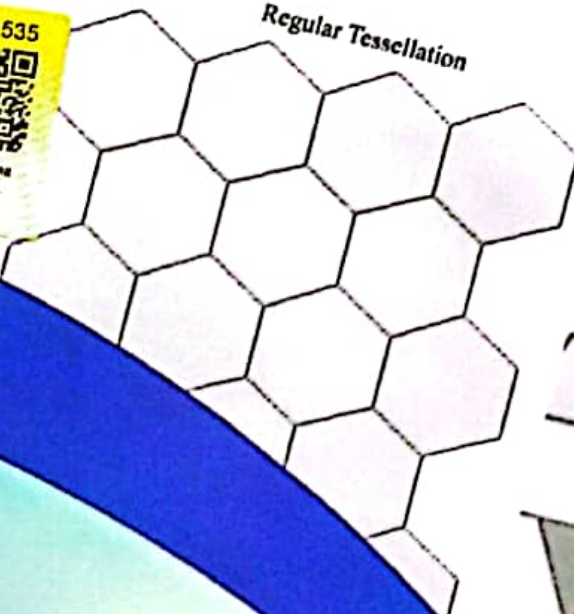


MATHEMATICS

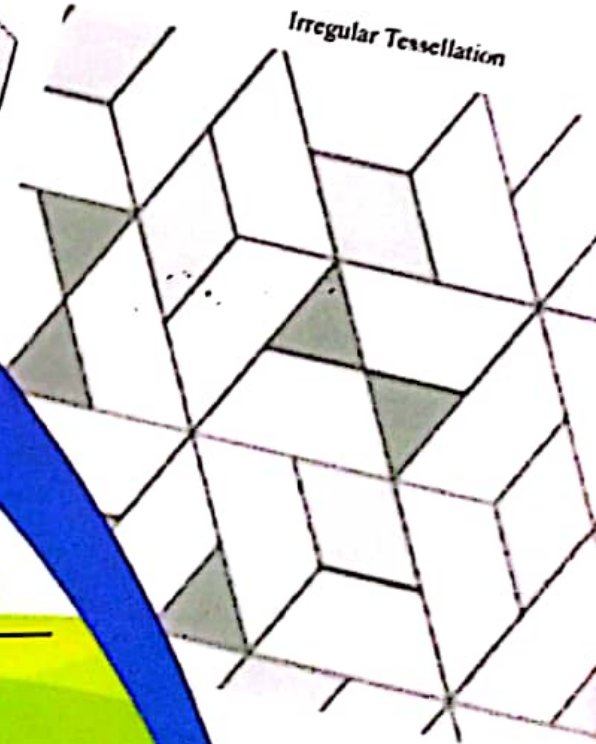
9



Regular Tessellation



Irregular Tessellation



Angle of elevation
Angle of depression



**PUNJAB CURRICULUM AND TEXTBOOK
BOARD, LAHORE**

π

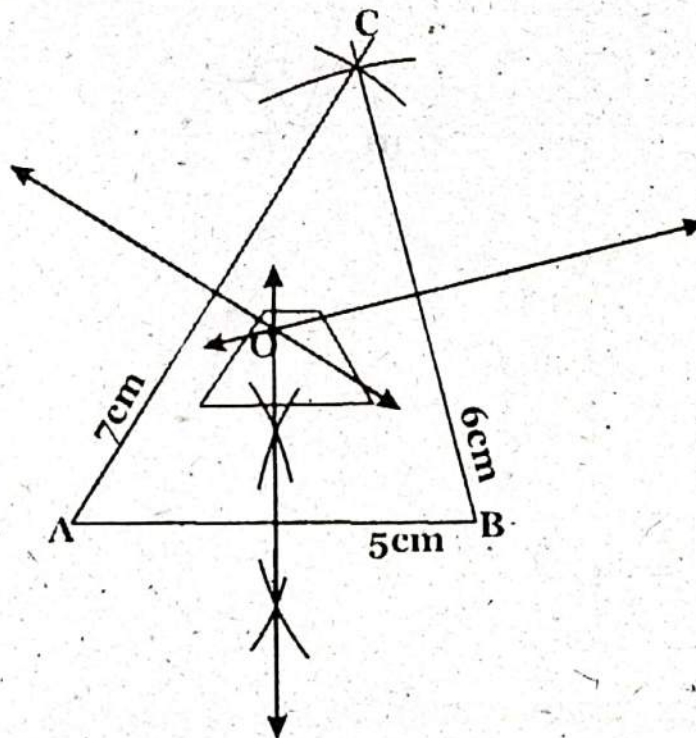
LOCI AND CONSTRUCTION

EXERCISE 11.1

Q.1. Construct $\triangle ABC$ with the given measurements and verify that the perpendicular bisectors of the triangle are concurrent.

- (i) $m \overline{AB} = 5\text{cm}$, $m \overline{BC} = 6\text{cm}$ and $m \overline{AC} = 7\text{cm}$

