

14

Practical Geometry

INTRODUCTION

In this chapter, you will learn how to draw accurate and scale drawing using geometrical instruments. You may be asked to construct an accurate drawing or to take measurements from a drawing. You must have the proper geometrical instruments to do this:

- a ruler (to draw or measure line segments in cm and mm)
- a divider (to help in measuring line segments accurately)
- a protractor (to draw or measure angles)
- a compass with a sharp pencil on one end (to draw circles or arcs)
- set squares
- another sharp pencil
- a rubber (to rub incorrect work, if any)

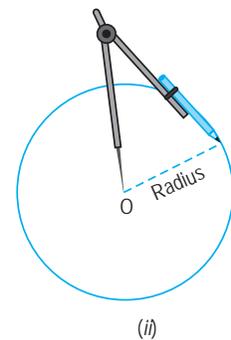
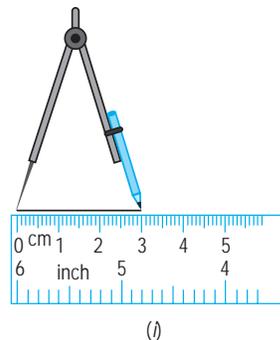
Make sure that your geometrical instruments are in good conditions with accurate markings on them and your compass is reasonably tight. Your drawing must be neat and clean. Remember that small errors in the work tend to build up big error in the end.

Construction of a circle when its radius is known

To construct a circle of radius 3 cm.

Steps of construction

1. Mark a point O, as the centre of the circle.
2. Open the compass to the required radius of 3 cm (see fig. (i)).
3. Place the pointer of the compass of O and hold it from the knob firmly.
4. Revolve (swing) the pencil and of the compass slowly to draw the circle. (see fig. (ii))
5. Remove the compass. The figure you get is that of a circle of radius 3 cm with point O as its centre.



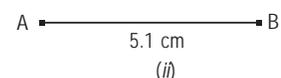
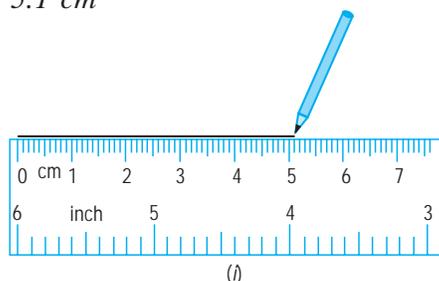
Construction of a line segment of a given length

To construct a line segment of length 5.1 cm

Use of ruler only

Steps of construction

1. Mark a point A on the sheet of paper and place the ruler so that the zero mark of the ruler is at A.

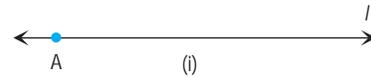


2. Mark a point B with a pencil against the mark of the ruler which indicates 5.1 cm.
3. Join the points A and B by moving the tip of the pencil against the straight edge of the ruler (see fig. (i)).
4. Remove the ruler and the pencil. You get a line segment AB of length 5.1 cm (see fig. (ii)).

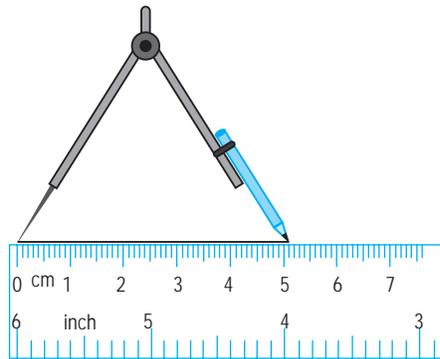
Use of ruler and compass

Steps of construction

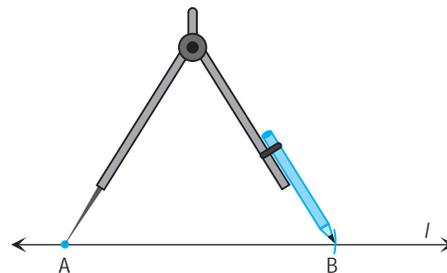
1. Draw a line l and mark a point A on it (see fig. (i)).



