. If a third line is drawn passing through the same point, these 3 straight lines are called **concurrent lines**. In the figure lines $\overleftrightarrow{AB}$, $\overleftrightarrow{CD}$, $\overleftrightarrow{EF}$ pass through one point. Here point 'P' is the **point of concurrency**.



Three or more lines passing through a point are called 'Concurrent Lines'. The point through which the lines pass is called 'Point of Concurrency'.

1. The junction of many roads is an Example : for point of concurrency.
2. If we draw more than 2 diameters for a circle, all the diameters meet at the centre of the circle. These are concurrent lines.
3. The spokes of the wooden wheel of a bullock cart are concurrent lines.

Example : 6



From the given figure, find out the concurrent lines and point of concurrency.

Solution:

$\overleftrightarrow{AB}$, $\overleftrightarrow{CD}$, $\overleftrightarrow{PQ}$, $\overleftrightarrow{RS}$ are concurrent lines.

These lines pass through the point 'O'.

Therefore 'O' is the point of concurrency.

Do it yourself

Check if there are concurrent lines at road junction of your village or in the things used by you.

Discuss:

Does the letter 'E' contain parallel lines, perpendicular lines, intersecting lines, concurrent lines and point of concurrency?

Group Game:

The teacher should arrange the students in a straight line. As the teacher calls out 'parallel lines', 'perpendicular lines', etc. the students should stretch and fold their arms accordingly. As the teacher increases the speed, the student who performs wrong is sent out. The student who performs correctly till the end is the winner.

Exercise 10.2

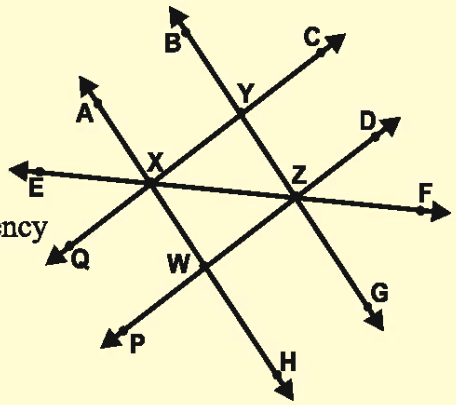
1. Collinear points are points that lie on the _____.

2. 3 points lying on the same straight line are called _____.

3. _____ lines can be drawn passing through one point.

4. Through the two given points _____ line can be drawn.

5. From the given figure list out
   - **a.** Intersecting lines
   - **b.** Parallel lines
   - **c.** Collinear points
   - **d.** Concurrent lines and their point of concurrency



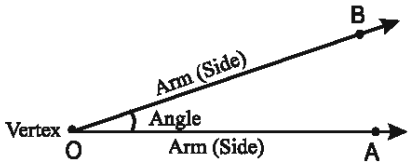
Points to Remember

1. Points indicate a definite position.
2. A line is a set of points closely arranged.
3. A straight line extends in both the direction.
4. A ray is a line with a starting point.
5. A line segment is a part of a line between two points.
6. A plane is a flat surface which extends indefinitely in all directions.
7. Two non-parallel lines intersect at a point.
8. Lines which do not intersect at any point are called parallel lines.
9. Two lines which intersect each other at right angles are called perpendicular lines.
10. Three or more points which lie on the same straight line are called collinear points.
11. Three or more lines passing through a point are called concurrent lines.

11. Angles and Triangles

11.1 Angles

Mark a point 'O' on a sheet of paper. From 'O' draw two rays $\overrightarrow{OA}$, $\overrightarrow{OB}$ as shown in the figure.



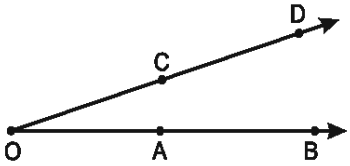
(fig 1).

In this figure both the rays start from a single point 'O'. An angle is formed at 'O'. Two rays $\overrightarrow{OA}$, $\overrightarrow{OB}$ are called as arms (or sides) of the angle. The common point 'O' is called as the 'vertex' of the angle. The angle is represented by a small curve as shown in the figure 1.

So, an angle is formed when two rays are drawn from a common point.

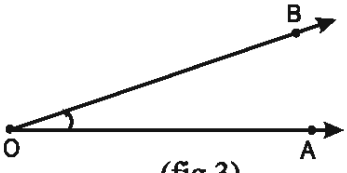
The angle shown in fig. 1 is represented as $\angle AOB$ or $\angle BOA$. We read it as angle AOB or angle BOA. Vertex of the angle is always written in the middle. Sometimes the angle is represented as $\angle O$.

Observe the following figure (fig. 2)



(fig 2).

We know that rays are named by two points – one at its start and one on the remaining portion. So, $\overrightarrow{OA}$, $\overrightarrow{OB}$ represent the same ray. Likewise $\overrightarrow{OC}$, $\overrightarrow{OD}$ also represent the same ray. Therefore, the angles can be represented by the following ways.

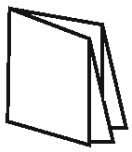


(fig 3).

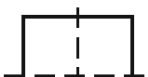
$\angle O$, $\angle COA$, $\angle DOA$, $\angle COB$, $\angle DOB$, $\angle AOC$, $\angle AOD$, $\angle BOC$, $\angle BOD$

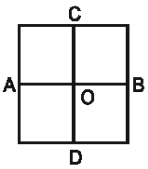
In fig. 3, with 'O' as the centre, $\overrightarrow{OA}$ rotates in the anti-clockwise direction and reaches $\overrightarrow{OB}$. The rotation made by the ray is called the measure of that angle.

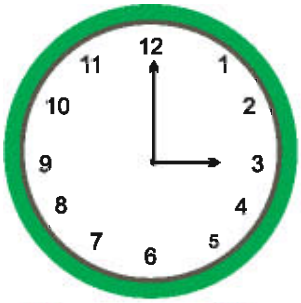
Right angle:



Fold a piece of paper as shown in the figure and unfold it. We get two intersecting line segments. Name these as AB and CD. These line segments make four angles at the point of intersection 'O'. We see that the four angles ∠AOC,∠BOC, ∠DOB,∠AOD are equal.

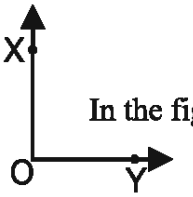






The measure of the angle at 3 o'clock.

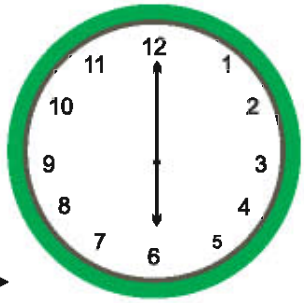
Each of them is called a right angle. Right angle measures 90°.



In the fig. ∠XOY is a right angle

Straight Angle:

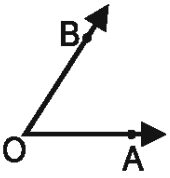
An angle whose measure is 180° is called a straight angle.

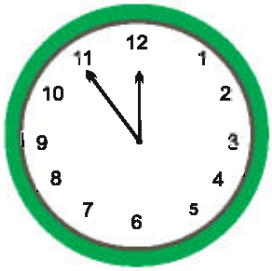


Measure of the angle at 6 o'clock.

Acute Angle:

An angle whose measure is greater than 0° but less than 90° is called an acute angle
Example: 2°, 10°, 37°, 18°, 89°.



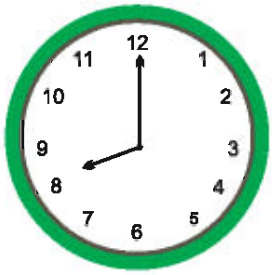


Measure of the angle at 11.55

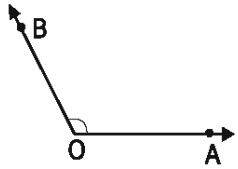
Obtuse angle:

An angle whose measure is greater than 90° and less than 180° is called an obtuse angle

Example: 91°, 96°, 142°, 160°, 178°

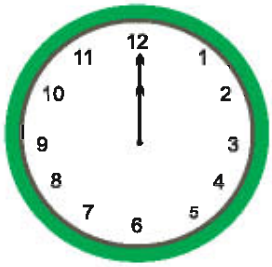


Measure of the angle at 8 o'clock.



Zero angle:

If both the rays coincide, the angle formed is 0°.



Measure of the angle at 12 o'clock.

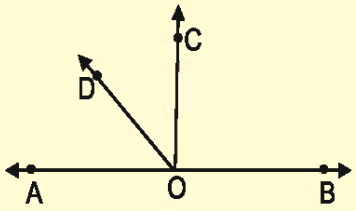
Exercise 11.1

1. State whether the given angles are acute, right or obtuse angle.
   (i) 45° (ii) 138° (iii)100° (iv)175°

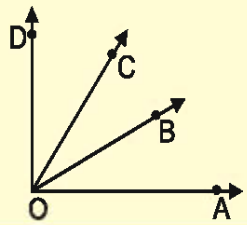
2. What is the measure of the angle formed by the hour hand and minute hand of a clock for the following timings?
   (i)12.10 (ii) 4.00 (iii)9.00 (iv)7.45

3. Name the angles and write its kind.

(i)



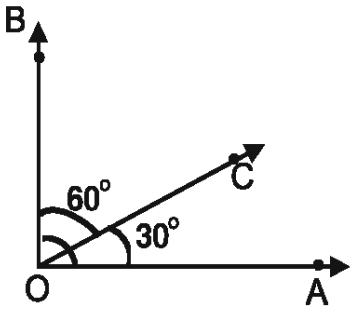
(ii)



11.2 Complementary angles and Supplementary angles

Complementary angles:

In the figure given $\angle AOB = 90^\circ$, we know that it is a right angle. The other angles are $\angle AOC = 30^\circ, \angle COB = 60^\circ$. Sum of $\angle$ AOC and $\angle COB$ is 90°.



