Chapter 3

LINE SEGMENT

In learning Mathematics, you have already come across various kinds of figures like the circle, triangle, quadrilateral, hexagon etc.

Can you dawn a circle in your notebook?

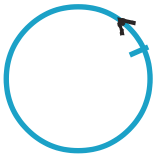


Fig 1

If you move a pencil along the circle that you have drawn, you will observe that:

1. You start at a point and reach the same point again.
2. While starting at a point on the circle and coming back to the same point again, you don't have to pass twice through any point.

Such figures with the two above mentioned properties are known as closed figures. Now look at another figure.

Fig 2

Is "P" a closed figure?

No, because starting at any point on the figure "P", to reach or come back at the same point again without lifting your pencil, you will have to pass through some points on the figure two times.

Now, look at the figures given below and say whether they are open or close figures. Also identify whether they are made up of straight lines, curved lines or both.

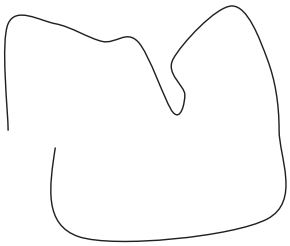


Fig 3

Fig 4

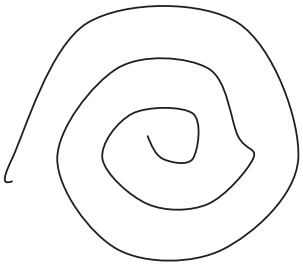


Fig 5

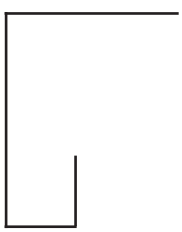


Fig 6

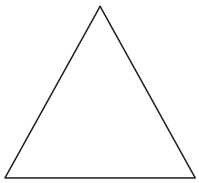


Fig 7


Fig 8

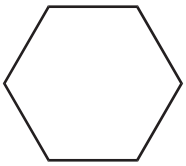


Fig 9

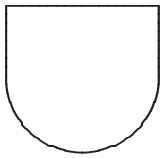


Fig 10

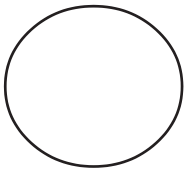


Fig 11

Write about figures in the following table -

S. No.	Fig No.	Close curve or Open curve	Made up of straight lines or curve lines or both type of lines
1.	3	Open curve	Curve lines
2.	4		
3.	5		
4.	6		
5.	7		
6.	8		
7.	9		
8.	10		
9.	11		

Can you make a list of figures that can be seen around you which are made up of straight lines and curved lines?

Till now you have used two types of lines- one is a curved line that is uneven and the other is straight line, about which you have already studied in your previous classes. Let us now know something more about straight lines.

You all know how to draw a straight line. Can you draw a horizontal straight line on the blackboard? This straight line can be as long as the width of the blackboard on which you have drawn it. Now, suppose we increase the width of the blackboard two times of what it is now, then the straight line can also be extended two times its length. If the blackboard is extended more and more and more. This means a straight line can be increased in length from both sides endlessly.

Therefore, a straight line is a non curve line which extended at both ends will never come to stop. Can you draw a straight line on your note book?

If you can draw it, describe how you drew it and if you can't, say why you can't draw it.

In trying to draw a straight line you have found that you can draw straight line only as long as your note book, but this line doesn't ever come to an end, so how can we draw it in our note books?

We really can't. We can only draw it symbolically. Can you suggest some way in which a straight line can be represented in your note book ?

Your suggestion could be:

.....

Drawing A Straight Line Using A Symbol

Fig 12

In figure 12, a straight line is shown with two arrow heads at both its ends. The arrow heads on both the sides symbolize the fact that the straight line has no end point, it doesn't come to a stop and moves on, and on.

Similarly, if we draw a straight line starting from a stated point that moves on in one direction without coming to a stop, we then call it a **ray**. Draw a **ray** in your note book and write the description of how you drew it. Since a ray begins at a particular point and moves on and on, therefore a ray is shown with an arrow head on one side of the straight line.