2. Place the pointer end of the compass at the zero mark of the ruler and open the compass so that the pencil end is on the mark indicating 5.1 cm of the ruler (see fig. (ii)).



(ii)



(iii)

3. Without changing the opening of the compass, place the pointer end at A and draw (swing) an arc to cut line l at the point B (see fig. (iii)).
4. Remove the compass. You get a line segment AB of length 5.1 cm (see fig. (iv)).

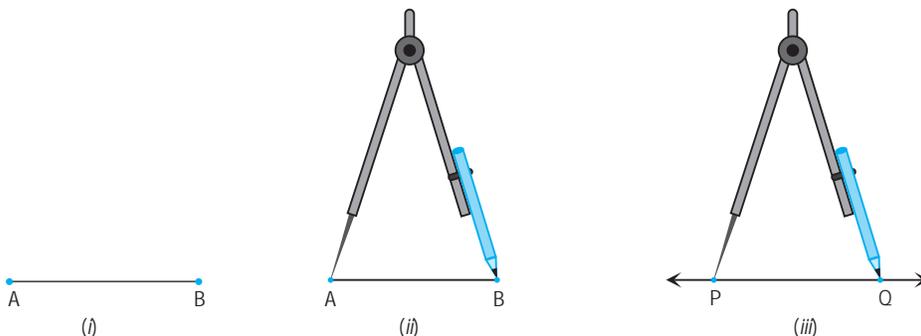


Constructing a copy of given line segment

To construct a line segment whose length is equal to that of a given line segment AB.

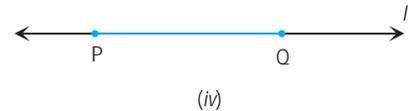
Steps of construction

1. Given a line segment AB whose length is not known (see fig. (i)).
2. Place the pointer end of the compass at the point A and open the compass till the pencil end exactly coincides with the point B. This opening of the compass gives the length of the segment AB (see fig. (ii)).



3. Draw any line l and take a point P on it. Without changing the opening of the compass place the point end at the point P and draw an arc to cut the line l at the point Q (see fig. (ii)).

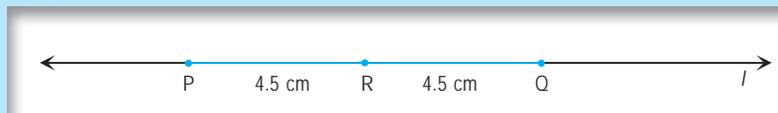
4. Remove the compass, the line segment PQ is a copy of the line segment AB (see fig. (iv)).



Exercise 14.1

- Construct a circle of radius:
 - 2 cm
 - 3.2 cm
 - 4.1 cm
- With the same centre O, draw two circles of radii 4 cm and 2.5 cm
- Draw any circle and mark points A, B and C such that
 - A is on the circle.
 - B is in the interior of the circle.
 - C is in the exterior of the circle.
- Draw a circle and any two of its (non-parallel) diameters. If you join the ends of these diameters, what is the figure obtained? What figure is obtained if the diameters are perpendicular to each other? How do you check your answer?
- Let A, B be the centres of two circles of equal radii; draw them so that each one of them passes through the centre of the other. Let them intersect at C and D. Examine whether \overline{AB} and \overline{CD} are at right angles.
- Draw a line segment of length 6.5 cm using ruler.
- Construct a line segment of length 5.6 cm using ruler and compass.
- Construct \overline{AB} of length 7.8 cm. From this cut off \overline{AC} of length 4.7 cm. Measure the length of \overline{BC} .
- Given \overline{AB} of length 4.5 cm, construct \overline{PQ} such that the length of \overline{PQ} is twice that of \overline{AB} . Verify by measurement.

[Hint. Draw any line l .



Construct \overline{PR} such that length of \overline{PR} = length of \overline{AB} ; then cut off \overline{RQ} such that length of \overline{RQ} = length of \overline{AB} .

