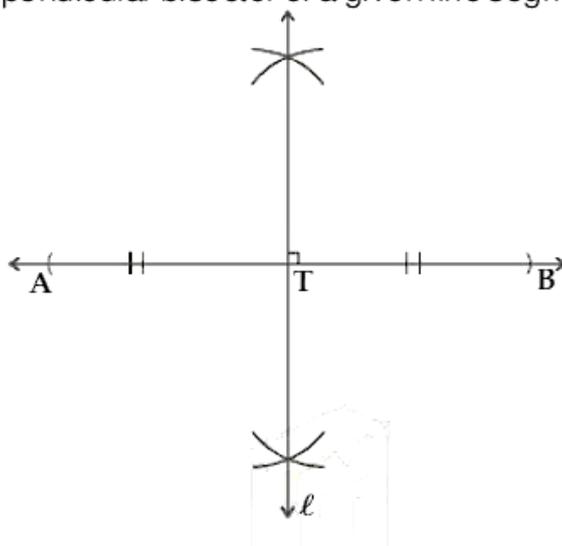


# LOCI /GEOMETRY - CONSTRUCTIONS BASIC

- (i) To draw a perpendicular bisector of a given line segment.



## Perpendicular Bisector of a Line Segment

A **perpendicular bisector** of a line segment is a line that divides the segment into two equal parts and intersects it at a right angle ( $90^\circ$ ).

### Steps to construct it:

1. Draw a line segment  $AB$ .
2. With  $A$  as the center, draw an arc above and below the line using a radius greater than half of  $AB$ .
3. Repeat the same with  $B$  as the center, using the same radius.
4. The arcs intersect at two points (say  $P$  and  $Q$ ) above and below the line segment.
5. Draw a straight line through  $P$  and  $Q$ . This line is the **perpendicular bisector** of  $AB$ .
6. The point where the bisector meets  $AB$  is the midpoint  $T$ .

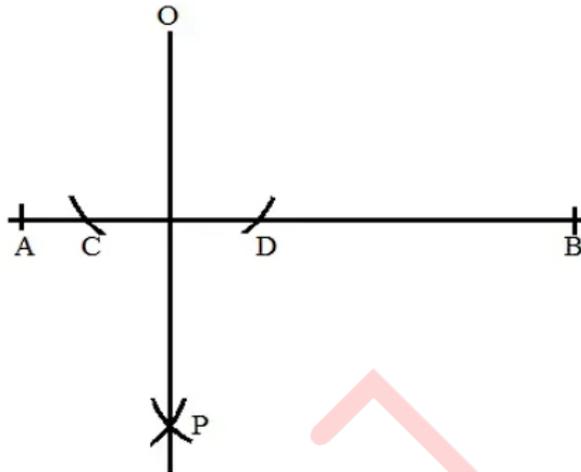
### Key properties:

- The bisector always passes through the midpoint of the segment.
- It makes a  $90^\circ$  angle with the original line segment.
- Any point on the perpendicular bisector is equidistant from  $A$  and  $B$ .

Construct the perpendicular from a point P outside the line outside the line  $\overline{AB}$  to the line.

**Solution**

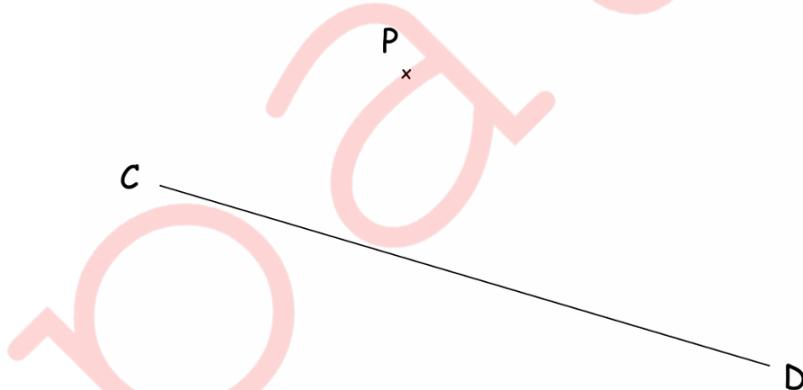
1. Draw a line  $\overline{AB}$ .
2. Choose a point O above  $\overline{AB}$ .
3. Open your pair of compasses to a convenient radius and at O, draw arcs to cut  $\overline{AB}$  at two distinct points C and D.
4. With C and D as centres and a convenient radius, draw arcs to intersect at P below  $\overline{AB}$ .
5. Join O and P to cut  $\overline{AB}$  as shown below.