A ray starting at point "O"

Fig 13

In other words we can say that a ray is a straight line that has only one end point.

Thus, a straight line that begins at a point and moves on in one direction is known as a ray. It doesn't have fixed length.

Think of other examples of rays in your daily life and write them down.

ACTIVITY 1

Can you identify the straight lines and ray in the following figures :

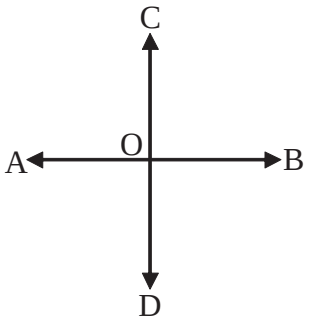


Fig 14

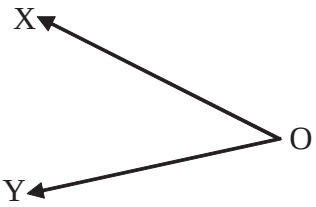


Fig 15

Fig 16

Write about the figures as you identify them.

ACTIVITY 2

You are given two points below. How many straight lines can you draw passing through point P? Draw them. How many straight lines can you draw from point Q? Draw such lines.

P Q

Fig 17

Answer the following :

1. Can you count the number of straight lines passing through point P?

   ---

2. Can you count the number of straight lines passing through point Q?

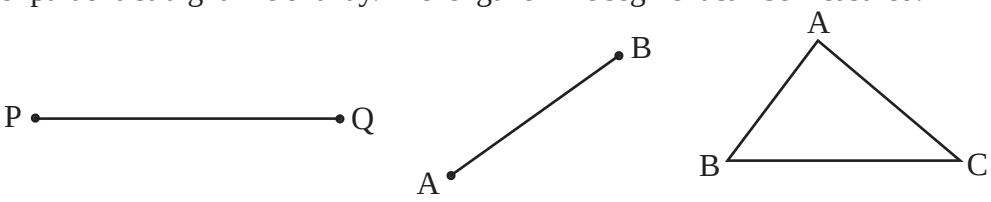
   ---

3. How many straight lines can you draw passing through both points P and Q?

From the above activities, you can say that from a given point we can draw infinite number of straight lines. But, through two given points, we can draw only one straight lines.

A Line Segment

Now look at these straight lines that are used in making this figure begin from a definite point and end at definite points. Such lines are called line segments. so, a line segment is a portion or part of a straight line or a ray. The length of line segment can be measured.



ACTIVITY 3

Study the figures 18 and 19 and answer the questions given below:

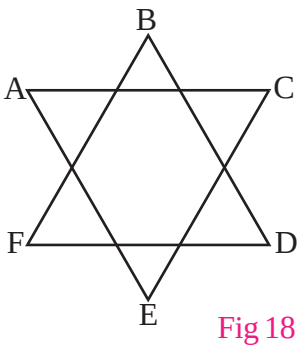


Fig 18

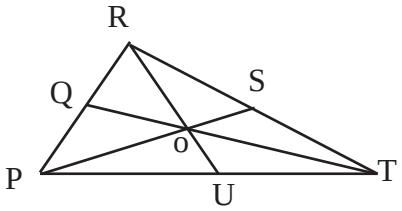


Fig 19

Identify the lines segments in figure18. Write the name of all the line segments. How many line segments are there?

How many points of intersection can be seen in figure 18 and 19? Which line segment intersect the other and at which points?

What is a line segment? Write in your words.

ACTIVITY 4

Take two points P and Q. The points are joined in three ways in the figure, you can try more ways.

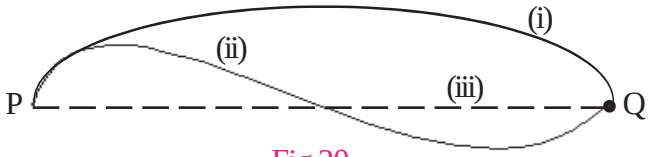


Fig 20

Points P and Q can be joined in many ways. But they can be joined only in one way by a line segment. So, a line segment is the smallest line to join two points.

