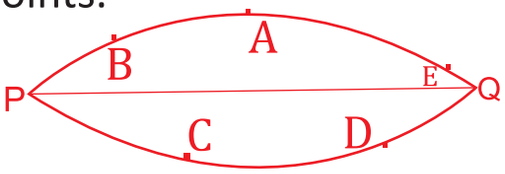
9 Geometry

Point : A point is an exact location in Shape. It is represented by a dot (.) it is very small, that it has no size, it has no length, breadth or thickness. It is denoted by capital letters i.e. A, B C, D and E are points.

• A • B • C • D • E



Line Segment : Suppose P and Q are two points. There can be many ways to reach P to Q or Q to P. But the shortest path is the straight path that joins P and Q.

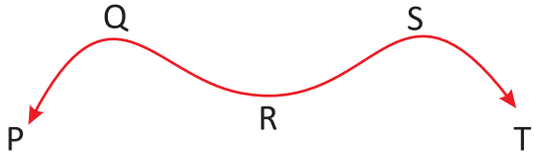
The straight path from P to Q is called line segment P Q. The line segment P Q is denoted by $\overline{PQ}$. P and Q are the end points of the line segment $\overline{PQ}$.

Line : A line is a straight path which extends endlessly in both directions.

The line segment has two end points whereas a line has no end points. Through two given points one and only one line can be drawn.

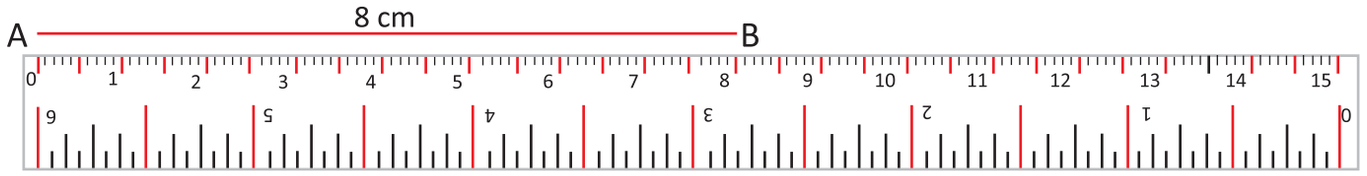
Ray : A straight path which extends endlessly in one direction only is called a ray. It has one end point called initial point.

Curved Line : Curved lines can not drawn with the help of a scale.



Measuring of Line Segments: To measure the given line segments we use scale (ruler). The upper edge of the scale has centimetre marks. Each centimetre is divided into 10 equal parts. Each part is called a millimetre.

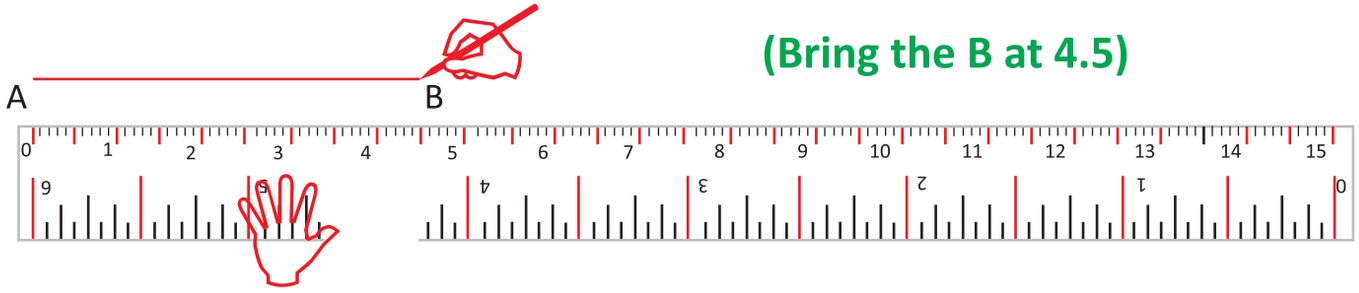
Example I : Measure the length of line segment AB.