(i.e) $30^\circ + 60^\circ = 90^\circ$

30° and 60° are complementary angles.

If the sum of the measures of two angles is 90°, then they are called complementary angles.

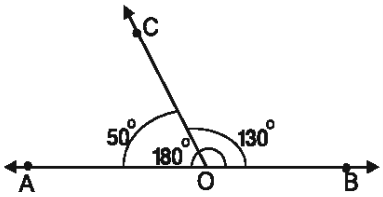
For Example :
When a ladder is leaning on a wall, the angles made by the ladder with the floor and the wall are always complementary.

Example : 1

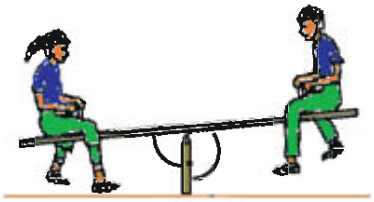
The complement of $40^\circ = 90^\circ - 40^\circ = 50^\circ$
The complement of $66^\circ = 90^\circ - 66^\circ = 24^\circ$
The complement of $35^\circ = 90^\circ - 35^\circ = 55^\circ$

Supplementary angles

In the given figure the angle formed by AB with 'O' is a straight angle (ie) 180°.
Here $\angle AOC = 50^\circ$, $\angle COB = 130^\circ$.
Moreover the sum of these two is 180°.
(i.e) $130^\circ + 50^\circ = 180^\circ$
130° and 50° are supplementary angles.



If the sum of the measures of two angles is 180° then they are called supplementary angles.



Example: The angles formed at the centre point of a see-saw are always supplementary angles.

Supplement of $40^\circ = 180^\circ - 40^\circ = 140^\circ$
Supplement of $110^\circ = 180^\circ - 110^\circ = 70^\circ$

Supplement of $78^\circ = 180^\circ - 78^\circ = 102^\circ$
Supplement of $66^\circ = 180^\circ - 66^\circ = 114^\circ$

Exercise 11.2

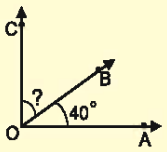
1. Find the complementary angles for the following.

   (i) 37° (ii) 42° (iii) 88° (iv) 0° (v) 16°

2. Find the supplementary angles for the following.

   (i) 6° (ii) 27° (iii) 88° (iv) 104° (v) 116° (vi) 146° (vii) 58° (viii)179°

3. Find the measures of the angle from the figure.
   ∠BOC = _____.



4. State whether true or false.

   (i) Measure of a straight angle is 180°
   (ii) If the sum of the measures of two angles is 90°, then they are called complementary angles.
   (iii) Complement of 26° is 84°.
   (iv) If the sum of the measures of two angles is 180°, then it is called a right angle.
   (v) Complement of an acute angle is an acute angle.
   (vi) The supplement of 110° is 70°.

5. State whether the given angles are complementary or supplementary

   (i) 25°, 65° (ii) 120°, 60° (iii) 45°, 45° (iv) 100°, 80°

6. (i) Find the angle which is equal to its complement?
   (ii) Find the angle which is equal to its supplement?

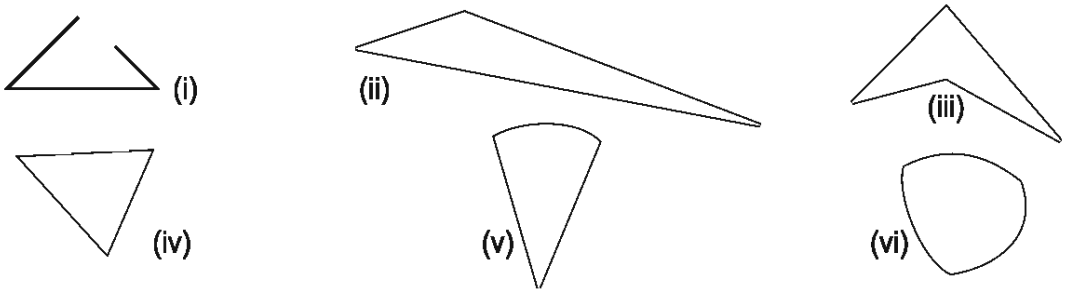
7. Fill in the blanks.

   (i) Supplement of a right angle is ……..
   (ii) Supplement of an acute angle is …….
   (iii) Supplement of an obtuse angle is ……..
   (iv) complement of an acute angle is ……..

11.3 Triangles

We know angles and triangles. What is the relation between them?
We have already learnt that a three sided (line segments) closed plane figure is called a triangle. Then we wonder why is it called a **triangle** ?
When the three sides of a triangle meet they form three angles also! So it is called a triangle.

Find which of the following are triangles?



Types of triangles

Triangles are classified according to the measures of their sides and angles.
Measure the sides and angles of the following triangles and fill the table given

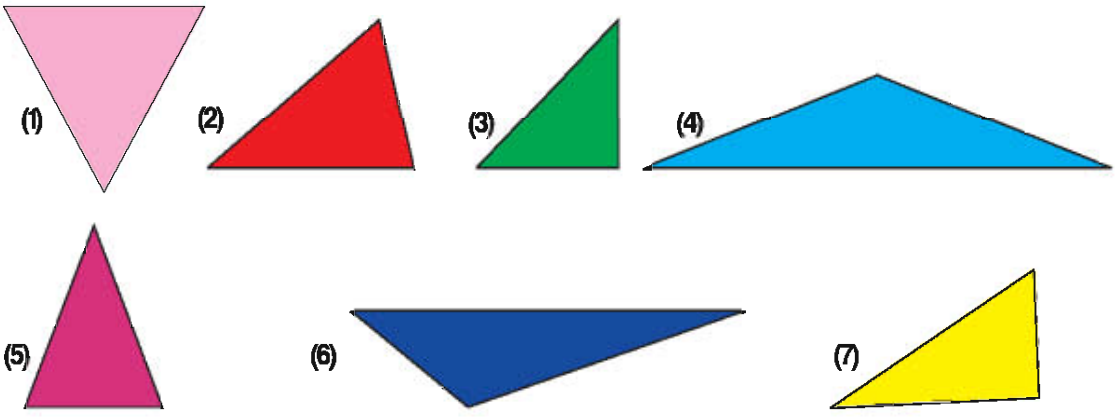


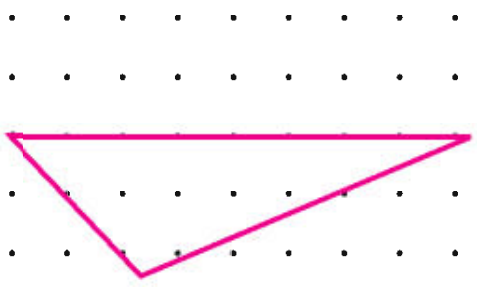
Figure	Measure of the angle	sum of the measure of the angles	Nature of the angles	Measure of the sides	Kinds of Triangles
1	60°, 60°, 60°	180°	Three angles are equal	3 cm, 3 cm, 3 cm	Equilateral triangles
2					
3					
4					
5					
6					
7					

In the above triangles, compare the sum of any two sides with the third side.

From this, we come to know

- If the measure of three angles of a triangle are equal then its sides are also equal.
- If the measure of two angles of a triangle are equal then its two sides are equal.
- If the measure of two sides of a triangle are equal then its two angles are equal.
- If the measure of the angles are different then the measure of its sides are also different.
- If the measure of the sides are different then the measure of its angles are also different.
- Sum of the three angles of a triangle is 180°
- Sum of any two sides of a triangle is greater than the third side.

The above points are applicable to all triangles.

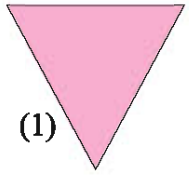


Do it yourself

Using rubber bands in a Geo board try to form various triangle and observe their properties.

Classification of triangles on the basics of sides:

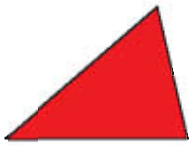
If all the three sides of a triangle are equal then it is called an equilateral triangle.
Example: fig(1)


(1)

If any two sides of a triangle are equal then it is called an isosceles triangle.

Example: Figures (3), (4), (5).

(2)



If all the three sides of a triangle are unequal then it is called a scalene triangle

Example: Figures (2), (6), (7)

(3)

Classification of triangle on the basis of angles:
If each angle of a triangle is an acute angle, it is called an acute angled triangle

(4)

Example: Figures (1), (2), (5).

In a triangle, if any one angle is a right angle, then the triangle is called a right angled triangle.

Example: Figures (3), (7)

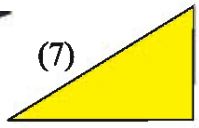
(5)

In a triangle, if one angle is an obtuse angle, then the triangle is called an obtuse angled triangle.

Example: figures (4), (6)

(6)

(7)



A few questions may arise now.

1. What type of triangle is it if it has a right angle and an obtuse angle?
2. Is it possible for a triangle to have either two obtuse angles or two right angles?

According to question 1 if a right angle and an obtuse angle is present in the same triangle the sum of the angles will always be more than 180°. (why?)
So, such a triangle is not possible.

Example : 2

Write the type of triangle, based on their sides

(i) In Δ ABC, AB = 7 cm, BC = 8 cm, CA = 6 cm
(ii) In Δ PQR, PQ = 5 cm, QR = 4 cm, PR = 4 cm

Solution:
(i) All the three sides are unequal. So Δ ABC is a scalene triangle.
(ii) QR = PR = 4 cm. Two sides are equal. So Δ PQR is an isosceles triangle.

Example : 3

Can a triangle be drawn using measurements 4 cm, 10 cm and 5 cm? Give reason.