Fig 21

Meena says that the smallest distance between P and Q is a line segment. Do you agree? Why?

Collinear Points

Observe the points located on a surface-

Fig 22

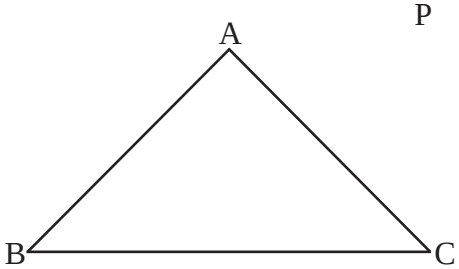


Fig 23

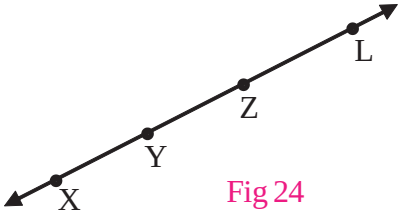


Fig 24

In fig.22, Points P, Q and R are on the same straight line. They are called collinear points.

In fig.23, Points A, B and C are not on the same straight line. They are not called collinear points. Why?

In fig.24, Points X, Y, Z and L are on the same straight line. Are they called collinear points?

Comparison of Line Segments

The comparison of two line segments means to find which line segment is longer?

(1) To compare by observation-

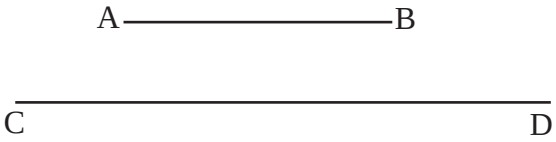


Fig 25

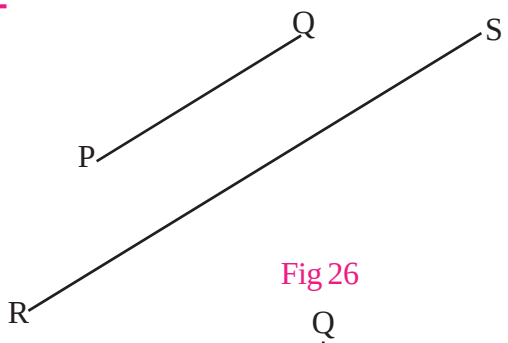


Fig 26

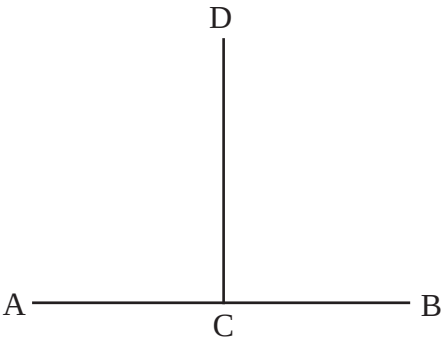


Fig 27

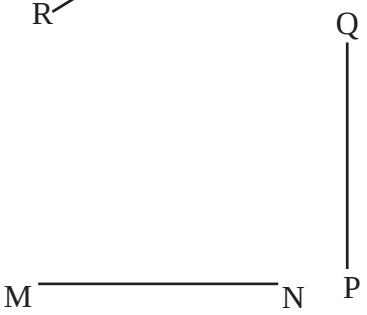


Fig 28

Just by looking at the figures 25 and 26, it can be said that line segment CD is longer than AB and RS is longer than PQ or in fig 25, CD > AB and in fig 26, PQ < RS. In fig 27 and 28, can you find out, which line segment is bigger? Let us measure them.