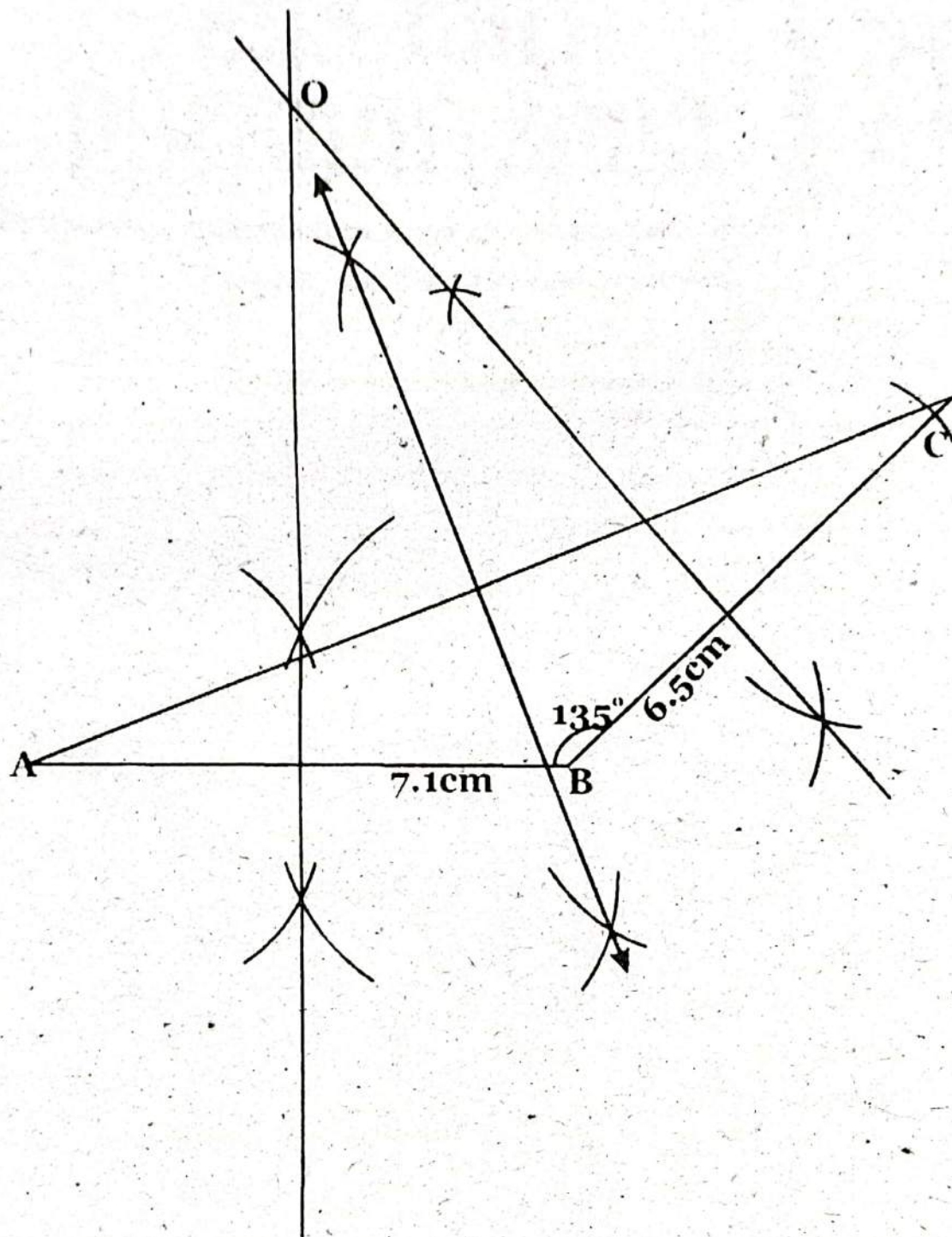
Construction



- (i) Construct $\triangle ABC$ with given measurements.
- (ii) Draw right bisectors of sides \overline{AB} , \overline{BC} and \overline{CA} of triangle.
- (iii) All right bisectors meet at point O.
So right bisectors of sides of $\triangle ABC$ are concurrent.
(Pass through same point.)

(ii) $m \overline{AB} = 7.1\text{cm}$, $m\angle B = 135^\circ$ and $m \overline{BC} = 6.5\text{cm}$

Construction Steps

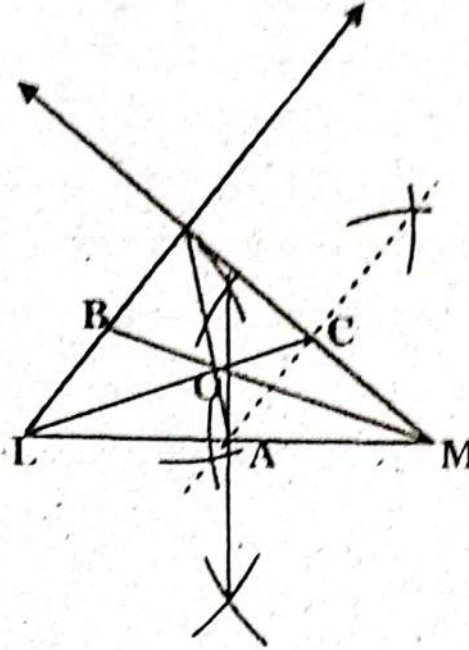


- (i) Construct triangle according to measurement.
- (ii) This is an obtuse angle triangle.
- (iii) Draw perpendicular bisector of sides \overline{AB} , \overline{BC} and \overline{CA} of triangle.
- (iv) All perpendicular bisectors pass through same point O. So perpendicular bisectors are concurrent.

Q.2. Construct $\triangle LMN$ of the following measurements and verify that the medians of the triangle are concurrent.

- (i) $m\overline{LM} = 4.9\text{cm}$, $m\angle L = 51^\circ$ and $m\angle M = 38^\circ$

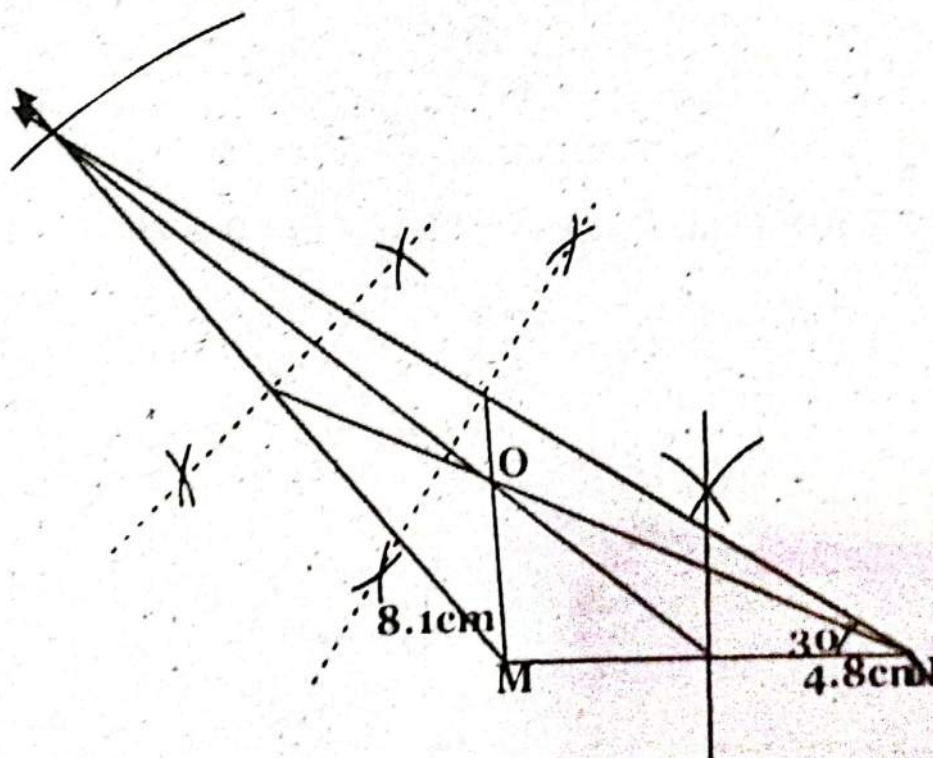
Construction Steps



- (i) Construct $\triangle LMN$ according to given measurement.
- (ii) Find mid points of all sides of $\triangle LMN$.
- (iii) Join mid points A, B, C with opposite vertices.
All medians pass through same point O. So medians of triangle are concurrent.