Solution:
10 + 4 = 14 is greater than 5.
10 + 5 = 15 is greater than 4.
4 + 5 = 9 is less than 10.

A triangle cannot be formed, because the sum of two sides is less than the third side.

Example : 4

Determine the kind of triangle if the three angles are
(I) 60°, 45°,75° (ii) 20°, 90°, 70° (iii) 104°, 35°, 41°

Solution:
(i) Each angle is less than 90°. So it is an acute angled triangle.
(ii) One angle measures 90°. It is a right angled triangle.
(iii)One angle is greater than 90°. So it is an obtuse angled triangle.

Example : 5

Can we draw a triangle with angles 30°, 80°, 85°?

Solution:
The sum of the measure of the three angles is 30° + 80°+ 85° = 195°.
But the sum of the measure of the angles of a triangle is 180°.
Therefore a triangle cannot be formed using the given angles.

Example : 6

Can 100°, 120° be any two angles of a triangle?

Solution:
Sum of the given angles is $100° + 120° = 220°$. This is greater than 180°, but the sum of the measures of the angles of a triangle should always be 180°. Even though the third angle is not known it is not possible to form a triangle with the given measures.

Therefore a triangle cannot have two obtuse angles.

Exercise 11.3

1. Fill in the blanks:

(i) The sum of the three angles of a triangle is .....

(ii) In an equilateral triangle ..... sides are equal.

(iii) The triangle in which two sides are equal is called ..... Triangle.

(iv) If a triangle has one right angle it is called a ..... Triangle.

(v) In a triangle the sum of the measure of any two sides is ..... than the third side.

(vi) Triangles can be classified into ..... kinds according to their sides.

(vii) Triangles can be classified into ..... kinds according to their angles.

2. What are the six parts of a triangle?

3. Classify the triangle based on their angles.

Serial number	∠A	∠B	∠C	Type
(i)	30°	45°	105°	
(ii)	25°	90°	65°	
(iii)	62°	45°	73°	
(iv)	120°	30°	30°	

4. Can we have a triangle whose degree measures as:

(i) 30°, 60°, 90°

(ii) 40°, 100°, 40°

(iii) 60°, 70°, 20°

(iv) 50°, 75°, 65°

(v) 90°, 90°, 0°

5. Classify the triangles based on their sides

Serial number	AB cm	BC cm	CA cm	Type
(i)	5	2	5	
(ii)	3	3	3	
(iii)	6	7	3	
(iv)	4	5	7	

6. State if the following could be the possible lengths of the sides of a triangle

(i) 3 cm, 6 cm, 9 cm (ii) 10 cm, 6 cm, 3 cm (iii) 15 cm, 10 cm, 8 cm

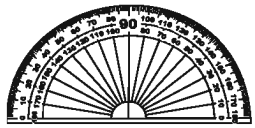
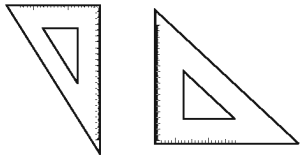
(iv) 12 cm, 20 cm, 8 cm

12-Practical Geometry

In our daily life we come across many shapes. These shapes contain many lines and angles. Many shapes are drawn as pictures. To draw these pictures we use instruments such as a ruler, compass, divider, protractor and set squares. All these instruments are in the geometry box.

12.1 Geometrical instrument box:

The instruments found in the geometry box are ruler, compass, divider, protractor and a pair of set squares.

S.No	Name and Diagram	Description	Uses
1	Ruler 	One edge of the ruler is graduated in centimetres and the other in inches	1. To draw lines 2. To measure the length of the line segment
2	Compass 	One side has a sharp edge and the other has a provision to insert a pencil	To draw a circle or a arc of the circle with the given measurement.
3	Divider 	Sharp edges on both the sides	1. To measure the length of a line segment 2. To compare the lengths of two given line segments.
4	Protractor 	It is in a semi-circular shape. The graduation starts from 0 ° on the right side and ends with 180 ° on the left side and vice versa	1. To measure angle 2. To construct angles
5	Pair of set squares 	1. One set square has 45 °, 45 °, 90 ° at the vertices 2. The other has 30 °, 60 °, 90 ° at the vertices	1. To draw perpendicular lines 2. To draw parallel lines

POINTS TO REMEMBER

1. In the instrument box all the instruments should have fine edges and tips.
2. It is better to have two sharp edged pencils, one to insert in the compass and the other to draw lines and mark points.
3. There should be an eraser and a sharpner also in the geometry box.

12.2 To draw and measure line segments

We know

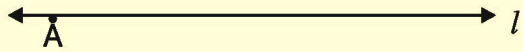
- A line segment is the shortest distance that connects two given points, but a line has no end points.
- The line segment AB can be written as $\overline{AB}$ or line segment AB.
- Length of the line segment AB = length of the line segment BA ($\overline{AB} = \overline{BA}$).
- A line segment can be measured either with a ruler or a divider.

Construction of a Line Segment:

Example : 1

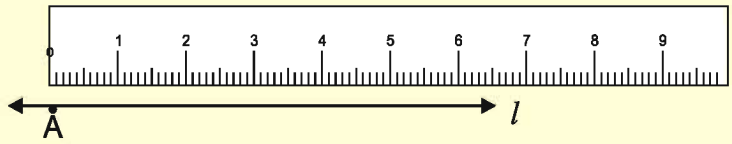
Draw a line segment AB = 5.8 cm using a ruler.

Step 1:



Draw a line "*l*" and mark a point A on it.

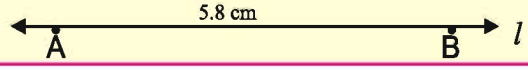
Step 2:



Fix a ruler on the line. Fix it in such a way that the zero on the scale and the point " A" coincides.

Step 3:

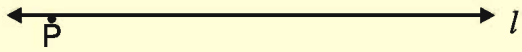
1. From A, measure 5.8 cm
2. Mark the point as B
3. $\overline{AB}$ = 5.8 cm is the required line segment



Example : 2

With the help of a ruler and compass draw a line segment $\overline{PQ}$ = 2.5 cm

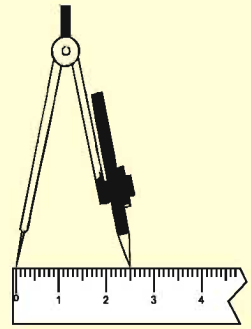
Step 1:



Draw a line "*l*" and mark a point P on it.

Step 2:

With the help of a compass measure 2.5cm as shown in the figure.

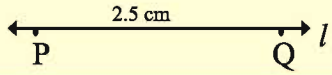


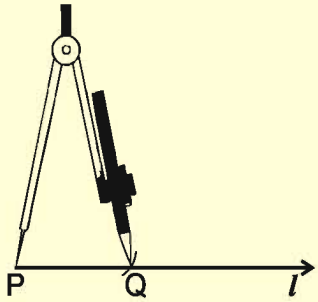
Step 3:

(I) Place the sharp edge of the compass at P

(ii) Then with the pencil point draw a small arc on l to cut the line. Mark the point as Q.

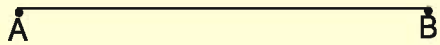
(iii) $\overline{PQ}$ = 2.5 cm is the required line segment

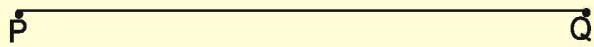




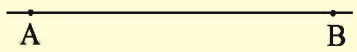
Exercise 12.1

1. With the help of a ruler and a compass find the length of the following line segments.

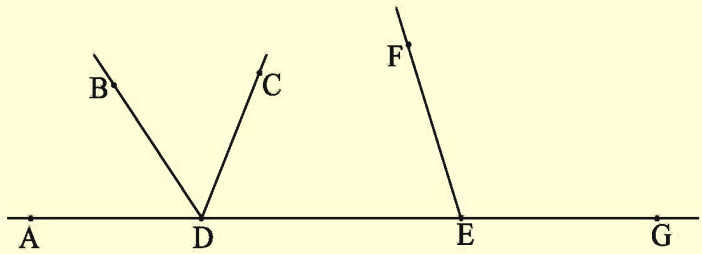
i) 

ii) 

2. Find the length of the following line segments.

i) 

AB = -------

ii) 

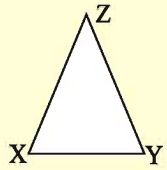
AD =
BD =
CD =
AE =

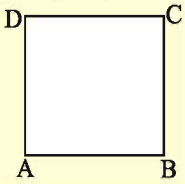
DE =
EF =
EG =
DG =
AG =

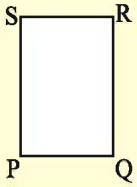
3. Draw a line segment for the following measurements using a ruler.
(i) CD = 7.5 cm (ii) MN = 9.4 cm (iii) RS = 5.2 cm

4. With the help of a ruler and a compass draw line segment for the following measurements.
(i) XY = 7.8 cm (ii) PQ = 5.3 cm (iii) AB = 6.1 cm

5. Find the perimeter for the following figures.

i) 

ii) 

iii) 

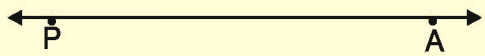
12.3 Constructing and Measuring Angles.

The unit for measurement of an angle is degree.

Example : 3

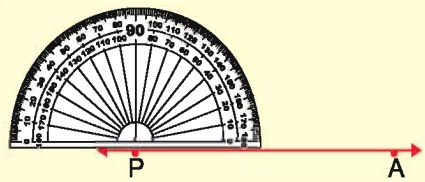
Construct an acute angle of 60 °

Step 1: Draw a line segment PA.



Step 2: (i) Place the protractor on the line segment PA

(ii) Place the mid point of the protractor at point P as shown in the figure.