Solution : Place the edge of the scale along the line segment AB. Keeping the zero centimetre mark of the scale at point A. We can see from the scale that the 8 cm mark is where against the point B. Therefore, in this way the length of the line segment is measured 8 cm and it is written as $\overline{AB}$ = 8 cm.

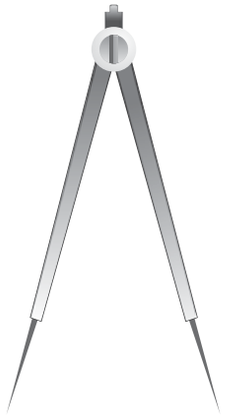
Example II : Draw a line segment of length 4.5 cm.

Solution : Place the scale on the paper and hold it as shown below :



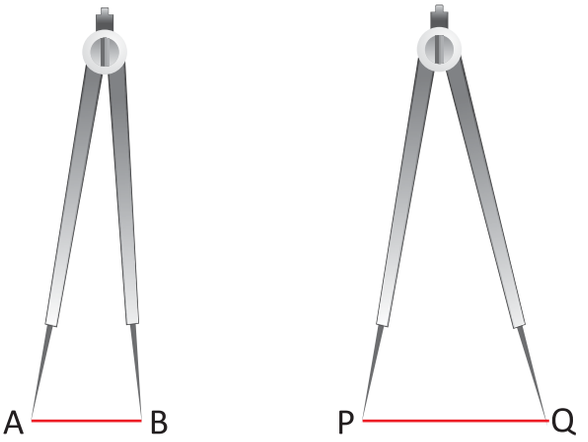
Mark two points, A and B against the marks of the scale which indicate '0' and 4.5 cm (4 big divisions and 5 small divisions). Pressing the scale evenly, join the points A and B by moving the tip of the sharp pencil along the edge of the scale. Lift the scale and obtain the required line segment AB of given line, i.e. $\overline{AB}$ = 4.5 cm.

Comparison of Line Segments



Two line segments AB and PQ can be compared by using an instrument called divider. It has two arms with pointed ends. The distance can be adjusted between its two ends.

Place the end points of the divider on the end points A and B of the line segment AB as given here :



Now lift the divider without disturbing its arms, and place one end point of the divider on point P of the line segment PQ. Observe where the other end point of the divider falls on the line segment PQ. Here, it falls before the point Q. We can say that line segment AB is shorter than the line segment PQ.

If the other end point of the divider falls exactly on Q, then the line segments AB and PQ are equal and if it falls beyond the point Q then the line segment AB is longer than line segment PQ.

EXERCISE 9.1

1. Construct a line segment of length.

a. 5 cm 5mm b. 7.9 cm c. 3.4 cm

d. 4 cm 3 mm e. 6.4 cm f. 5.4 cm

2. How many line segments joining any two given points among three non- straight points can be drawn?

3. How many line segments joining any two given points among three straight points can be drawn?

4. How many millimetres are there in a centimetre?

5. Which of the following is correct?

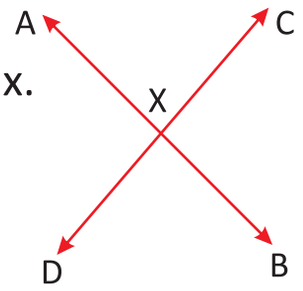
a. 1 cm = 0.1 mm b. 1 mm = 0.1 cm

c. 1 m = 0.01 cm d. 1 cm = 0.1 m

More About Lines, Line Segments and Rays

Intersecting lines

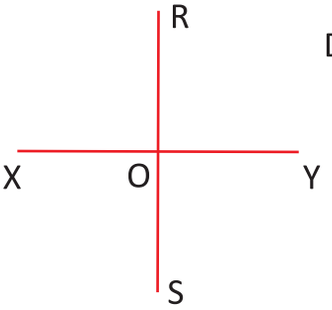
$\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ are intersecting or crossing each other at point x.



For Example : The letter X.

Intersecting line segments

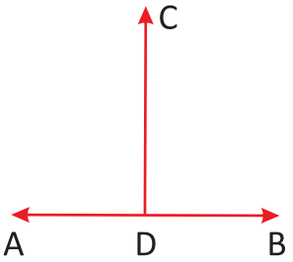
$\overline{RS}$ and $\overline{XY}$ are intersecting at point O.