- (ii) $m\overline{MN} = 4.8\text{cm}$, $m\angle N = 30^\circ$ and $m\overline{LM} = 8.1\text{cm}$

Construction Steps

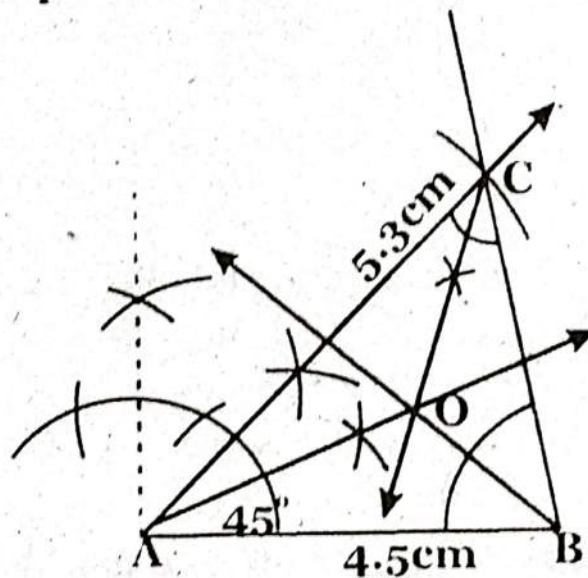


- (i) Construct $\triangle LMN$ with give measurements.
- (ii) Find mid points of all sides.
- (iii) All these mid points are joined to opposite vertices. So all medians pass through same point O.
So medians are concurrent.

Q.3. Verify that the angle bisectors of $\triangle ABC$ are concurrent with the following measurement:

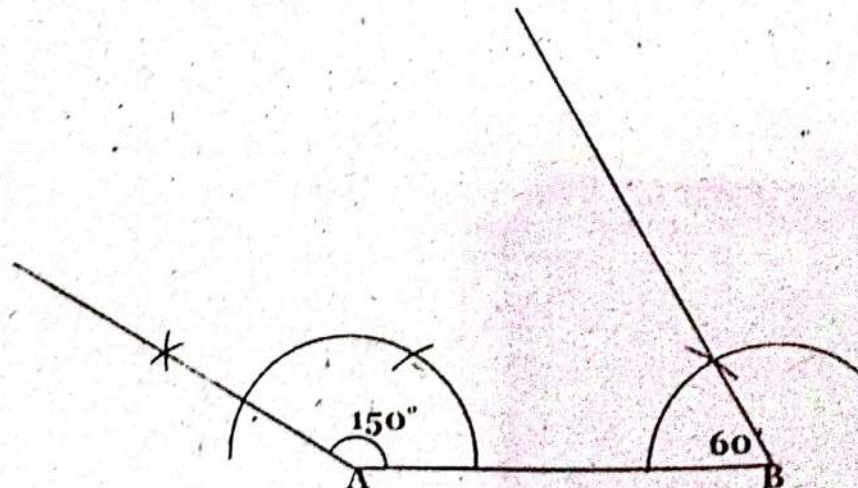
- (i) $m \overline{AB} = 4.5\text{cm}$, $m\angle A = 45^\circ$ and $m \overline{AC} = 5.3\text{cm}$

Construction Steps



- (i) Construct $\triangle ABC$ according to given measurements.
- (ii) Draw angle bisectors of each angle. All these angle bisectors pass through the same point O. So angle bisectors are concurrent.
- (ii) $m \overline{AB} = 6\text{cm}$, $m\angle A = 150^\circ$ and $m\angle B = 60^\circ$

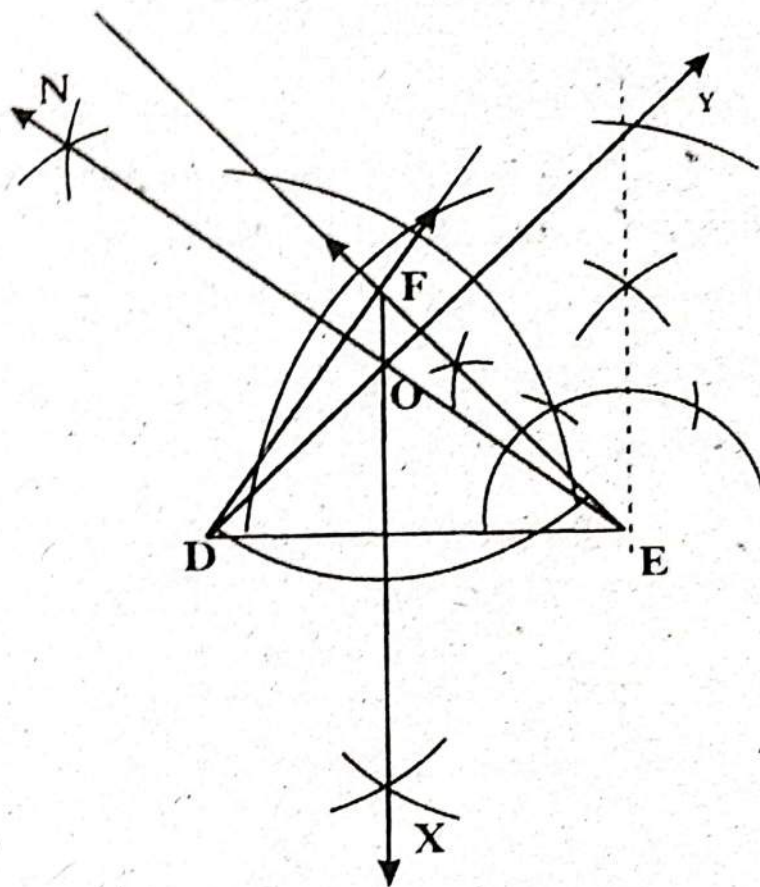
Sol.



Sum of three angles of a triangle is 180° . But here sum of two given angles is $150^\circ + 60^\circ = 210^\circ$ which is not possible. So triangle is not possible to construct. Hence no angle bisectors and so no point of concurrency exist here.

- Q.4. Given the measurements of $\triangle DEF$: $m\overline{DE} = 4.8\text{cm}$, $m\overline{EF} = 4\text{cm}$ and $m\angle E = 45^\circ$, draw altitude of $\triangle DEF$ and find orthocentre.

Construction Steps



- (i) Construct triangle DEF according to given measurements.

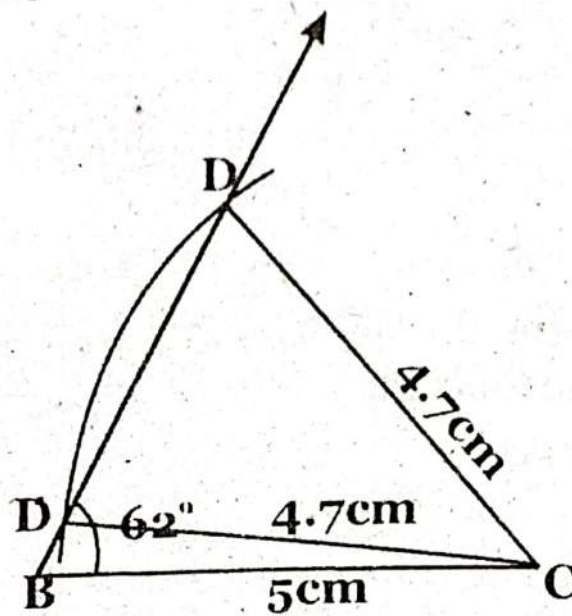
- (ii) Draw altitudes \overline{FX} , \overline{DY} , \overline{EZ} of the triangle

All these altitudes pass through same point O. So altitudes of triangle are concurrent. So orthocentre is point "O".