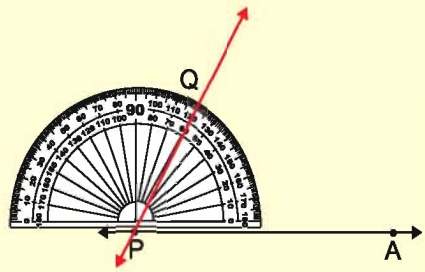


Step 3: (i) On PA from the right start counting from 0 ° in the ascending order (anti clock wise direction) and finally mark a point Q using a sharp pencil at the point showing 60 ° on the semi-circular edge of the protractor.

(ii) Remove the protractor and join PQ

(iii) We get the required angle

$m\angle APQ = 60^\circ$



Example : 4

Construct an obtuse angle 125 °

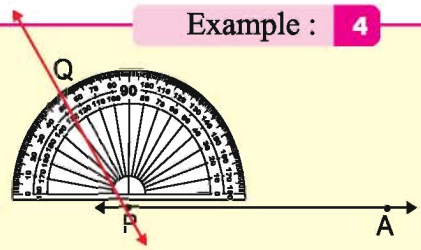
Follow the procedure given in example3 for step 1 and step 2

Step 3:

(i) On PA from the right start counting from 0 ° in the ascending order (anticlockwise direction) and finally mark a point Q using a sharp pencil at the point between 120 ° and 130 ° showing 125 ° on the semi-circular edge of the protractor.

(ii) Remove the protractor and join PQ

We get the required angle $m\angle APQ = 125^\circ$



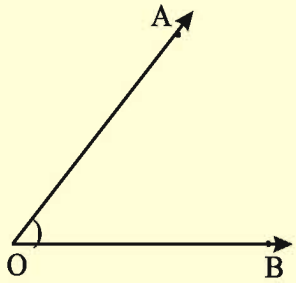
Exercise 12.2

1. Draw and name the following angles.

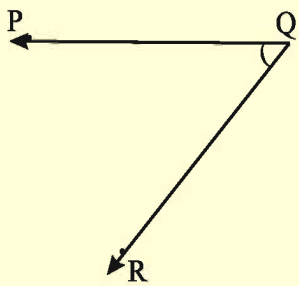
i) 65° ii) 35° iii) 110° iv) 155° v) 69°

2. Draw and measure the angles made by the hour hand and minute hand of a clock when it shows 9 o' clock, 4 o' clock and 12 o' clock respectively.

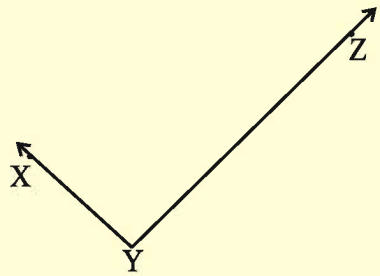
3. Measure and name the angles for the following figures.



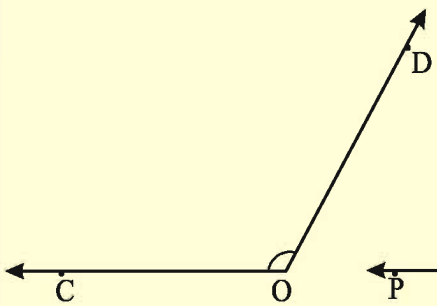
i)



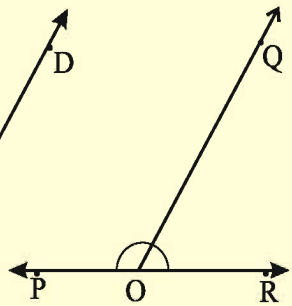
ii)



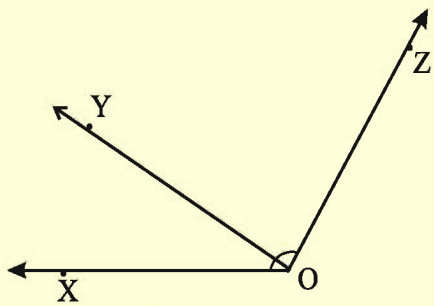
iii)



iv)

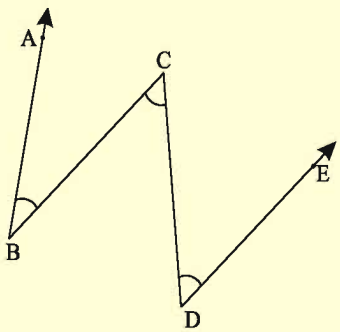


v)

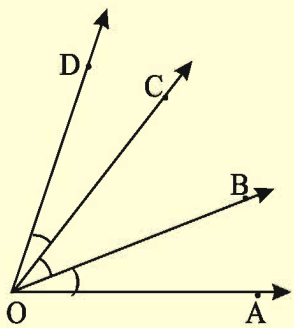


vi)

4. From the given figure measure and write m∠ABC , m∠BCD , m∠ CDE

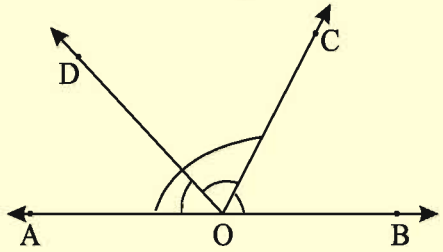


5. Measure the following six angles in the figure given below



1. m∠ AOB
2. m∠ AOC
3. m∠ AOD
4. m∠ BOC
5. m∠ BOD
6. m∠ COD

6. Measure and name the angles in the following figure.

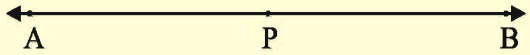


12.4 Construction of Perpendicular lines and parallel lines

Example : 5

Using a set square and a ruler construct a line perpendicular to the given line at a point on it.

Step 1



(i) Draw a line AB with the help of a ruler

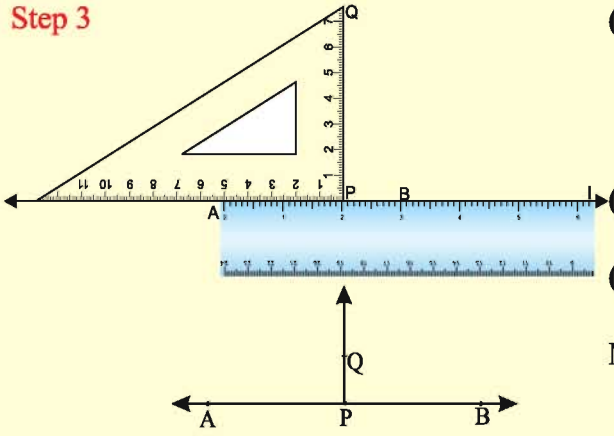
(ii) Mark a point P on it

Step 2

(i) Place a ruler on the line AB

(ii) Place one edge of a set square containing the right angle along the given line AB as shown in the figure.

Step 3



(i) Pressing the ruler tightly with the left hand, slide the set square along the ruler till the edge of the set square touches the point P.

(ii) Through P, draw a line PQ along the edge.

(iii) PQ is the required line perpendicular to AB

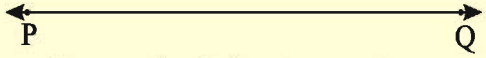
Measure and check if

$m\angle APQ = m\angle BPQ = 90^\circ$

Example : 6

Using a set square and a ruler draw a line perpendicular to the given line through a point above it.

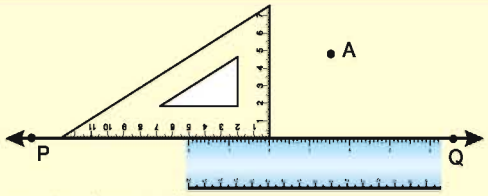
Step 1:



(i) Draw a line PQ using a ruler

(ii) Mark a point A above the given line

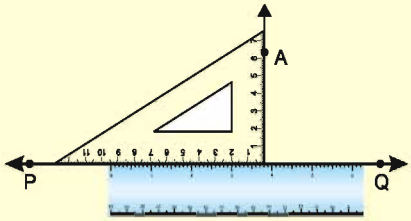
Step 2



(i) Place the ruler on the line PQ

(ii) Place one edge of a set square containing the right angle along the given line PQ as shown in the figure.

Step 3

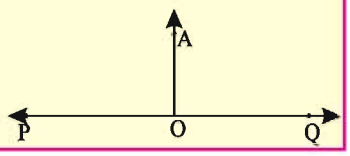


(I) Pressing tightly the ruler with the left hand, slide the set square along the ruler till the edge of the set square touches the point A

(ii) Through A draw a line AO along the edge.

(iii) AO is the required line perpendicular to PQ

Measure and check : $m\angle POA = m\angle QOA = 90^\circ$



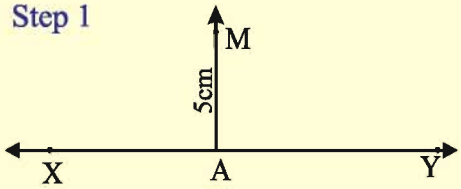
Example : 7

Using a set square and a ruler draw a line parallel to a given line through a point at a distance of 5cm above it.

(i) Draw a line XY using ruler and mark a point A on it.

(ii) Draw AM = 5 cm with the help of a set square.