**HOME WORK**

Construct the perpendicular from the point P to the line CD.

You must show all construction lines.



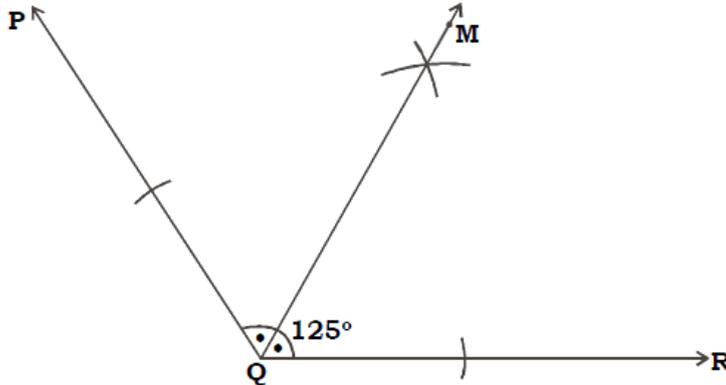
**Practice Questions**

1. Construct the perpendicular bisector of a line segment  $XY$  of length 6 cm. Mark the midpoint.
2. Prove that any point on the perpendicular bisector of a line segment is equidistant from its endpoints.
3. If the midpoint of  $AB$  is  $M(2,3)$  and  $A(0,3)$ , find the coordinates of  $B$ .
4. A perpendicular bisector of  $PQ$  passes through point  $R(4,5)$ . If  $P(2,5)$ , find the coordinates of  $Q$ .

5. Explain why the perpendicular bisector is useful in constructing triangles with equal sides.

**Draw an angle of  $125^\circ$  and bisect it.**

**(2 marks)**



**Explanation: Bisecting a  $125^\circ$  Angle**

To **bisect an angle** means to divide it into two equal parts. In this case, we are bisecting an angle of  $125^\circ$ , so each resulting angle will measure  **$62.5^\circ$** .

**Steps to bisect a  $125^\circ$  angle:**

1. Draw angle  $\angle PQR$  with vertex at point  $Q$  and arms  $QP$  and  $QR$  forming a  $125^\circ$  angle.
2. Place the compass at point  $Q$  and draw an arc that intersects both arms of the angle. Let the points of intersection be  $A$  on  $QP$  and  $B$  on  $QR$ .
3. Without changing the compass width, draw arcs from points  $A$  and  $B$  so they intersect at a point  $M$ .
4. Draw a straight line from  $Q$  through  $M$ . This line is the **angle bisector**, dividing the  $125^\circ$  angle into two equal angles of  $62.5^\circ$ .

**Key properties:**

- The bisector always passes through the vertex of the angle.
- It creates two angles of equal measure.
- The bisector is useful in geometric constructions, especially in triangle and polygon constructions.