(2) Correct measurement with the help of a scale-

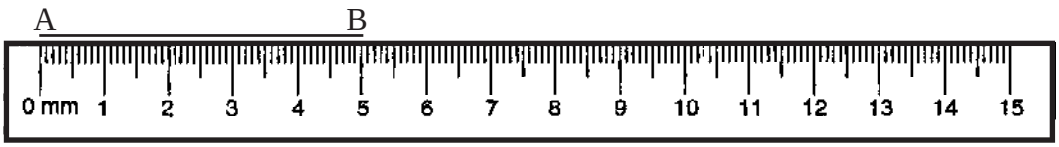


Fig 29

In fig 29, the length of line segment AB is shown with the help of a scale.

Method of Measurement

Let us measure the line segment AB. We place a ruler with its edge along the line segment AB in such a ways that the zero mark of the ruler coincides with the point A. Then we read the mark on the ruler which is against the point B. This gives us the length of the line segment AB (fig 27). Thus the lengths of line segment is 5cm or we write $\overline{AB}$ = 5cm.

(3) Measurement by Divider

You have seen that the length of a line segment can be measured with the help of a scale where the scale can be put on a straight surface. Can we measure the distance between inner walls of a box or a glass with the help of scale?

Take a divider, put it on the mouth of the tumbler stretching it in such a way that the point of divider touches the inner walls of the glass.

Now take out the divider without disturbing it on the scale as shown in fig 31 and measure the length.

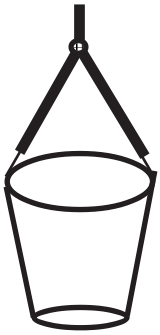


Fig 30

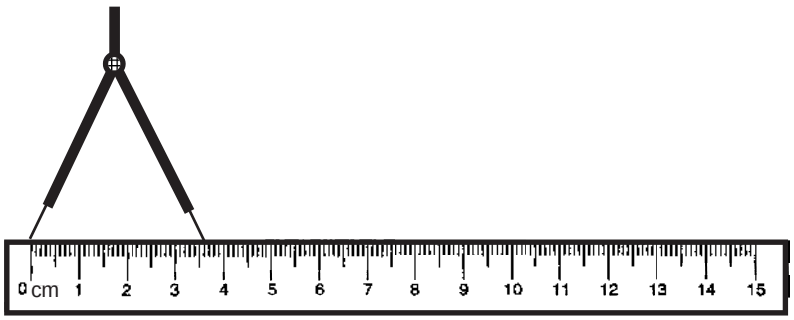


Fig 31

For the teacher - It should be noted that beginning the measurement from any point of the scale, does not affect the measure of the length using the old scale, not starting from zero, how can you measure any length? Discuss this with students. Let them practice measuring any length starting at any point on the scale.

ACTIVITY 5

Compare the measures of line segments in the following figures with the help of divider or compasses. Write the measures of each figure in their increasing order.

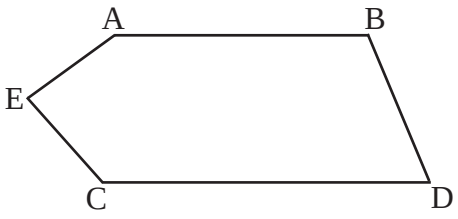


Fig 32

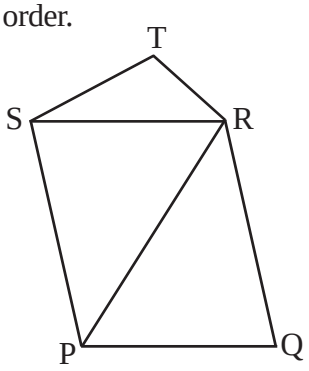


Fig 33

Measure the following line segments with the help of scale and compass and write their measurements.