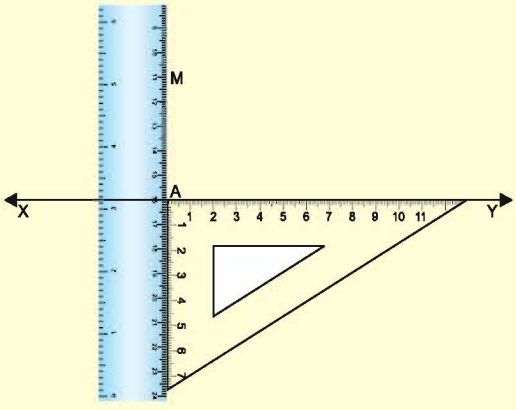
Step 1



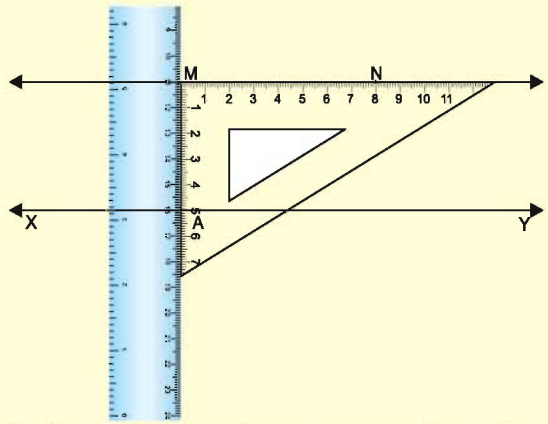
Step 2

Place the set square on the line segment XY

(i) Place the scale as shown in the figure



Step 3



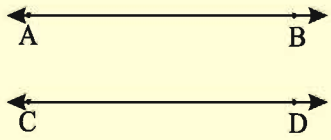
(i) Pressing tightly the ruler, slide the set square along the ruler till the edge of the set square touches the point M.

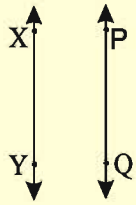
(ii) Through M, draw a line MN along the edge.

(iii) MN is the required line parallel to XY through M.

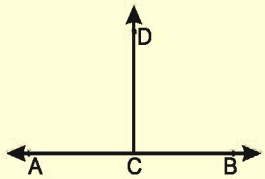
Exercise 12.3

1. Find the distance between the given parallel lines





2. Find the length of the perpendicular lines AB and CD



3. Draw a line segment measuring 5.6 cm. Mark a point P on it. Through P draw a line perpendicular to the given line.

4. Draw a line segment measuring 6.2 cm. Mark a point A above it. Through A draw a line perpendicular to the given line.

5. Draw a line segment measuring 7.1 cm. Mark a point M below the line segment. Through M draw a line perpendicular to the given line segment.

6. Draw a line segment measuring 5.2 cm. Mark a point B above it at a distance of 4.3cm. Through B draw a line parallel to the given line segment.

7. Draw a line segment. Mark a point Q below it at a distance of 5.1cm. Through Q draw a line parallel to the given line segment.

Points to Remember

- Line segment is the shortest distance that connects the two given points.
- A line segment has 2 end points
- A line segment AB is denoted as $\overline{AB}$
- A line has no end points.
- Length of the line segment AB = length of the line segment BA. (ie) $\overline{AB} = \overline{BA}$
- The unit for measurement of an angle is degree.
- The angle between two perpendicular lines is 90°.

13. Data Handling

13.1 Data

You must have seen your teacher writing information regarding attendance of the students on the black board.

Information regarding number on roll and attendance		Boys	Girls	Total
Class : 6 Day : Monday	Number on Roll	20	20	40
	No.of students present	20	18	38

In the same way, the marks obtained by students of a class in a particular examination, the maximum and minimum temperature of different places in a state are collection of information in the form of numerical figures.

> Any collection of information in the form of numerical figures giving the required information is called a data.

13.1.1 Collection of data

To submit information to the Government, the data of the mode of transport of 40 children of a school was collected.

They tabulated the same as follows

S.No.	Mode of transport	S.No.	Mode of transport	S.No.	Mode of transport	S.No.	Mode of transport
1	Bus	11	Bus	21	Bus	31	Bus
2	Train	12	Cycle	22	Cycle	32	Cycle
3	Cycle	13	Walk	23	Walk	33	Train
4	Bus	14	Bus	24	Walk	34	Bus
5	Walk	15	Walk	25	Walk	35	Bus
6	Walk	16	Walk	26	Bus	36	Walk
7	Train	17	Bus	27	Bus	37	Walk
8	Bus	18	Bus	28	Walk	38	Walk
9	Cycle	19	Train	29	Cycle	39	Train
10	Bus	20	Cycle	30	Bus	40	Bus

13.1.2. Raw data (unclassified data)

It is difficult to find how many different modes of transports are used by the students. How many of them use each mode? etc. from the above table. It is just a collection of data. They are not classified to give specific information.

13.1.3. Classification of data

From the above unclassified data, we come to know that many students use bus, cycle and train as a mode of transport or they come by walk.

From the information collected from students the modes of transport are listed one below the other as shown in the table. A mark is made against each mode for each student using it. Finally we count the number of marks to get the number of students using each mode.

Bus	||||||||||||||||	16
Train	|||||	5
Cycle	|||||||	7
By walk	||||||||||||	12
Total		40

' I ' is called a 'tally mark'. It is difficult to count if there are more number of tally marks.

Therefore to make it easier to count, we change it as follows.

Mode of Transport	Tally Mark	Number of students
Bus	𝍸 𝍸 𝍸 |	16
Train	𝍸	5
Cycle	𝍸 ||	7
By walk	𝍸 𝍸 ||	12
	Total	40

After 4 tally marks the fifth tally mark is entered as a cross line cutting across diagonally all the 4 tally marks as shown (𝍸) and it is counted as 5. We can calculate the number of students coming by bus as 5 + 5 + 5 + 1 = 16. In the same way we can find the remaining data also.

The raw data is rearranged and tabulated to get classified or tabulated data.

Example : 1

Information was collected from 20 students of a class regarding competitions they like to participate.

No. of the student	Competetion	No. of the student	Competetion	No. of the student	Competetion	No. of the student	Competetion
1.	Cricket	6	Kabadi	11	Ball Badminton	16	Ball Badminton
2.	Kabadi	7	Cricket	12	Kabadi	17	Ball Badminton
3.	Foot Ball	8	Cricket	12	Foot Ball	17	Football
4.	Foot Ball	9	Kabadi	14	Ball Badminton	19	Ball Badminton
5.	Kabadi	10	Foot Ball	15	Kabadi	20	Football

Tabulate the above information using tally mark.

All the students have chosen any one of the games.

We can tabulate it as follows:-

Cricket	𝍸	3
Kabadi	𝍸 |	6
Foot Ball	𝍸 |	6
Ball Badminton	𝍸	5
	Total	20

Example : 2

The classified data of the number of students who were absent in a class room in a particular week is given.

If each student is denoted by a tally mark, answer the following:-

Days	No. of students (tally marks)
Monday	𝍸
Tuesday	𝍸
Wednesday	𝍸
Thursday	
Friday	𝍸
Saturday	𝍸 𝍸

1 How many students were absent on each day of the week?

Answer: Monday – 5, Tuesday – 4, Wednesday – 2, Thursday – 0, Friday – 1, Saturday - 8

2 Which day had maximum number of absentees?

Answer : Saturday

3 Which day had minimum number of absentees?

Answer : Thursday

Do it yourself

Ask the students to collect and tabulate the information about the different types of houses in villages.

Type of house	Tally mark	Total no. of houses
Thatched house		
Tiled house		
Asbestos house		
Concrete house		

1) Which type of houses are more in number?
2) Which type of houses are less in number?
3) Are there two or more type of houses in the same number? If so, name them.

13.2.Drawing Pictographs:

Information are easily understood when represented by pictures.

Example : 3

The following picture shows the number of people who visited the tourism trade fair in 5 weeks.

☺ Represents 10,000

First week	☺ ☺ ☺ ☺
Second week	☺ ☺ ☺ ☺ ☺
Third week	☺ ☺ ☺ ☺ ☺ ☺
Fourth week	☺ ☺ ☺
Fifth week	☺ ☺ ☺ ☺ ☺ ☺ ☺

Questions:

1. How many of them visited the fair in the 1st week?
2. Which week had maximum visitors?
3. Which week had minimum visitors?
4. Find the total number of visitors who enjoyed the fair?

Solution:

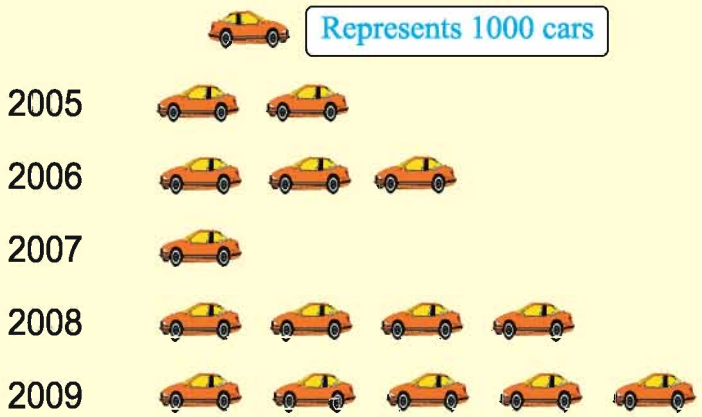
1. 40,000 people visited in the first week.
2. Maximum people visited in the fifth week
3. Minimum people visited in the fourth week
4. Total number of visitors in the fair = 2,50,000

Example : 4

The manufacturing of cars in a car factory during the years 2005 to 2009 is given in the following table.

Year	No. of cars
2005	2000
2006	3000
2007	1000
2008	4000
2009	5000

The following pictograph represents the above information.



Pictograph of the manufacture of cars in a car factory during the years 2005 to 2009.

Questions:

1. In which year the minimum number of cars were manufactured?
2. Find the year in which the number of cars manufactured was 3000
3. Find the total number of cars manufactured upto 2008 (inclusive of 2008).
4. Find the total number of cars manufactured in 2008 and 2009.

Solution :

1. Minimum number of cars were manufactured in 2007
2. 3000 cars were manufactured in 2006.
3. 10,000 cars were manufactured up to 2008
   (2000 + 3000 + 1000 + 4000 = 10,000)
4. 9000 cars were manufactured in 2008 and 2009.