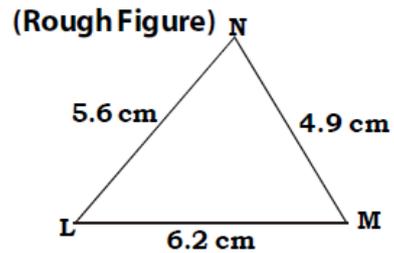
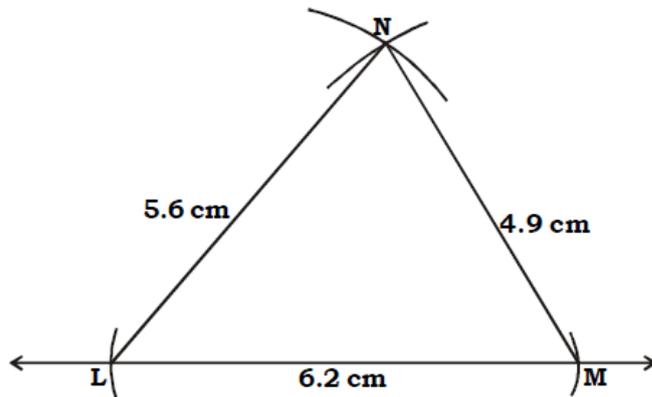
## **HOMEWORK**

**Practice Questions**

1. Construct an angle of  $90^\circ$  and bisect it. What is the measure of each resulting angle?
2. If an angle measures  $140^\circ$ , what will be the measure of each angle after bisection?
3. Explain why the compass arcs must be equal when bisecting an angle.
4. Draw an angle of  $60^\circ$  and use a compass to bisect it. Label all points clearly.

5. A bisector divides an angle into two parts measuring  $47^\circ$  each. What was the original angle?

**Construct  $\triangle LMN$ , such that  $LM = 6.2$  cm,  $MN = 4.9$  cm,  $LN = 5.6$  cm.**  
(2 marks)



### Constructing Triangle $\triangle LMN$

We are asked to construct a triangle with given side lengths:

- $LM = 6.2$  cm
- $MN = 4.9$  cm
- $LN = 5.6$  cm

#### Steps to construct:

1. Draw the base line segment  $LM = 6.2$  cm.
2. With  $L$  as the center, draw an arc of radius 5.6 cm.
3. With  $M$  as the center, draw another arc of radius 4.9 cm.
4. The two arcs intersect at point  $N$ .
5. Join  $LN$  and  $MN$ . The triangle  $\triangle LMN$  is now constructed with the required side lengths.

#### Key properties:

- The triangle is uniquely determined by the three given sides (SSS construction).
- The intersection of arcs ensures accuracy in locating point  $N$ .
- This method is fundamental in classical geometry using compass and straightedge.

## HOME WORK

### Practice Questions

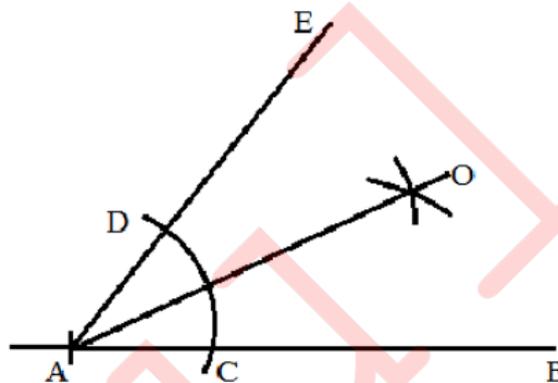
1. Construct a triangle  $\triangle ABC$  such that  $AB = 5$  cm,  $BC = 6$  cm, and  $AC = 7$  cm.
2. Explain why three given sides uniquely determine a triangle.
3. If a triangle has sides 8 cm, 6 cm, and 5 cm, check whether it can be constructed (hint: triangle inequality).
4. Construct a triangle with sides 4 cm, 4 cm, and 6 cm. What type of triangle is it?

5. Why is the intersection of arcs necessary in SSS triangle construction?

Construct an angle of  $60^\circ$  and bisect the angle.

**Solution**

1. Draw a line  $\overline{AB}$ . With A as centre and any convenient radius an arc to cut AB at C
2. With the same radius and now C as centre draw another arc to intersect the first arc at D. Join the A to D.
3. With C and D as centres draw arcs to intersect at O. Join A to O, as shown below.