- Q.5. Construct the following triangles and find whether there exists any ambiguous case.

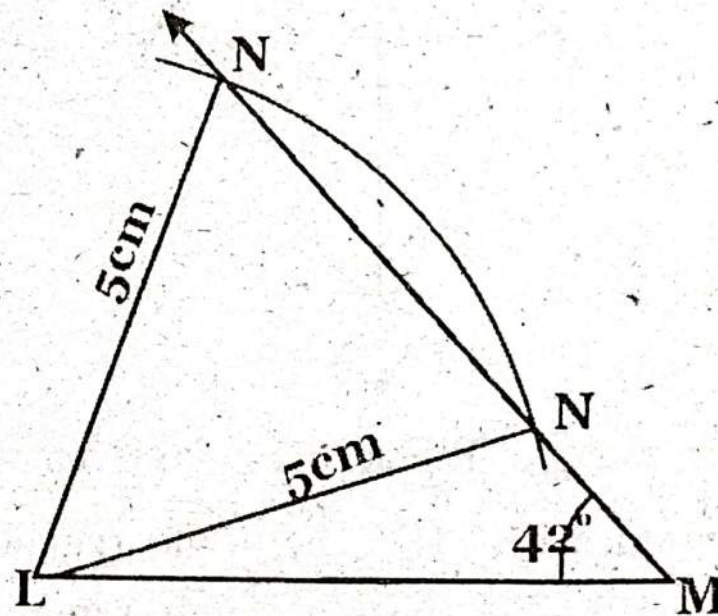
- (i) $\triangle ABC$; $m\overline{BC} = 5\text{cm}$, $m\angle B = 62^\circ$ and $m\overline{AC} = 4.7\text{cm}$

Construction Steps



- (i) Construct triangle with the given measurements.
- (ii) An arc of length 4.7cm C intersects angle arm of 62° at two distinct points D and D' . So here two triangles are constructed named as $\triangle BCD'$ and $\triangle BCD$.
- (ii) $\triangle KLM$; $m\overline{LM} = 5\text{cm}$, $m\angle M = 42^\circ$ and $m\overline{LN} = 5\text{cm}$

Construction Steps

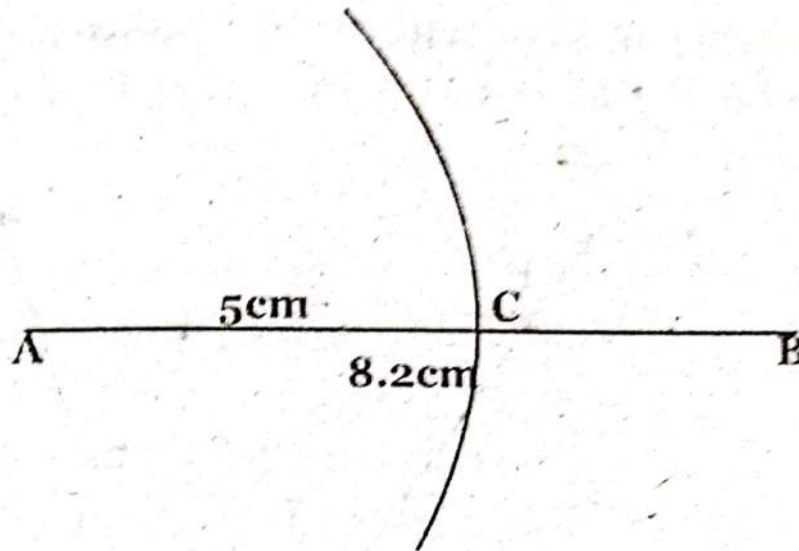


- (i) Construct triangle with given measurements.
- (ii) An arc of length 5cm intersects angle arm at two distinct points D and D' . So we have two triangles named as $\triangle LMN$ and $\triangle LMN'$.

EXERCISE 11.2

Q.1. Two points A and B are 8.2 cm apart. Construct the locus of points 5 cm from point A.

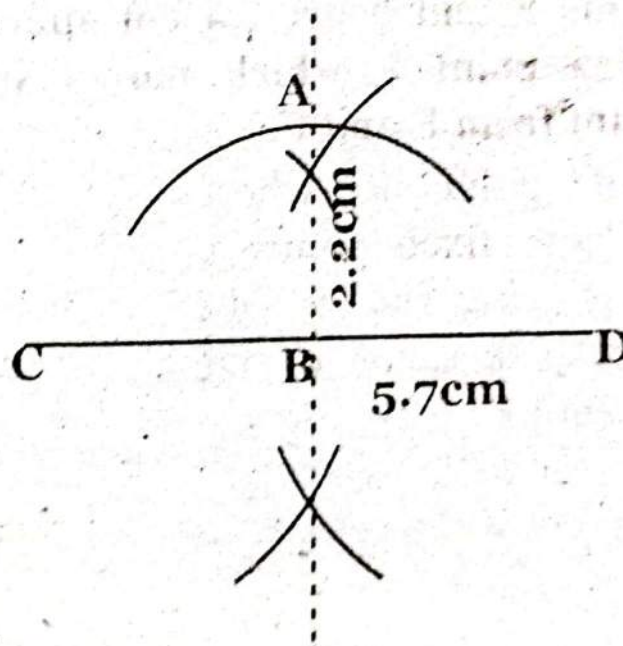
Construction



- (i) Draw a straight line segment such that $m\overline{AB} = 8.2\text{cm}$
- (ii) Take point A as centre, draw an arc of radius 5 cm which cuts line segment \overline{AB} at point C. So arc represents locus of points 5 cm from point A.

Q.2. Construct a locus of point 2.2 cm from line segment CD of measure 5.7 cm.