Exercise 13.1.

I. See the pictograph and answer the questions

 represents 200 girls

2006	
2007	
2008	
2009	
2010	

Pictograph of the total number of girls studied in a high school in the years 2006 to 2010.

Questions:

1. Find the year in which the minimum numbers of girls studied.
2. Find the year in which the maximum number of girls studied.
3. Find the years in which the number of girls studied was 600.
4. Find the difference between the maximum number of students and minimum number of students.
5. Say true or false
   1. Equal number of girls studied in the year 2008 and 2009

II. See the pictograph and answer the following questions.

Each picture represents Rs. 10,000

Wood	
Sand	
Brick	
Stone	
Cement	

Pictograph shows the expense in constructing a house.

Questions:

1. What information is given by the pictograph?
2. How much did he spend for sand?
3. What is the total amount spent for bricks and stones?
4. State the item on which maximum amount was spent?
5. What is the total expense of constructing a house?

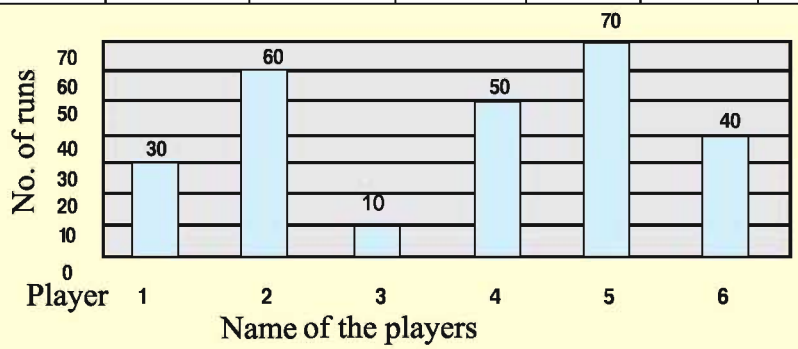
13.3. BAR DIAGRAM

- Through bar diagrams the statistical data can be understood easily.
- It can be used to compare two items easily.
- A bar diagram consists of many rectangular bars.
- The bars are drawn between the horizontal line and the vertical line. The interval between the bars must be equal and the thickness of the bars must be same

Example : 5

The total number of runs scored by a few players in one-day match in India is given
Draw the bar diagram.

Players	1	2	3	4	5	6
No. of runs	**30**	**60**	**10**	**50**	**70**	**40**



Represent the number of players on the horizontal line and represent the number of runs on the vertical line

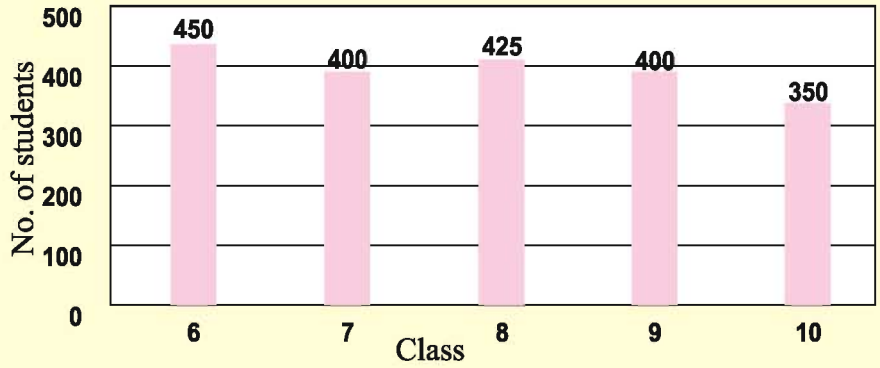
Scale - In vertical line 1 cm = 10 runs

Example : 6

The number of students in each class of a high school is given below.

Draw a bar diagram.

Class	6	7	8	9	10
No. of students	450	400	425	400	350



The number of students should be written on the vertical line and the classes 6 to 10 must be given on the horizontal line.

1 cm on the vertical line = 100 students.

Exercise – 13.2

1. Construct a bar graph to represent the following information. Number of absentees in a week in a corporation high school are given

Class	6	7	8	9	10
Absentees	8	12	9	15	6

2) The number of students taking part in various games in a higher secondary school are given below. Draw a bar diagram

Game	Foot Ball	Net Ball	Basket Ball	Cricket	Athletics
No. of Student	25	30	15	20	10

3) The savings of a student is given in the table. Draw a bar diagram.

Month	June	July	August	September	October	November	December
Amount (Rs)	20	35	25	15	10	40	30

4) Draw a bar diagram to represent the most popular television programmes.

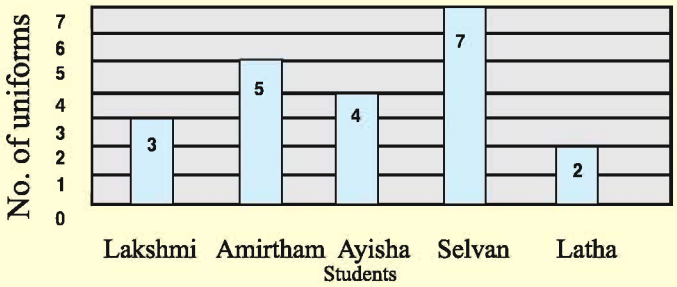
Television programme	Cartoon	Games	Pogo	Animal Planet	Tourism	News
No. of viewers	150	100	125	200	100	250

13. 4. Reading bar diagrams

Example : 7

The number of uniform sets a few 6 standard students have with them are given in the table followed by a bar diagram.

Name of the students	Lakshmi	Amirtham	Ayisha	Selvan	Latha
Number of uniforms	3	5	4	7	2



From the above bar diagram, answer the following:-

1 What is the name of the student having maximum number of uniform? (Selvan)

2 How many uniforms does Ayisha have? (4)

3 Who has the minimum number of uniforms? (Latha)

4 The information is given about _____ students. (5)

5 How many students have more than two sets of uniform? (4)

Example : 8

The bar diagram is given to represent the names of the schools and the number of students who took part in an examination conducted by a Municipal Higher Secondary School. Answer the following questions:

Higher sec school 1

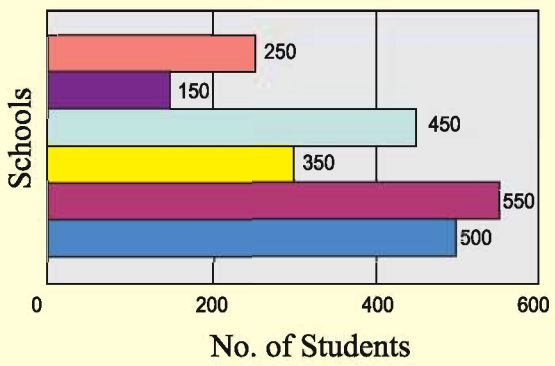
Hr sec school 2

Hr sec school 3

Hr sec school 4

Hr sec school 5

Hr sec school 6



1 Name the school from which maximum number of students participated (Hr sec school 5)

2 How many schools took part in the examination? (6)

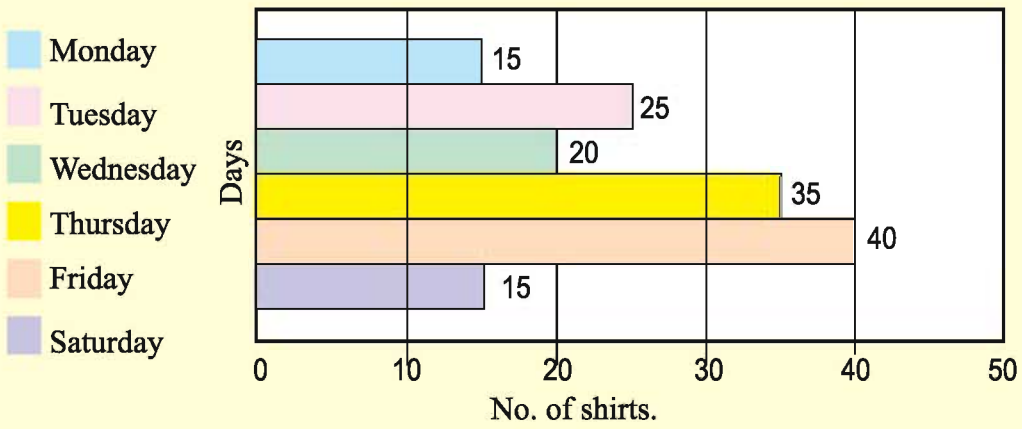
3 Name the school from which minimum number of students participated (Hr sec school – 4)

4 Name the school from which 350 students participated (Hr sec school – 4)

5 How many students participated from Hr sec school – 6 ? (500)

Exercise 13.3

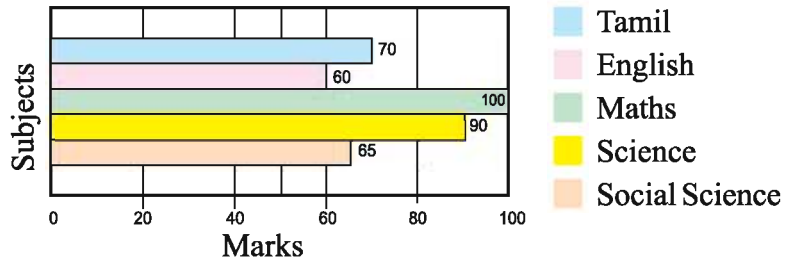
The bar diagram represents the number of shirts produced in a tailoring unit in 6 days. Answer the following.