Fig 34

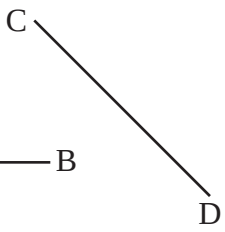


Fig 35

Fig 36

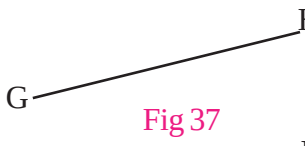


Fig 37

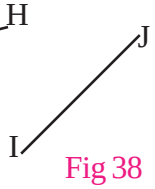


Fig 38

Drawing line segments of lengths equivalent to the sum of two or more line segments

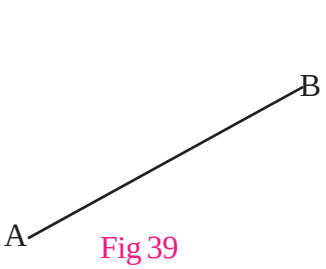


Fig 39

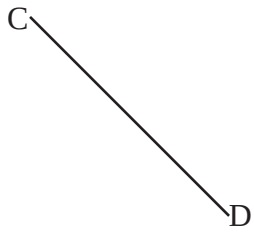


Fig 40

Fig 41

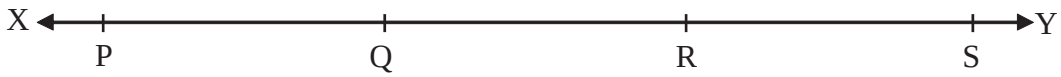


Fig 42

Steps :-

(1) Draw a line XY.

(2) Stretch the compass of length equal to that of line segment AB.

(3) Taking point P as a centre on line XY, draw an arc equal to the length of line segment AB and cut line XY at point Q.

(4) Take measure on the compass equal to line segment CD and draw an arc taking Q as the centre, cut line XY in the opposite direction of the arc at point P. Let the point be R.

(5) Similarly, take an arc equal to line segment EF and with R as the centre, cut on line segment XY. Let this point be S.

Is AB = PQ, CD = QR, EF = RS? Why?

Write in your notebook.

(6) PS = PQ + QR + RS

PS = AB + CD + EF

Now measure the length of PS. PS would be the sum of the given line segments.

Drawing line segment of length equivalent to the difference of line segments.

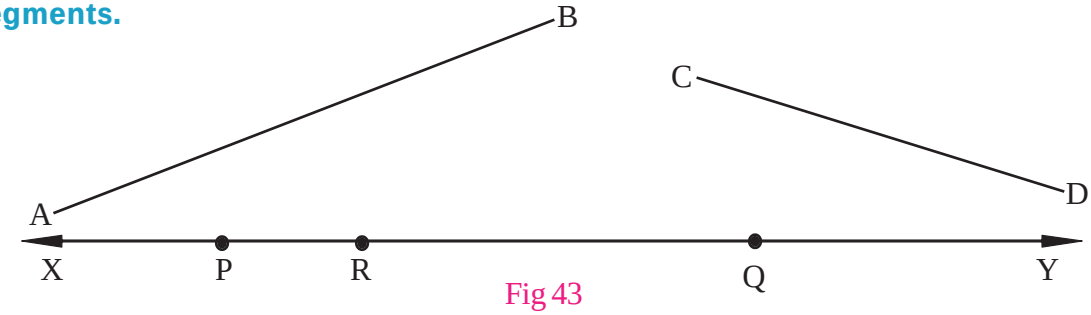


Fig 43

(1) Draw a straight line XY. Mark a point P on it.

(2) Stretch the compass to a length equal to $\overline{AB}$.

(3) Draw an arc at length of equal to AB and cut an arc on XY. Taking P as the centre. It cuts at point Q.

(4) Now take a measure on the compass equal to CD and with Q as centre, cut an arc on XY in the direction P. It cuts at R. Is AB = PQ and CD = QR? If yes, then why?

Write in your notebook. Here, why are the arcs are put in a direction opposite to PQ?

While adding the arcs were put in the same direction. Write the reasons in your notebook.

(5) PQ - QR = PR

or AB - CD = PR

Measure the length of PR, the difference of line segments will be PR.