Construction

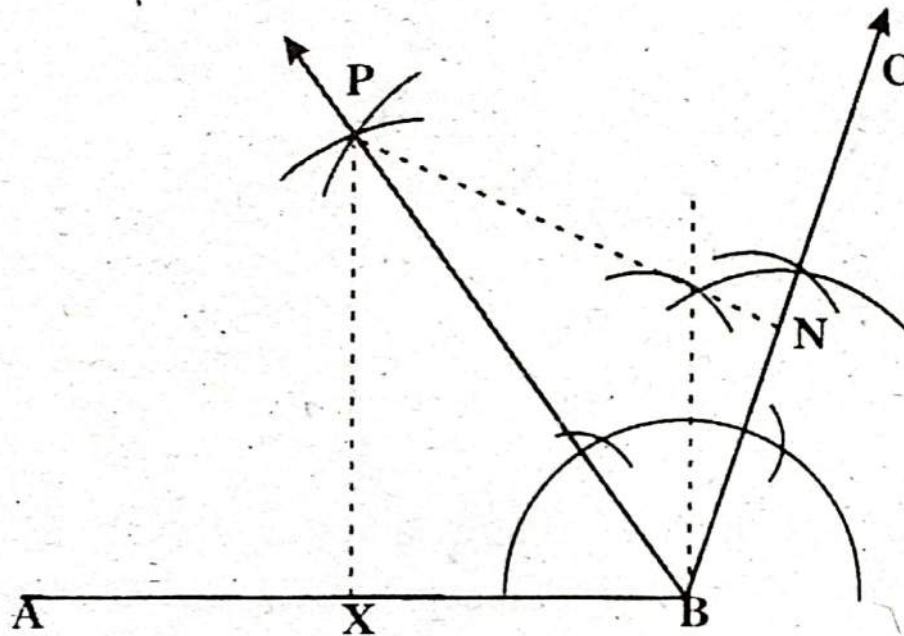


- (i) Draw a line segment $m\overline{CD} = 5.7\text{cm}$

- (ii) Draw perpendicular bisector of \overline{CD} .
- (iii) \overline{AB} is perpendicular bisector which meet \overline{CD} at point B.
- (iv) Take point B as centre, draw an arc of radius 2.2cm which cuts \overline{AB} at A. which is the required locus of point 2.2cm from line segment \overline{CD} of measure 5.7 cm.

Q.3. Construct an angle $ABC = 105^\circ$. Construct a locus of a point P which moves such that it is equidistant from \overline{BA} and \overline{BC} .

Sol.



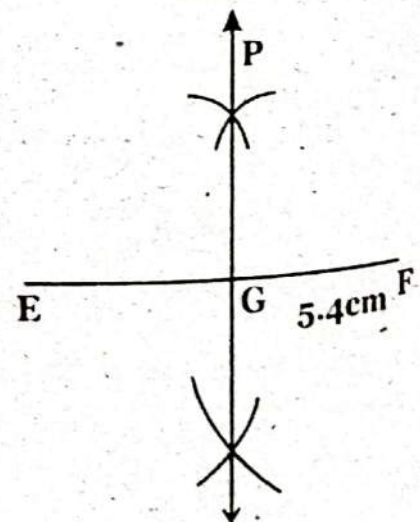
Point P lies on angle bisector of 105° .

Which is equidistant from its angle arm. Here

$$\overline{PX} = \overline{PZ}$$

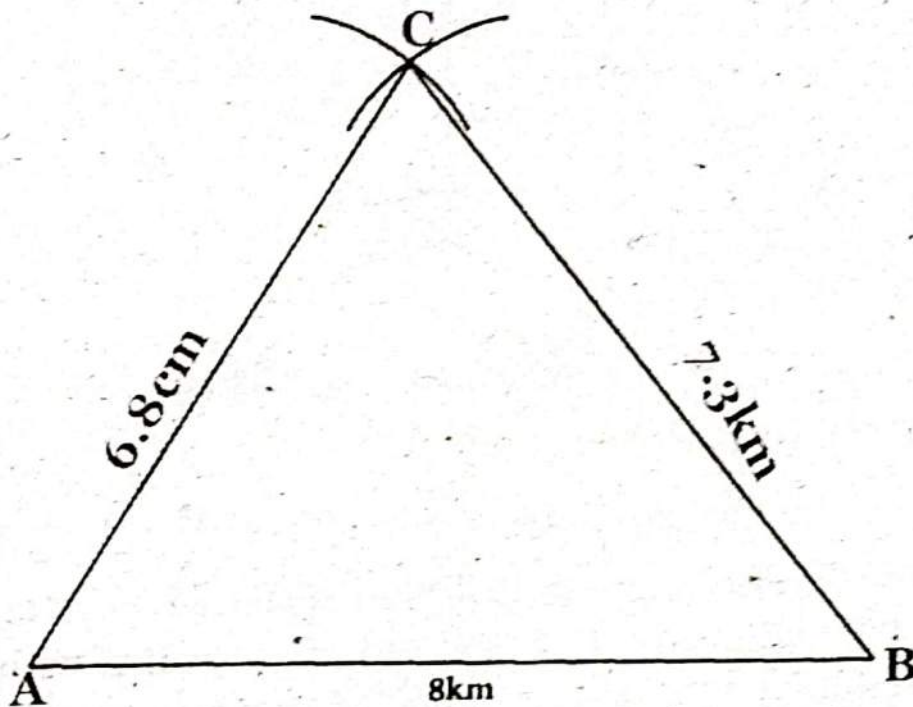
Q.4. Two points E and F are 5.4 cm apart. Construct a locus of a point P which moves such that it is equidistant from E and F.

Sol. Locus of point P whose distance from fixed points E and F is constant is the perpendicular bisector of the line segment EF.



- Q.5. The island has two main cities A and B 8 km apart. Kashif lives on the island exactly 6.8 km from city A and exactly 7.3 km from city B. Mark with a cross the points on the island where Kashif could live.

Construction



- (i) Draw a line segment $m\overline{AB} = 8\text{km}$. Here A, B represent two towns.
- (ii) Mark an arc of radius 6.8km taking point A as centre.
- (iii) Mark an arc of radius 7.3km taking point B as centre.
- (iv) Both arcs intersect each other at point C where Kashif could live.

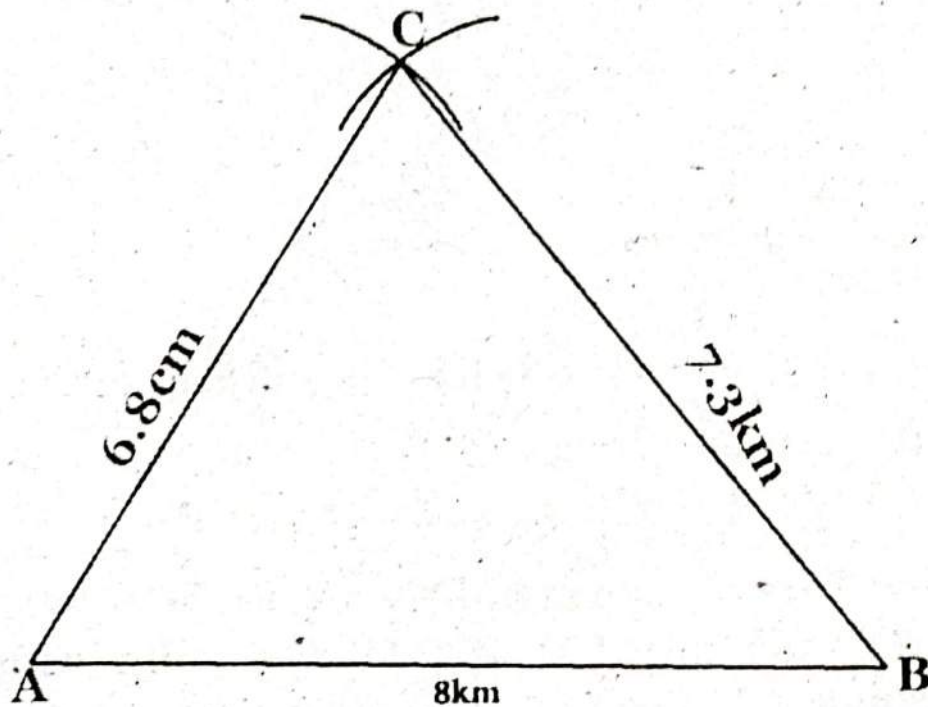
- Q.6. Construct a triangle CDE with $m\overline{CD} = 7.6\text{ cm}$, $m\angle D = 45^\circ$ and $m\overline{DE} = 5.9\text{cm}$. Draw the locus of all points which are:

- (a) equidistant from C and D
- (b) equidistant from \overline{CD} and \overline{CE}

Mark the point X where the two loci intersect.