Questions:

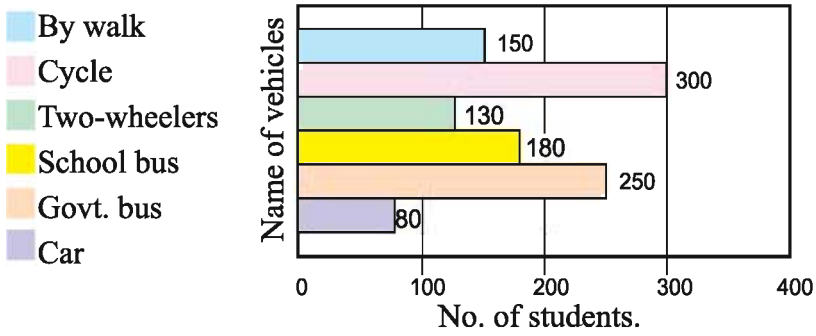
1 On which day of the week the maximum number of shirts were produced ? How many ?
2 What is the number of shirts produced on Tuesday ?
3 On which days of the week, were equal number of shirts produced?
4 What is the information given by the bar graph ?
5 How many shirts does one cm represent on the horizontal line?

II. The marks scored by a student in half yearly examination are given below. Answer the following questions:



1. What is the information given by the bar diagram?
2. How much did the student score in Science ?
3. Name the subject in which he has scored the maximum marks?
4. What is the total marks scored by him in both the languages together ?
5. Form a table to show the marks scored by the student in all the 5 subjects.

III. The bar diagram represents the number of students using different modes of transport. Answer the following questions.



Questions:

1. Which mode of transport is mostly used by the students?
2. What is the information given by the bar diagram ?
3. How many students come by walk to school ?
4. How many students were represented by 1 cm on the horizontal line ?
5. Name the mode of transport used by the minimum number of students?

Points to remember

1. Data is a collection of numerical figures giving required information.
2. The information which is collected initially is called the raw data or unclassified data.
3. The classified and tabulated information help us to get a better understanding of the data collected.
4. Pictographs are used to represent information through pictures.

Answers

Exercise1.1

1) (i) Thousand, 20 Thousand (ii) 12, 27 (iii) 1 lakhs, 30 lakhs (iv) 2 crore, 5 crore 1 lakhs (v) 97, 109 (similarly we can give many more answer)

2) (i) Four Hundred, Eight Thousand, Thirty Thousand, Ten lakhs, Twenty crores (Ascending Order)
Twenty crores, Ten lakhs, Thirty Thousand, Eight Thousand, Four Hundred (Descending Order)
(ii) 99, 8888, 23456, 55555, 1111111 (Ascending Order)
1111111, 55555, 23456, 8888, 99 (Descending Order)

Exercise1.2

1) Ten Thousand, Thousand, Hundred, Ten, One 2) No

3) (i) No (ii) No (iii) Yes

Exercise1.3

2) One Lakh = 100 Thousands = 1000 Hundreds = 10000 Tens = 100000 Ones
3) One Crore = 100 Lakhs = 10000 Thousands
4) Rs.10 lakhs 5) (i) 36, 216, 1296 (ii) 100, 10,000, 10,00,00,000.
6) Eighty Thousand > Twenty Thousands > Ten Thousand,
Ten Thousand < Twenty Thousands < Eighty Thousand

Exercise1.4

1) Yes (7 lakhs, 5 Thousand x 2 = 14 Lakhs 10 Thousand)

2) 10,000 Enough. (Science 462 x 18 = 7,668 < 10,000)
7200 not enough (Science 462 x 18 = 7,668 > 7,200)

3) Rs. 100

4) (i) 67,290 (ii) 63, 290 (iii) 61,290 (iv) 31,235 (v) 30,235 (vi) 29,935

5) (i) 1,000 (ii) 2,000 (iii) 400 (iv) 500 (v) 50,505 (vi) 10,101

Exercise 2.1

1) (i)169 (ii) 264 iii) 1300 (2) 3775 (3)(i)6200 (ii) 2500 (iii) 650

Exercise 2.2

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

2) (i) c (ii) c (iii) a (iv) b (v) a

3) (i) 1,2,4,8 (ii) 1,3,5,15 (iii) 1,3,5,9,15,45 (iv) 1,11,121 (v) 1,2,7,14

4) 81,84,87,90,93,96,99

5) (i) 25,30,35,40,45,50 (ii) 30,40,50, all multiples of 10 are multiples 5 also

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

7) (i) a (ii) b (iii) d (iv) b (v) c

8) 31,37,41,43,47,53,59

9) No

Exercise 2.3

1) i) True ii) True iii) True

2)

Numbers	Divisibility								
	2	3	4	5	6	8	9	10	11
918	Yes	Yes	No	No	Yes	No	Yes	No	No
1,453	No	No	No	No	No	No	No	No	No
8,712	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes
11,408	Yes	No	Yes	No	No	Yes	No	No	No
51,200	Yes	No	Yes	Yes	No	Yes	No	Yes	No
732,005	No	No	No	Yes	No	No	No	No	No
12,34,321	No	No	No	No	No	No	No	No	Yes

3) 76043120, 9732, 98260, 431965, 1190184, 31795872, 32067, 12345670, 869484, 56010, 923593

4) 64, 8, 112 (5) Yes

Exercise 2.4

1. (i) 2 x 3 (ii) 3 x 5 (iii) 3 x 7 (iv) 2 x 3 x 5 (v) 11 x 11 (vi) 5 x 29
(vii) 2 x 3 x 3 x 3 x 3 (viii) 2 x 5 x 17 (ix) 2 x 2 x 3 x 3 x 5 (x) 2x 2x 2x 5x5

Exercise 2.5

1) i) True ii) False iii) False iv) True
2) i) (c) ii) (c) iii) (a) iv) (c)
3) i) 6 , 210 ii) 34 , 102 iii) 3 , 900 iv) 12 , 432
4) 15 kg

Exercise 2.6

1) (iv) 2) 39 3) 14

Exercise 3.1

1. (i) $\frac{10}{12}, \frac{15}{18}, \frac{20}{24}, \frac{30}{36}$ (ii) $\frac{9}{24}, \frac{15}{40}, \frac{21}{56}, \frac{6}{16}$ (iii) $\frac{6}{21}, \frac{14}{49}, \frac{12}{42}, \frac{16}{56}$

iv) $\frac{6}{20}, \frac{9}{30}, \frac{12}{40}, \frac{15}{50}$ 2. $\frac{2}{5}, \frac{16}{40}$ $\frac{3}{4}, \frac{9}{12}, \frac{12}{16}$ 3. (i) $\frac{6}{7}$ (ii) $\frac{7}{12}$ (iii) $\frac{3}{4}$ (iv) $\frac{1}{3}$ (v) $\frac{5}{9}$

4. (i) 5 , 12 (i) 35 , 12 (iii) 63 , 40

Exercise 3.2

1. (i) $\frac{5}{7}$ (ii) $\frac{7}{12}$ (iii) $\frac{16}{19}$ (iv) $\frac{31}{34}$ (v) $\frac{37}{137}$

2. (i) $\frac{3}{4}$ (ii) $\frac{7}{7} = 1$ (iii) $\frac{12}{13}$ (iv) $\frac{12}{7}$ (v) $\frac{81}{124}$ (vi) $\frac{13}{72}$

3. (i) $\frac{8}{13}$ (ii) $\frac{3}{17}$ (iii) $\frac{1}{39}$ (iv) $\frac{64}{47}$ (v) $\frac{75}{107}$ (vi) $\frac{13}{122}$

Exercise 3.3

1. (i) $\frac{5}{7}$ (ii) $\frac{7}{12}$ (iii) $\frac{6}{5}$ (iv) $\frac{4}{3}$ (v) $\frac{3}{2}$

2. (i) $\frac{17}{12}$ (ii) $\frac{7}{8}$ (iii) $\frac{8}{5}$ (iv) $\frac{27}{8}$ (v) $\frac{17}{50}$ (vi) $\frac{33}{20}$

3. (i) $\frac{5}{12}$ (ii) $\frac{3}{10}$ (iii) $\frac{3}{8}$ (iv) $\frac{17}{28}$ (v) $\frac{5}{9}$

Exercise 3.4

1. $\frac{1}{5}, \frac{1}{6}, \frac{1}{7}, \frac{1}{8}, \frac{1}{9}, \frac{1}{10}, \frac{1}{20}, \frac{1}{50}, \frac{1}{100}, \frac{1}{200}$ 2) 20 Goats 3) 750 Adults

Exercise 3.5

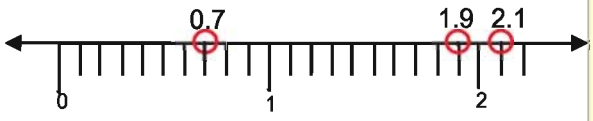
1) (i) $\frac{7}{10}$ (ii) 12 (iii) 0 (iv) $\frac{1}{10}$ (v) Decimal Point

2) 23.4 69. 2 82.8

3)

Decimal Nos	Integral Part	Decimal Part	Value of the Decimal Part	Number Name
7.6	7	6	0.6	Seven units and six-tenths
28.5	28	5	0.5	Twenty eight and five-tenths
24.0	24	0	0	Twenty Four

4) (i) 124.6 (ii) 18.3 (iii) 7.4 5)



6) (i) 0.2 (ii) 3.7 (iii) 786.3

Exercise 3.6

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

2) (i) 23.18 (ii) 9.05

3) (i) 9 Thousand (ii) 6 hundredths (iii) 3-Ones (iv) 2 tenths

4) (i) 23.47 (ii) 137.05 (iii) 0.39

5) (i) $106+\frac{86}{100}$ (ii) $1+\frac{2}{10}$ (iii) $76+\frac{45}{100}$ (iv) $\frac{2}{100}$

Exercise 3.7

1) (i) 10.75 (ii) 3.18 (iii) 8.58 (iv) 2.69

2) (i) 309.005 (ii) 300.61 3) (i)2.966 (ii) 47.46

Exercise 4.1

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

2) (i) $7 > 3$ (ii) $-3 > -5$ (iii) $2 > -3$ (iv) $7 > -3$ (v) $1 > -4$ (vi) $-4 > -7$