Parallel Lines

Suppose the teacher asks students to draw two lines on the note book and the students draw lines that looked like this:

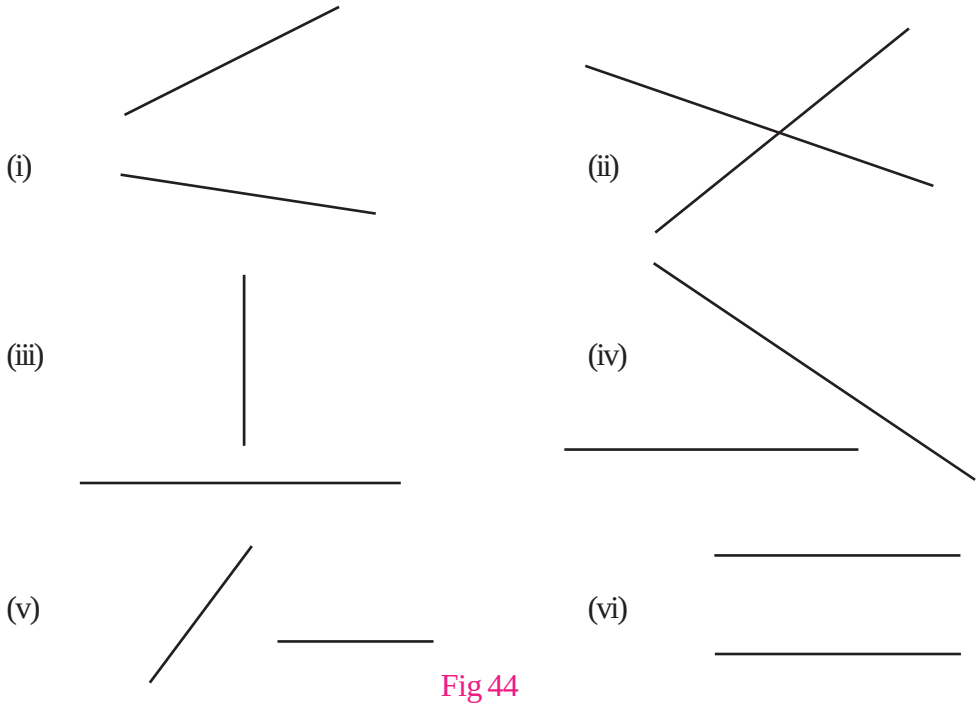


Fig 44

Now, you also draw a few pairs of lines in your note book.

Now look at the pairs of lines given below:

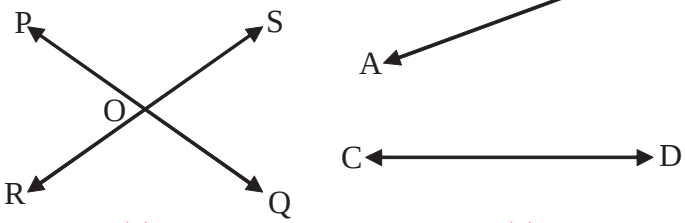


Fig 45(1)

Fig 45(2)

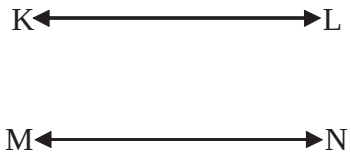


Fig 45(3)

In fig 45(1) the lines PQ and RS cut each other at point O. Therefore the lines PQ and RS are intersecting lines and point O is common to them.

In fig 45(2) the lines AB and CD are not cutting each other in the present state, if they are extended forwards or backward, they would intersect each other. Therefore, fig 45(2) would also come in the category of intersecting lines like fig 45(1).

In fig 45(3) the lines KL and MN are neither intersecting each other in the present state, nor will they intersect if they are extended in any direction.

How can we verify that they will not intersect each other?