Thus, \overline{PQ} is a line segment of length = twice length of \overline{AB} .]

- Given \overline{AB} of length 7.3 cm and \overline{CD} of length 3.4 cm. Construct a line segment \overline{PQ} such that the length of \overline{PQ} is equal to the difference between the lengths of \overline{AB} and \overline{CD} . Measure the length of \overline{PQ} .
- Draw any line segment \overline{PQ} . Without measuring \overline{PQ} , construct a copy of \overline{PQ} .
- Given some line segment \overline{AB} , whose length you do not know, construct \overline{PQ} such that the length of \overline{PQ} is twice that of \overline{AB} .

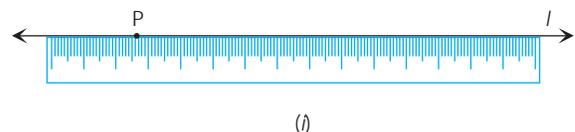
Construction of a perpendicular to a line through point on it

To draw a perpendicular to a line at a point on the line

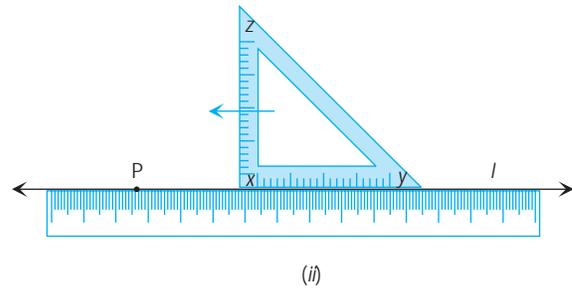
Use of set square and ruler

Steps of construction

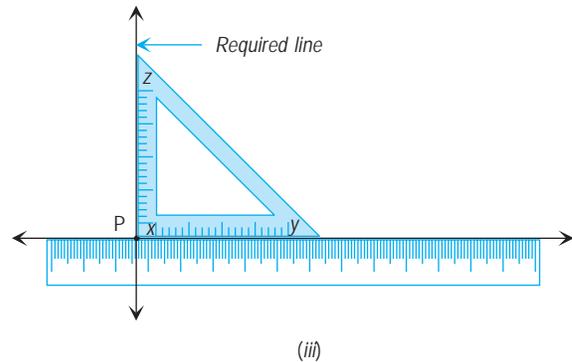
- Let l be the given line and P be a point on it.
- Place your ruler so that one of its edge just lies along the line l (shown in fig. (i)).



- Place your set square so that one of its shorter edges XY just lies along the line l . Hold the ruler firmly and slide the set square along the ruler until the other shorter edge XZ just passes through P (shown in fig. (ii)).



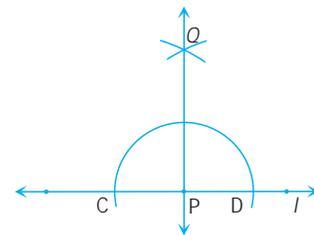
- Draw the line along the edge XZ of the set square. This is the required line through P which is perpendicular to the line l .



Use of ruler and compass

Steps of construction

- Let l be the given line and P be a point on it.
- With P as centre and any suitable radius, draw an arc to cut the line l at points C and D.
- With C and D as centres, draw two arcs of equal radius ($> \frac{1}{2}CD$) cutting each other at Q.
- Draw a line passing through points P and Q, then QP is the required line perpendicular to the line l at the point P.



ACTIVITY

Perpendicular to a line through a point on it

To draw a perpendicular to a line through a point on it by paper folding

To perform the activity

Steps

- Take a tracing paper.
- Draw a line l on the tracing paper and mark a point P on line l (shown in fig. (i)).
- Fold the tracing paper through P such that the parts of the line l on both sides of the fold fall on each other. Press the two parts together to form a crease (shown in fig. (ii)).
- Unfold the paper and mark a line on the crease. It is the required perpendicular to the line l through the point P (shown in fig. (iii)).