For Example : Adjacent edges of a table top.

Perpendicular lines

When a vertical ray, line or line segment meets a horizontal ray, line or line segment, perpendicular lines are formed.



For Example : The letter T and L.

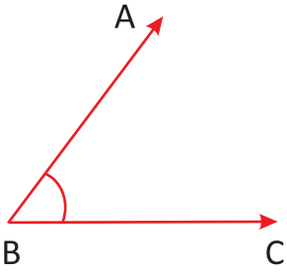
Parallel lines

Lines which never meet are called parallel lines. They are always at an equal distance from each other.

For Example : The edges of your scale and rails of a railways track.

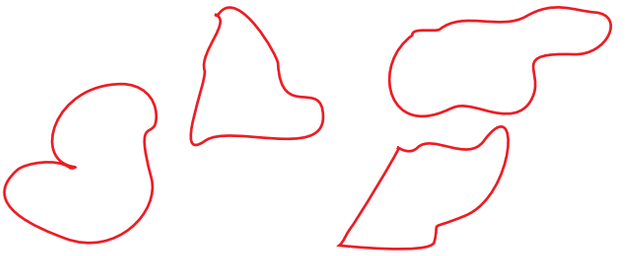
Angle

When two rays or line segments meet at a point, an angle is formed. The symbol used for angle is ∠. Thus, figure shows ∠ABC.



Closed Figures

Figures that start and end at the same place are closed figures. Figures given below are closed figure.

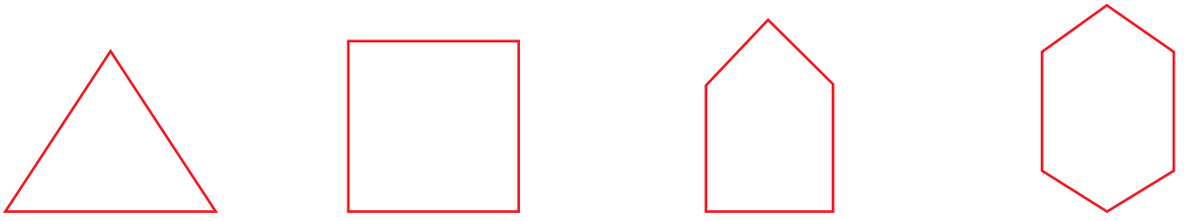


Open Figures

Figures that start at one place and end at another place are open figures. Figures given below are open figures.

Polygons

Figures made up of only straight line segments as their sides are called polygons.



EXERCISE 9.2

1. Find intersecting lines, perpendicular lines and parallel lines in the given figure.

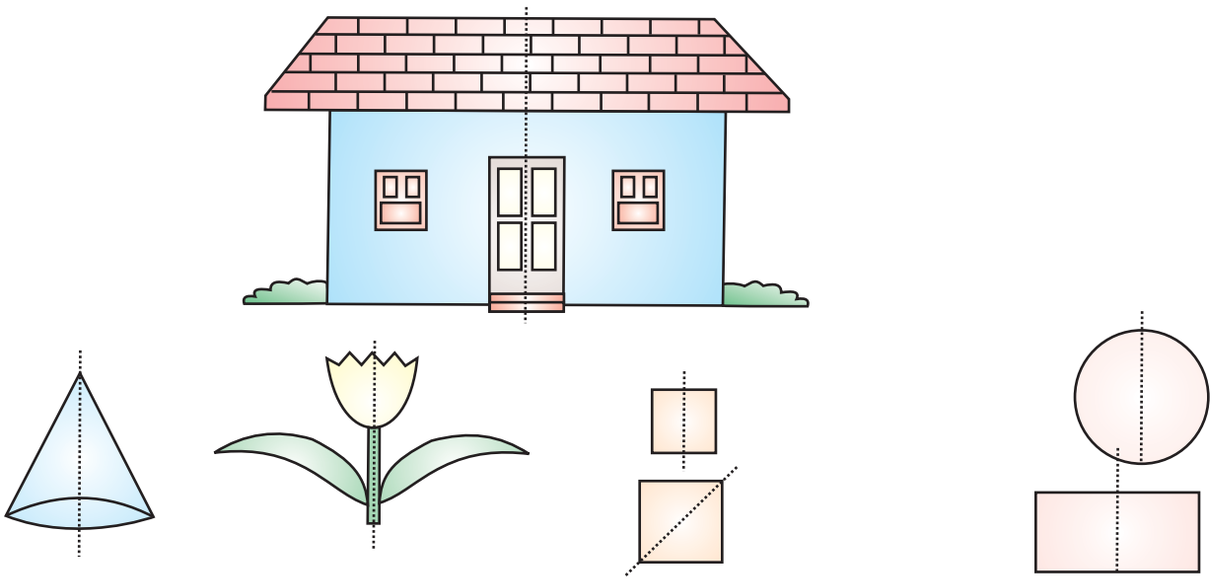
a.  b.  c.  d. e.  f. 