3) (i) $-2, -1, 0, 1, 2$ (ii) $-3, -2, -1, 0, 1$ (iii) 0 (iv) $-4, -3$ (iv) $-3, -2, -1, 0, 1, 2$ (v) $-1, 0, 1$

4) (i) 1 (ii) -4 (iii) 8 units (iv) 5 units

Exercise 4.2

1) (i) 4 (ii) −10 (iii) 2 (iv) −3 (v) −3

2) (i) 1 (ii) −10

3) (i) 7 (ii) 7 (iii) −70 (iv) 110 (v) −57 (vi) 0
(vii) −18 (viii) −52

4) (i) −3 (ii) 10

5) (i) 10 (ii) −17 (iii) 0 (iv) −30

Exercise 5.1

1 (i) 20 2 (ii)  3 (iv) Second number = 10 x First number

Exercise 5.2

1) a) (ii) b) (iii)

2) 40x 3) 12b 4) 6x

Exercise 5.3

1) (i) x+7 (ii) y-10 (iii) 3y-8 (iv) -7x - 5

2) i) Add 5 with twice y
ii) Subtract 5 from twice y
iii) Divide twice y by 5
iv) Divide 5 times y by 2

3) y+7, 7y, y-7, 7-y, $\frac{y}{7}, \frac{7}{y}$ 4) i) z+5 ii) 7z iii) 3z+5 5) 2t+30 (6) 10y (7) 7x

Exercise 5.4

1) a) iii b) iii c) iv

2) a) ii b) iii c) i

3) Not a solution. Not a solution. Is a solution. Not a solution

4) 6 + 7 = 13 Not a solution. 7 + 7 = 14 Not a solution. 8 + 7 = 15 Is a solution. 9 + 7 = 16 Not a solution

5) i) 2 − 3 = −1 Not a solution ii) − 2 +7 = 5 Not a solution
iii) 28 + 8 = 36 Not a solution iv) 3 − (−7) = 10 Is a solution

6) (i) 5 (ii) 10 (iii) 9 (iv) 35 (v) 20 7) y = 12

8) 15, 18, 24, 27, 30, 33, 39, 42, 45 ; z = 10 9) 1, 3, 4, 6 ; p = 12

Exercise 6.1

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

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

3. (i) 4:9 (ii) 5:9 (iii) 2:3 4) (i) 6:10, 9:15, 12:20, 24:40
(ii) 6:14, 12:28, 15:35, 30:70 (iii) 10:18, 15:27, 30:54, 40:72

5. (i) 3:4 (ii) 1:3 (iii) 1:2 6. (i) 40:1 (ii) 40:39 (iii) 1:39 7.(i) 3:5 (ii) 2:5
(iii) 3:2

8. (i) 1:2 (ii) 4:3 (iii) 2:3 (iv) 4:9 (v) 2:9 (vi) 1:3

Exercise 6.2

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

2) (i) **1** (ii) **2** (iii) **4** (iv) **4** (v) **2** **3)** Rs. 1950

4) 3500, 4000 5) Male **55,000**, Female**45,000 6) 80 7) 42 8) 18** cm

Exercise 7.2

1) (i) 10 mm (ii) 3000 m (iii) 150 cm (iv) 0.75 km (v) 53 mm

2) (i) 4475 m (ii) 1035 cm (iii) 147 mm 3) 27 m

4) 1242 cm (or) 12 m 42cm

5) (i) 2 kg (ii) 7000 g 6) (i) 1020 cg (ii) 3004 g 7) 18 kg 150 g

8) 37 kg 100 g 9)200 packets 10) 36 *l* 11) 37 *l* 550 *ml*

12) 5 *l*

Exercise 8.1

1) (i) 60 (ii) 1 (iii) 60 (iv) 7.5 a.m (v) 3.45 p.m

2) (i) 900 seconds (ii) 1812 seconds (iii) 11,405 seconds (iv) 2720 seconds

3) (i) 480 minutes (ii) 710 minutes (iii) 575 minutes (iv) 175 minutes

4) (i) 8 hours 45 minutes (ii) 2 hours (iii) 3 hours 18 minutes (iv) 1 hour

Exercise 8.2

1) (i) 6.30 hours (ii) 0 hour (iii) 21.15 hours (iv) 13.10 hours

2) (i) 10.30 a.m (ii) 12 noon (iii) Midnight 12 (iv) 11.35 p.m

Exercise 8.3

1) (i) 10 hours 45 minutes (ii) 10 hours 45 minutes 2) 11 hours 40 minutes

3) 3 hours 15 minutes

Exercise 8.4

1) (i) 7 (ii) 29 (iii) 72 (iv) 12 (v) 3600

2) (i), (iv) 3) 96 4) (i) 46 weeks and 6 days (ii) 25 weeks

Exercise 9.1

1) (I) 46 cm (II) 21 cm (III) 28 cm (IV) 24 cm (V) 21 cm

2) 16 units 4) 22 cm 5) 12 cm

Exercise 9.2

1) sq.cm, sq.cm, sq.m, sq.km, sq.m

Exercise 9.3

1.a) 16 sq. units b) 8 sq. units

Exercise 9.4

1) (i) 24 cm, 35 sq.cm (ii) 4 cm, 40 sq.cm (iii) 12m, 36m (iv) 7m, 32m

2) (i) 36 sq.m (ii) 75 sq.m 3) (i) 6 sq.cm (ii) 18 sq.cm

Exercise 10.1

1) Straight line 2) A, B 3) Q 4) Ray AB 5) Starting Point 6) AB; AC; AD; BC; BD; CD

Exercise 10.2

1) Straight line 2) Collinear points 3) Many 4) Only One

5) (a) $(\overleftrightarrow{AH}, \overleftrightarrow{CQ})$, $(\overleftrightarrow{AH}, \overleftrightarrow{DP})$, $(\overleftrightarrow{AH}, \overleftrightarrow{EF})$, $(\overleftrightarrow{BG}, \overleftrightarrow{CQ})$, $(\overleftrightarrow{BG}, \overleftrightarrow{DP})$, $(\overleftrightarrow{BG}, \overleftrightarrow{EF})$, $(\overleftrightarrow{CQ}, \overleftrightarrow{EF})$, $(\overleftrightarrow{DP}, \overleftrightarrow{EF})$

(b) $(\overleftrightarrow{AH}, \overleftrightarrow{BG})$, $(\overleftrightarrow{CQ}, \overleftrightarrow{DP})$

(c) A, X, W, H are the collinear points on $\overleftrightarrow{AH}$

B, Y, Z, G are the collinear points on $\overleftrightarrow{BG}$

C, Y, X, Q are the collinear points on $\overleftrightarrow{CQ}$

D, Z, W, P are the collinear points on $\overleftrightarrow{DP}$

E, X, Z, F are the collinear points on $\overleftrightarrow{EF}$

(d) $\overleftrightarrow{AH}$, $\overleftrightarrow{CQ}$, $\overleftrightarrow{EF}$ are concurrent line passing through X

$\overleftrightarrow{BG}$, $\overleftrightarrow{DP}$, $\overleftrightarrow{EF}$ are concurrent line passing through Z

Exercise 11.1

1. (i) Acute angle (ii) Obtuse angle (iii) Obtuse angle (iv) Obtuse angle
2. (i) Acute angle (ii) Obtuse angle (iii) Right angle (iv) Acute angle
3. (i) $\angle AOB$ Straight angle $\angle DOB$ Obtuse angle $\angle COB$ Right Angle
   $\angle AOD$ Acute angle $\angle DOC$ Acute angle $\angle AOC$ Right angle
   (ii) $\angle AOB$ Acute angle $\angle AOC$ Acute angle $\angle AOD$ Right angle
   $\angle BOC$ Acute angle $\angle COD$ Acute angle

Exercise 11.2

1) (i) 53^0 (ii) 48^0 (iii) 2^0 (iv) 90^0 (v) 74^0

2) (i) 174^0 (ii) 153^0 (iii) 92^0 (iv) 76^0 (v) 64^0
(vi) 34^0 (vii) 122^0 (viii) 1^0

3) 50^0

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

5) (i) Complementary (ii) Supplementary (iii) Complementary (iv) Supplementary

6) (i) 45° (ii) 90°

7) (i) Right angle (ii) Obtuse angle (iii) Acute angle (iv) Acute angle

Exercise 11.3

1) (i) 180 ° (ii) all three (iii) an isosceles (iv) right angled (v) greater
(vi) 3 (vii) 3

2) Three angles and three sides

3) (i) obtuse angled triangle (ii) right angled triangle (iii) acute angled triangle
(iv) obtuse angled triangle

4) (i) yes (ii) yes (iii) no (iv) no (v) no

5) (i) isosceles triangle (ii) equilateral triangle (iii) scalene triangle
(iv) scalene triangle

6) (i) impossible (ii) impossible (iii) possible (iv) impossible

Exercise 13.1

I) 1. 2006 2. 2010 3. 2008, 2009 4. 600 5.true

II) 1) The pictograph shows the expenses in constructing a house.
2) Rs. 60,000 3) Rs. 70, 000 4) Cement Rs. 70, 000
5) Total expense Rs. 2, 30, 000

Exercise 13.3

I) 1) Friday, 40 2) 25 3) Monday, Saturday
4) The bar graph shows the number of shirts produced in 6 days.

II) 1) The bar diagram shows the marks scored by a student in half-yearly examination.
2) 90 3) Maths 4) 130

5)

Subject	Tamil	English	Maths	Science	Social Science
Marks	70	60	100	90	65

III) 1) cycle
2) the bar diagram shows the number of students using different modes of transport.
3) 150
4) 100 students
5) car