Observe the lines in figure 45(3)

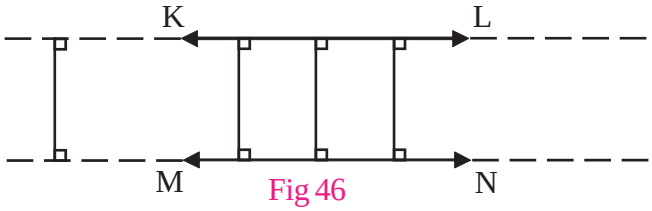


Fig 46

The perpendicular distance between KL and MN is equal at any point. If the lines are extended in any direction to any extent, the perpendicular distance between them would remain the same. You can also verify the perpendicular distance between the two lines by measuring it with the help of a divider. Are they equal? These lines are known as **parallel lines**. This means parallel lines always exist at equal distances. They neither come nearer to each other nor go farther.

Observe the things around you in your classroom, the blackboard in your class, the windows, doors, walls, your geometry box, desk, book, scale, note book etc. In all these things the edges will give you the notion of being parallel.

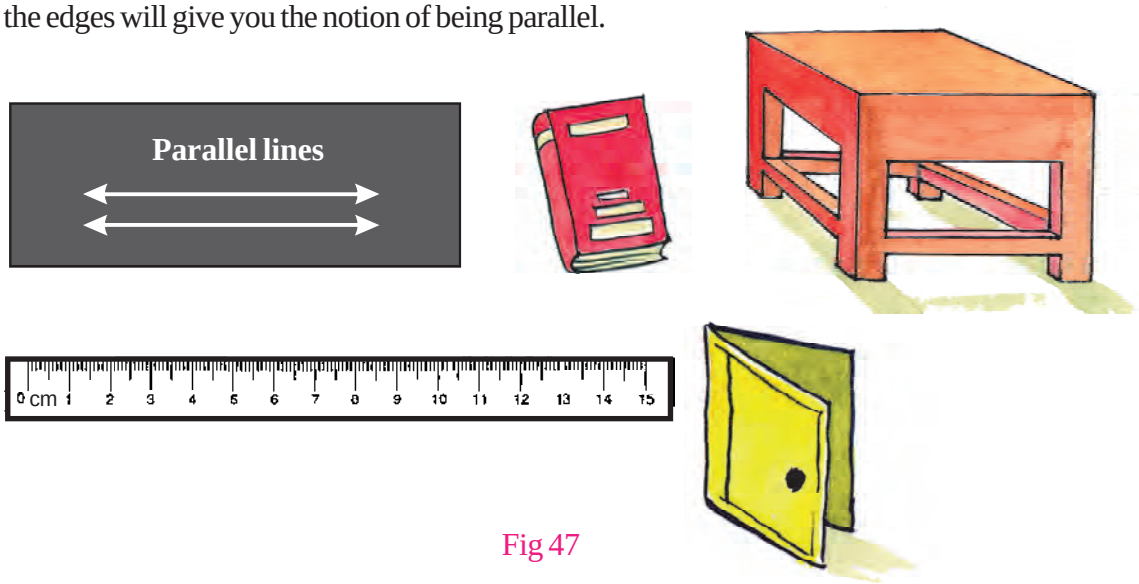


Fig 47

Look at these pictures. In these pictures, where, all do you see the examples of parallel line segments?

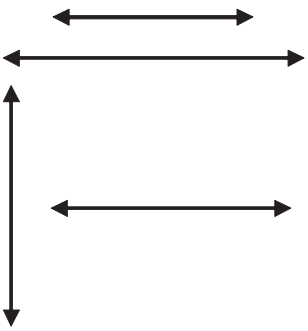
Make a list of examples of five intersecting and five parallel lines segments in your notebook.

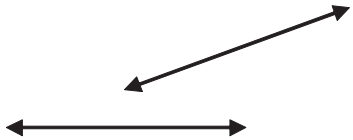
EXERCISE 3

Q.1. Say whether the following statements are true or false -

(i) Passing through one point, infinite number of line segments can be drawn.
(ii) Passing through two points, infinite number of lines can be drawn.
(iii) A line segment has only length and no breadth.
(iv) If four points are taken on a line segment, they are all collinear points.
(v) At the most 2 line segments can be drawn passing through 3 collinear points.