2. Find closed figures, open figures and polygons in the given figures.

a.  b.  c.  d.  e. 

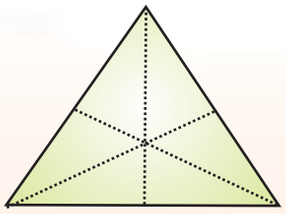
Line of Symmetry

Look at the figures given below and the dotted lines.

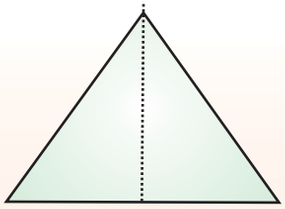


The above figures can be divided into two equal parts with the help of a dotted line. After marking the separation line, fold along with dotted lines, one part will fit exactly over the other part. The dotted lines are called the Line of Symmetry of the respective figures and the figures are called as the Symmetric Figures.

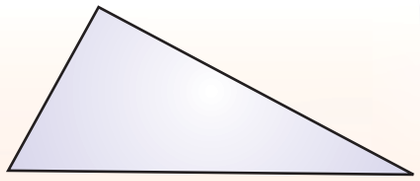
INFO ZONE



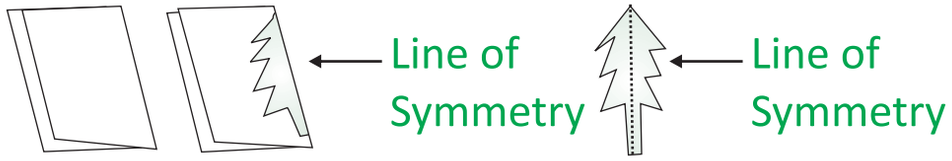
Three Lines of Symmetry



Single Lines of Symmetry

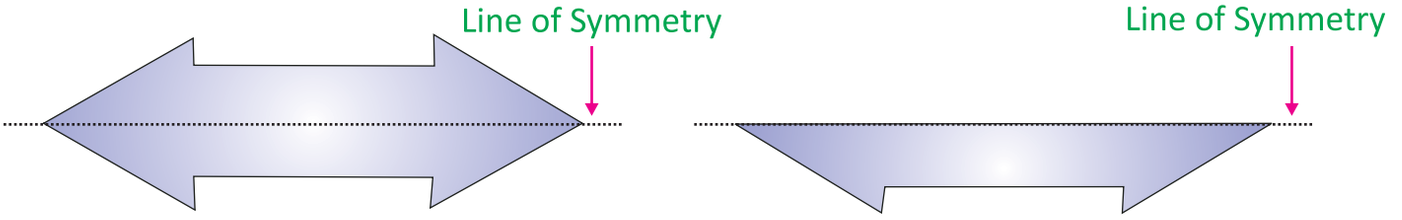


No Line of Symmetry

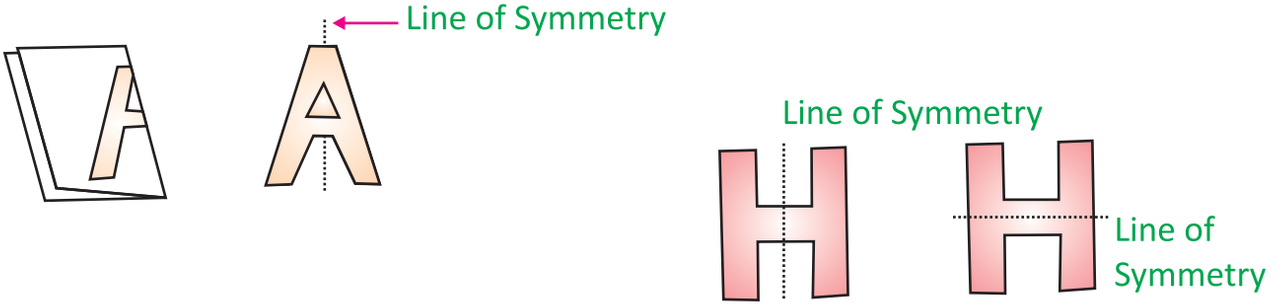


Try the given example. Fold a piece of a paper into two halves as in figure (a).