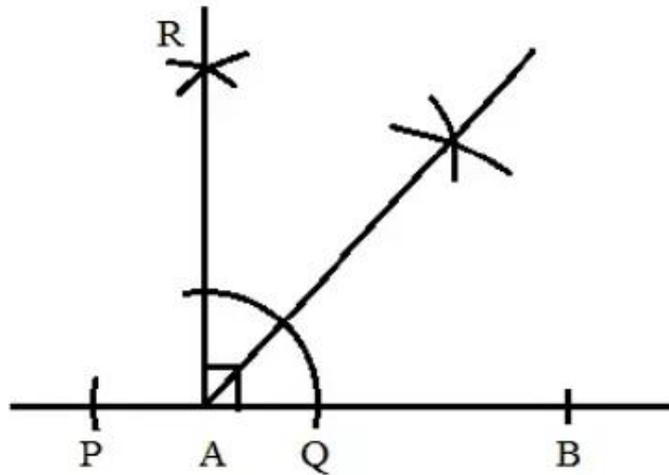


From the above procedure, to construct a  $30^\circ$  angle, you need to construct a  $60^\circ$  angle then bisect to obtain a  $30^\circ$ . Further bisecting the  $30^\circ$  angle result in a  $15^\circ$ . You have to try your hands on them.

Construct a  $90^\circ$  and a  $45^\circ$  angles.

**Solution**

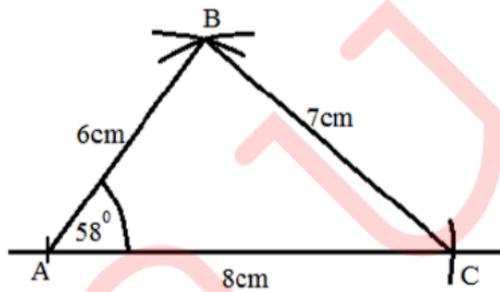
1. Draw a line  $\overline{AB}$  and with A as centre and any convenient radius draw arcs to intersect  $\overline{AB}$  at P and Q.
2. With P and Q as centres and any convenient radius draw arcs to intersect at R above  $\overline{AB}$ .
3. Join R to A to form a  $90^\circ$  angle. Then bisect the angle to obtain a  $45^\circ$  as shown below.



Construct a triangle ABC, given that  $|AB| = 6\text{cm}$ ,  $|BC| = 7\text{cm}$  and  $|AC| = 8\text{cm}$ . Measure  $\angle CAB$

**Solution**

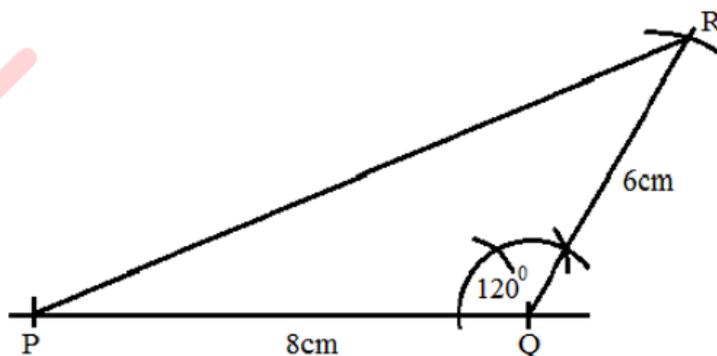
1. Construct the line segment  $\overline{AC} = 8\text{cm}$
2. With centre A and radius of 6cm draw an arc above  $\overline{AC}$ .
3. With centre C and radius 7cm, draw another arc to intersect the first arc at B.
4. Join A to B and C to B.  
 $\angle CAB = 58^\circ$  as shown below.



Construct  $\triangle PQR$  with  $|PQ| = 8\text{cm}$ ,  $\angle PQR = 120^\circ$  and  $|QR| = 6\text{cm}$ . Measure  $|PR|$  and  $\angle QRP$ .

**Solution**

1. Construct the line segment  $\overline{PQ} = 8\text{cm}$
2. Construct the angle  $120^\circ$  at Q.
3. With centre Q and radius 6cm, draw an arc above PQ at R.
4. Join Q to R and P to R.



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