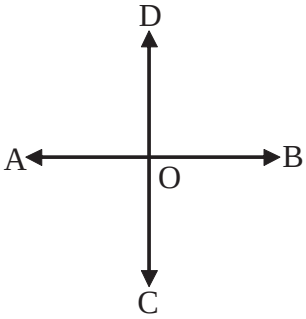
Q.2. Which of the pairs along the following figures are not intersecting lines?

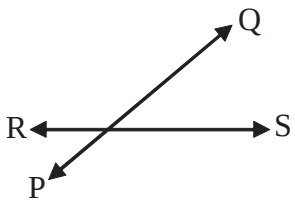
(i) 

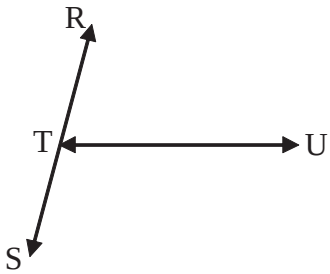
(ii) 

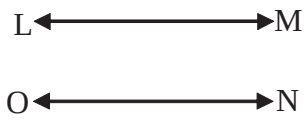
(iii)

Q.3. From the given pairs of lines select the pairs of intersecting lines.

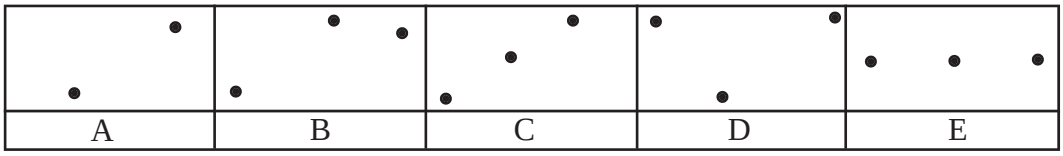
(i) 

(ii) 

(iii) 

(iv) 

Q.4. From the given blocks (A, B, C, D, E) choose the groups of points that are collinear.



Q.5. Draw line segments of the following measures:

6 cm 5 cm 4.5 cm 2.3 cm

Q.6. Draw 3 line segments 3 cm, 5 cm, 6.5 cm on one straight line.

Q.7. Some line segments are given below. Draw a line segment equal to the sum of their lengths.

(i) A ——— B C ——— D

(ii) A ——— B C ——— D

Q.8. Draw line segments equal to the difference of the given pairs of line segments.

(i) A ——— B C ——— D

(ii) A ——— B C ——— D

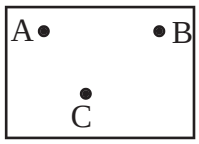
Q.9. Draw a line segment AB = 12 cm and divide it into 3 line segments of length 3 cm, 4 cm and 5 cm AC, CD and DB respectively. Now verify the following situations.

(i) AD – AC =CB - DB

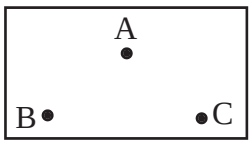
(ii) AB – CD =AC + DB

Q.10. How many line segments can be drawn with the help of the points given in each condition. Draw the line segments and write their numbers?

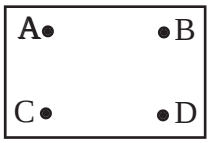
(i)



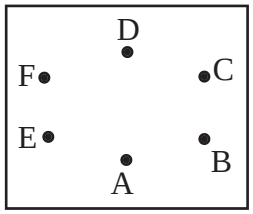
(ii)



(iii)



(iv)



(v)

What Have We Learnt ?

1. A ray has an initial point and it moves in one direction.
2. The straight line moves on and on in both sides.
3. A line segment is a portion or part of a straight line or a ray. Which has an initial and end point also. The length of a line segment can be measured.
4. Length of a straight line and a ray cannot be measured.
5. Two lines intersect each other at only one point.
6. Passing through one point infinite number of line can be drawn and passing through one point infinite number of ray can be drawn.