Draw a shape and cut it out as in figure (b). When you unfold the paper, the shape you will get is same as in figure (c). The shape in figure (c) is symmetric because both the halves are exactly the same.

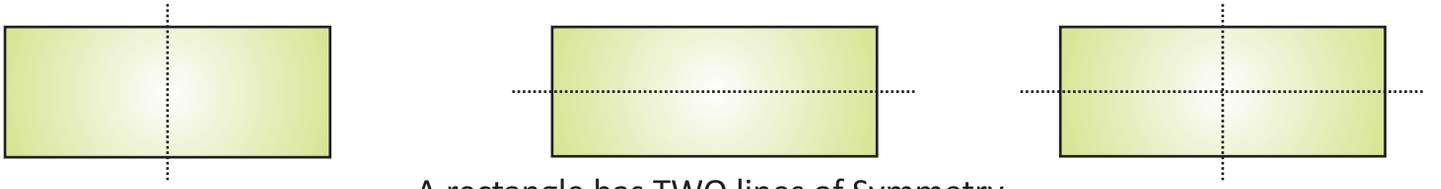


Here are some more examples. You should try to make some of your own.

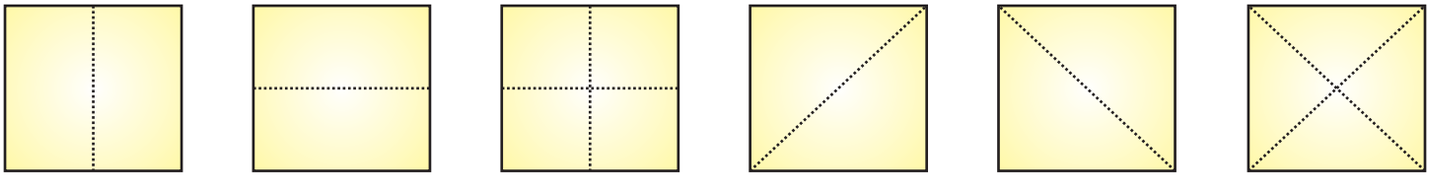


Figures with More than One Line of Symmetry

Some shapes have more than one line of symmetry. For example, a rectangle has two lines of symmetry and a square has four lines of symmetry.



A rectangle has TWO lines of Symmetry.



A square has FOUR lines of Symmetry.

Mirror Image : When you look at a mirror you see your own image. This is your reflection. The reflection is at the same distance from mirror as you are.

Look at the figures given below. The dotted line is the line of the mirror.

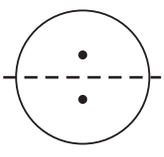
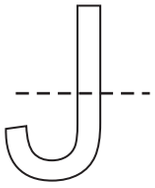
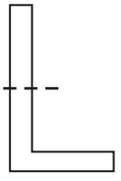
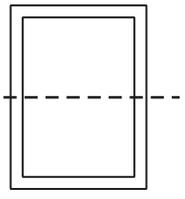
All these are examples of reflection.