- Q.5.** The island has two main cities A and B 8 km apart. Kashif lives on the island exactly 6.8 km from city A and exactly 7.3 km from city B. Mark with a cross the points on the island where Kashif could live.

Construction



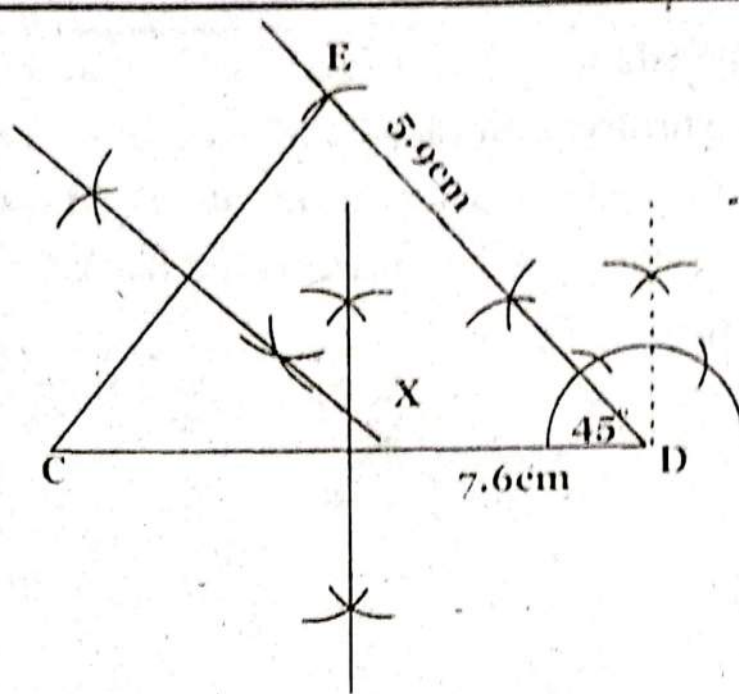
- (i) Draw a line segment $m\overline{AB} = 8\text{km}$. Here A, B represent two towns.
- (ii) Mark an arc of radius 6.8km taking point A as centre.
- (iii) Mark an arc of radius 7.3km taking point B as centre.
- (iv) Both arcs intersect each other at point C where Kashif could live.

- Q.6.** Construct a triangle CDE with $m\overline{CD} = 7.6\text{ cm}$, $m\angle D = 45^\circ$ and $m\overline{DE} = 5.9\text{cm}$. Draw the locus of all points which are:

- (a) equidistant from C and D
- (b) equidistant from \overline{CD} and \overline{CE}

Mark the point X where the two loci intersect.

Sol.

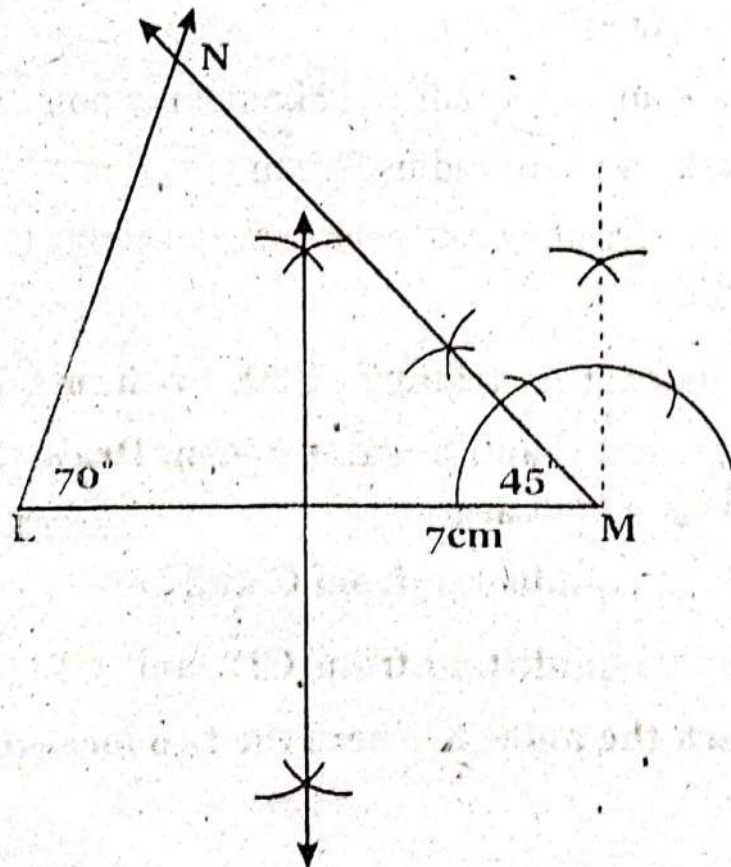


(a) Locus of all points which are equidistant from C and D is perpendicular bisector of \overline{CD} .

(b) Both loci intersect each other at point X.

Q.7. Construct a triangle LMN with $m\overline{LM} = 7\text{ cm}$, $m\angle L = 70^\circ$ and $m\angle M = 45^\circ$. Find a point within the triangle LMN which is equidistant from L and M and 3cm from L.

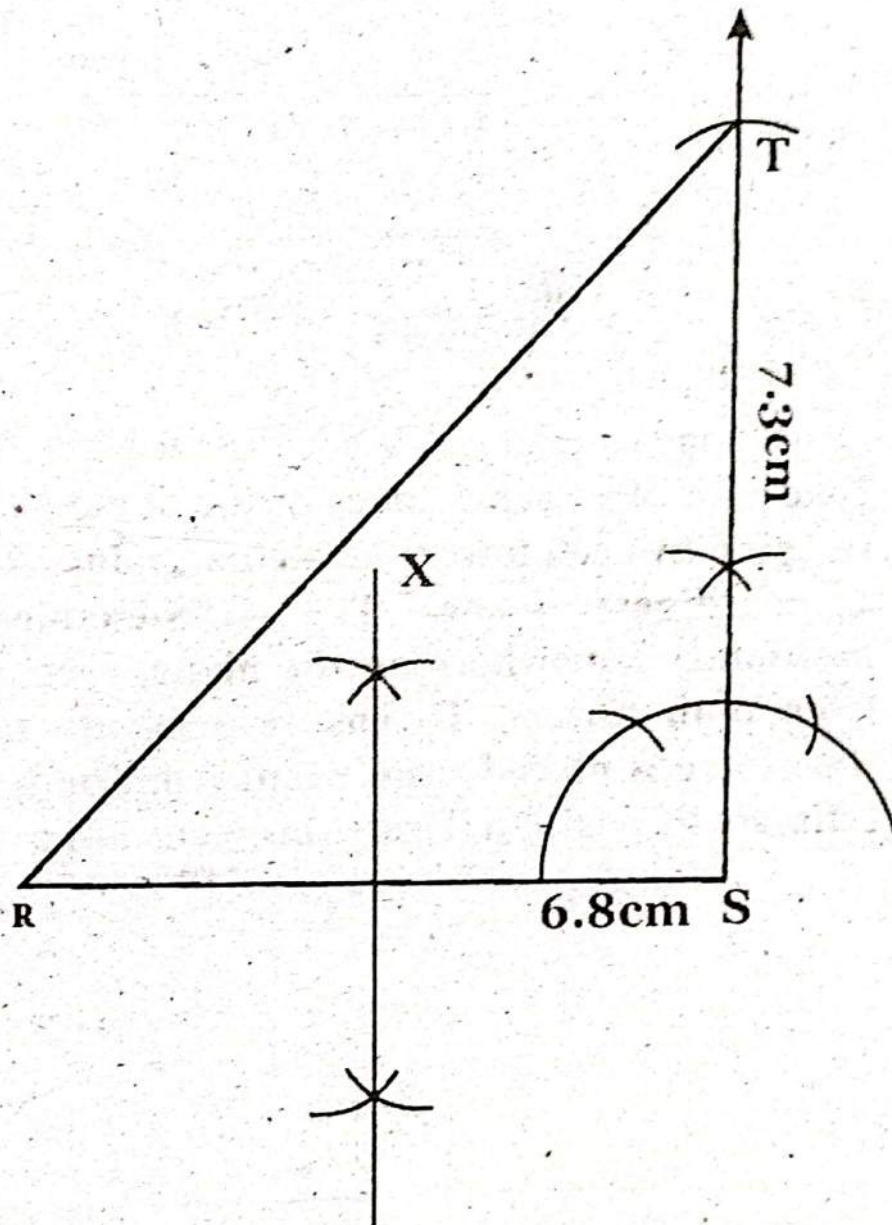
Sol.



We cannot find point within the triangle, which is equidistant from L and M and 3 cm from L. See the diagram.

- Q.8.** Construct a right angled triangle RST with $m\overline{RS} = 6.8\text{cm}$, $m\angle S = 90^\circ$ and $m\overline{ST} = 7.3\text{cm}$. Find a point within the triangle RST which is equidistant from \overline{RS} and \overline{RT} and 4.5 cm from R.

Sol.

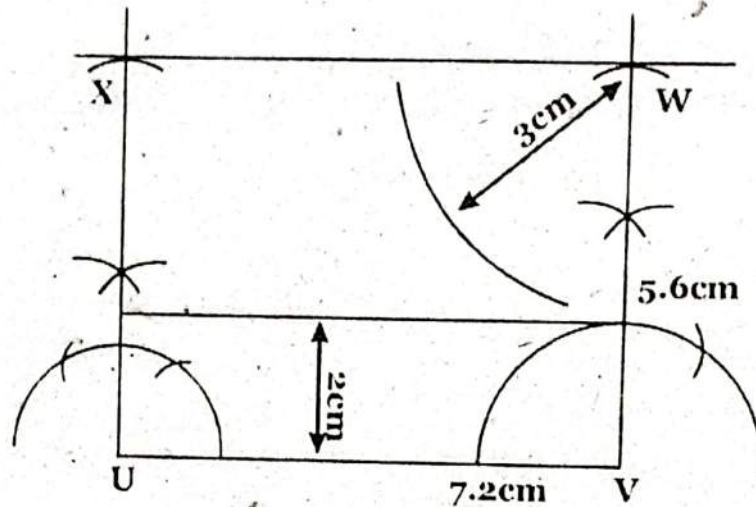


Construct right angled triangle RST. Draw perpendicular bisector of \overline{RS} .

Take point R as centre, mark an arc of radius 4.5cm which cuts perpendicular bisector at point X.

Q.9. Construct a rectangle $UVWX$ with $m\overline{UV} = 7.2\text{cm}$ and $m\overline{VW} = 5.6\text{cm}$. Draw the locus of points at a distance of 2 cm from \overline{UV} and 3.5cm from W .

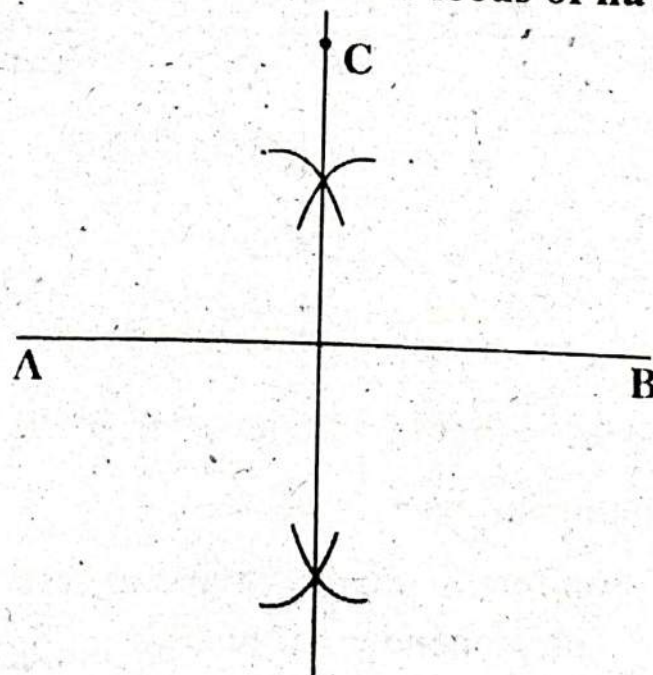
Construction



- (i) Construct a rectangle $UVWX$ according to measurement.
- (ii) Draw a line parallel to UV at a distance 2 cm from \overline{UV} .
- (iii) Take point W as centre, draw an arc of radius 3cm.

Q.10. Imagine two cell towers located at points A and B on a coordinate plane. The GPS-enabled device, positioned somewhere on the plane, receives signals from both towers. To ensure accurate navigation, the device is placed equidistant from both towers to estimate its position. Draw this locus of navigation.

Sol.