Look at the figures given below. Are they reflections of each other?

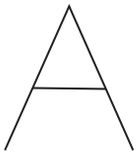
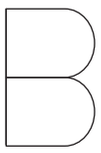
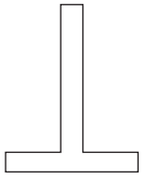
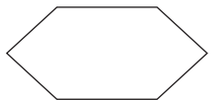
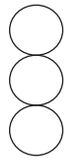
These are just rotated from left to right.

EXERCISE 9.3

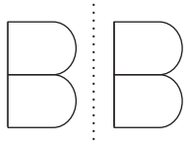
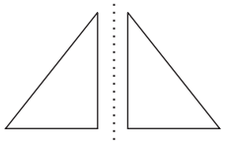
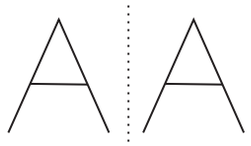
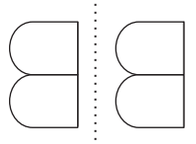
1. Tick (✓) on the figure which are symmetrical.

a.  b.  c.  d.  e. 

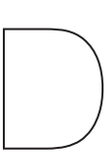
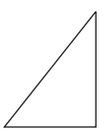
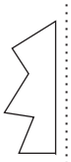
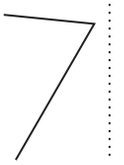
2. Draw the line of symmetry for each of the following.

a.  b.  c.  d.  e. 

3. Are the things given below examples of reflection?

a.  b.  c.  d. 

4. Draw the mirror image of each of the following.

a.  b.  c.  d. 

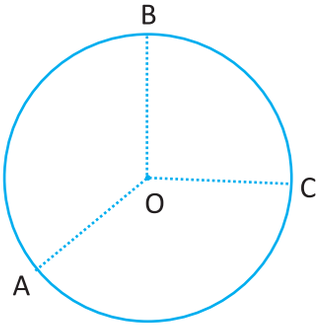
Circle

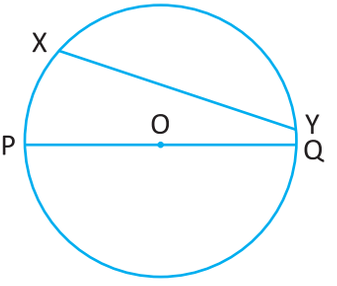
A round plane figure whose boundary consists of points equidistant from the centre is called circle. Look at the following figures. In the circle, there is a point O. This point is called the centre of the circle.

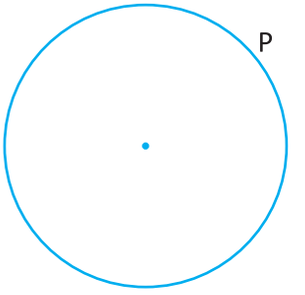
The distance of a point on the boundary of the circle from its centre is called the radius of the circle. Thus, OA represents the radius of the circle. OB and OC also represent the radius of the circle.

Let X and Y be two points on the boundary of the circle. Join X and Y by the line segment XY. The line segment XY is called a chord of the circle. PQ is also a chord of a circle. But the centre O of the circle is on this chord.

The length of such a chord is called the diameter of the circle. Every chord of the circle through the centre O is called a diameter.







The whole length of the boundary of a circle is called its circumference. If P is a point on the boundary of the circle, we say that P is a point on the circumference of the circle.

INFO ZONE

- Every diameter is a chord, but every chord is not a diameter.
- The diameter is the longest chord in any circle.
- A circle has many radii, chords and diameters but it has only one centre.

Compass

Have you seen a compass? Your instrument box should contain one compass. By using the compass you can make a circle. Look at the following steps :

a. Open your compass.

b. Press the tip of the compass on the paper. Hold the compass from the top.

c. Without moving the tip, try to move the pencil around.

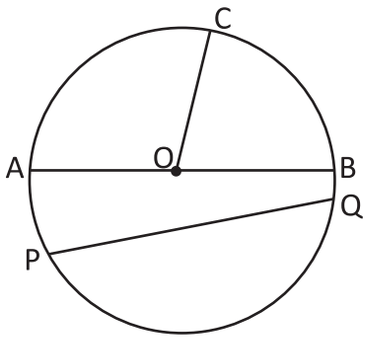
d. Now you get a circle.

EXERCISE 9.4

1. Draw the circles whose radii are :

a. 7 cm b. 5.4 cm c. 6.5 cm

2. In the figure O is the centre of the circle. Fill in the blanks :



a. AB is a ..... of the circle.

b. OC is a ..... of the circle.

c. PQ is a ..... of the circle.

POINTS TO REMEMBER

- A point is the smallest shape in geometry.
- A line segment has a definite length and is marked by two end points.
- A line extends in both directions endlessly. It has no end points.
- A ray starts from an end point and can extend in one direction only.
- Squares and rectangles are special quadrilaterals.
- If we join the centre to a point on the circle, we get a radius. A circle has many radii.
- If we join any two points on a circle we get a chord.
- Diameter = 2 × radius

RECAP EXERCISE

1. Multiple Choice Questions (MCQs)
Tick (✓) the correct options:

a. A line has ..... end points.

(i) one ☐ (ii) two ☐ (iii) no ☐ (iv) none of these ☐

b. Two lines can intersect at maximum ..... point.

(i) one ☐ (ii) two ☐ (iii) three ☐ (iv) four ☐

c. A polygon has ..... sides.

(i) three ☐ (ii) four ☐ (iii) five ☐ (iv) all of these ☐

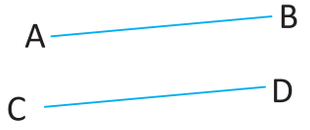
d. A circle may have ..... centre.

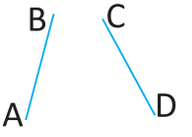
(i) one ☐ (ii) two ☐ (iii) three ☐ (iv) four ☐

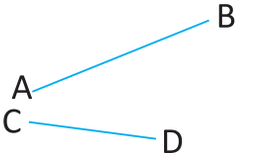
e. To draw a triangle we require.

(i) Scale ☐ (ii) Divider ☐ ii) Compass ☐ None of these ☐

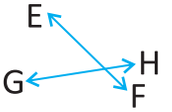
2. Construct the line segment of length.
a. 4.6 cm b. 5.4 cm c. 6.5 cm d. 8.2 cm

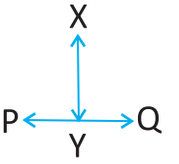
3. Compare the line segment. Which one is longer?
a. 

b. 

c. 

4. Which one is intersecting line in each pair of lines.
a. 

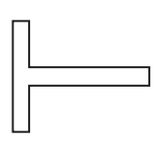
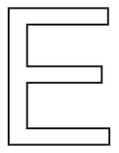
b. 

c. 

d. 

5. Draw line of symmetry in the following figures.
a. X b. O c. B d. H e. T

6. Draw the mirror images of each of the following figures.

a.  b.  c.  d. 

7. Draw the circle of the following radii.

a. 2.5 cm b. 3.2 cm c. 5.4 cm d. 6.8 cm

How many lines of symmetry are there in a circle?

Lab Activity

Objective : To build the skill of using the compass to draw circles.

Materials : Compass, pencil, pair of scissors, papers of four different colours, thermocol board (circular shape), glue etc.

Presentation :

- This activity will be performed in groups of 4 students.
- A student will use the compass and draw a small circle on a coloured paper.
- Another student will draw a slightly bigger circle on another coloured paper.
- Similarly, two more slightly bigger and bigger circles will be drawn by other partners.
- The centres will be marked and the circles will be cut out.
- They will be stuck one on top of the other as shown in the figure, taking care to see that the centres are also on the top of each other.
- Then the whole lot will be stuck on the thermocol board.
- A dart board has been prepared, which can be hung on the wall.
- Pencils can be used as darts and points scored, as per the position of the circles.