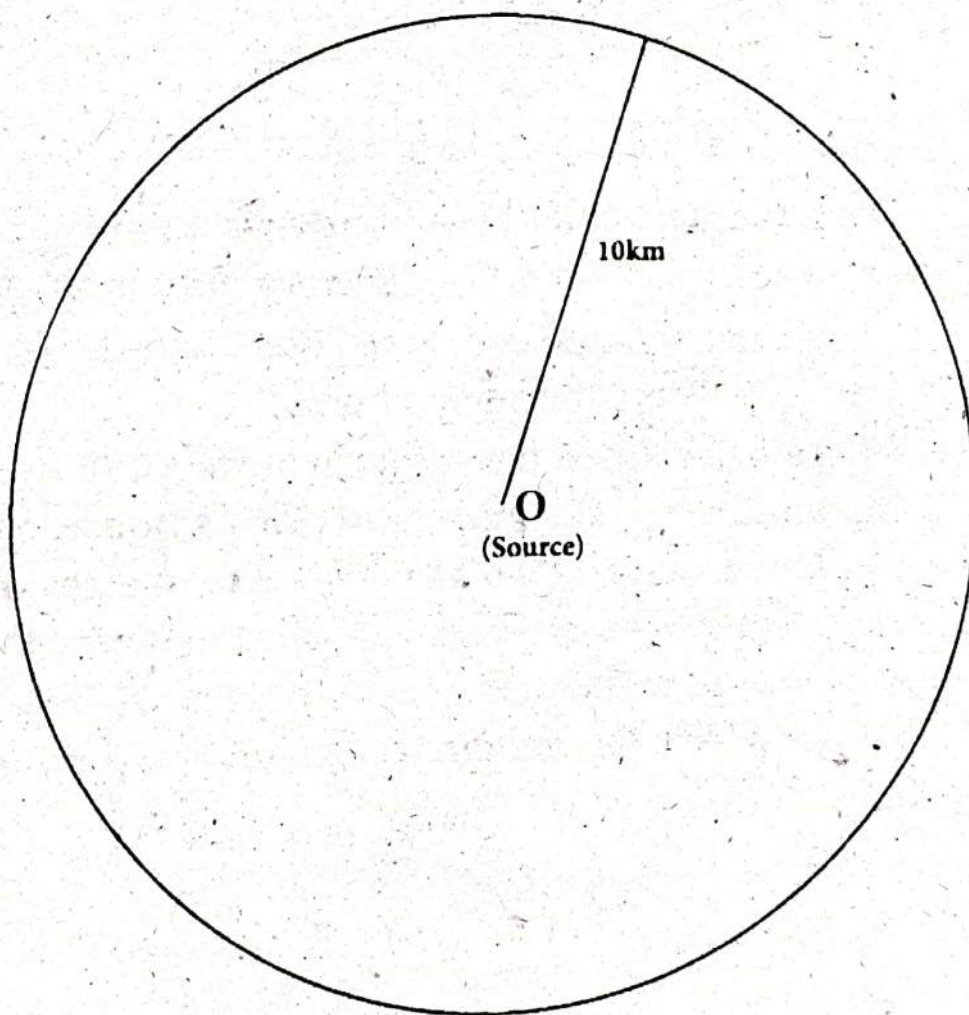


Any point on perpendicular bisector is equidistant from end points of line segment.

So locus of navigation is the perpendicular bisector of \overline{AB} . Point C is the position of device.

- Q.11.** Epidemiologists use loci to determine infection zones, especially for contagious diseases, to predict the spread and take containment measures. In the case of a disease outbreak, authorities might determine a quarantine zone within 10 km of the infection source. Draw the locus of all points 10 km from the source defining the quarantine area to monitor and control the disease's spread.

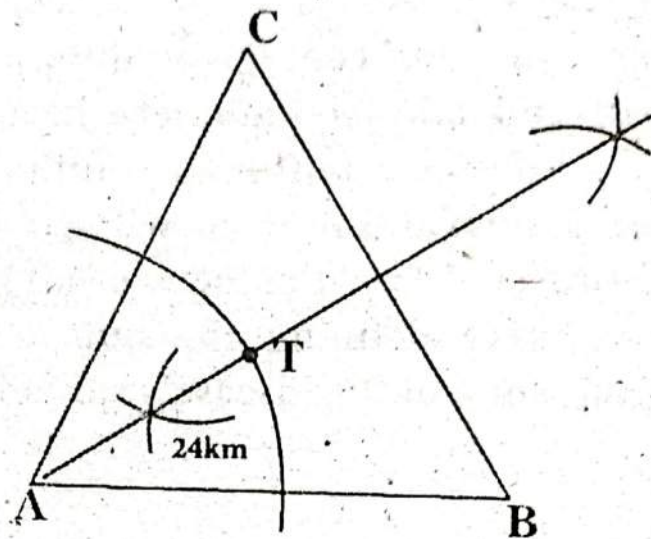
Sol.



In the diagram, let O be the infection source. We draw a circle of radius 10km (5cm) to determine quarantine zone which shows locus of all points 10km from source defining the quarantine area to monitor and control the spread of disease.

Q.12. There is a treasure buried somewhere on the island. The treasure is 24 kilometres from A and equidistant from B and C. Using a scale of 1cm to represent 10 km, find where the treasure could be buried.

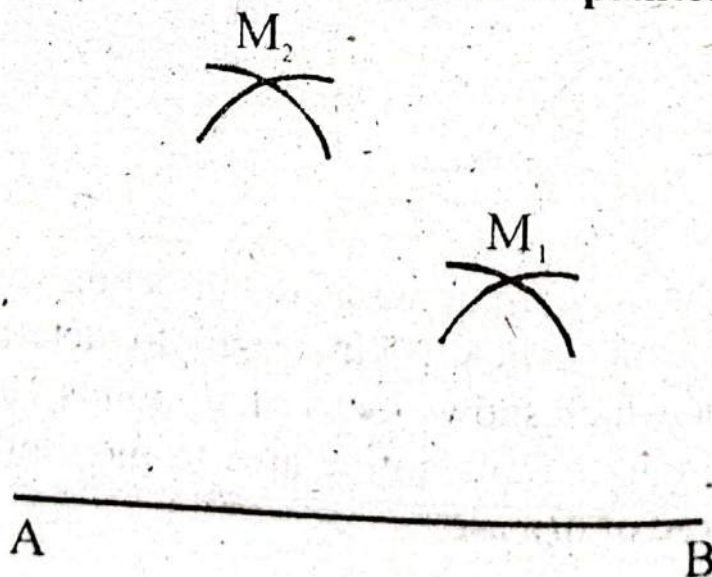
Construct



- (i) Draw $\triangle ABC$ of any measurements.
- (ii) Draw perpendicular bisector of side \overline{BC} .
- (iii) Draw locus of points 2.4km away from point A.
- (iv) The point of intersection of locus and \perp bisector give the point where treasure is buried.

Q.13. There is an apple tree at a distance of 90 metres from banana tree in the garden of Sara's house. Sara wants to plant a mango tree M which is 64 metres from apple tree and between 54 and 82 metres from the banana tree. Using a scale of 1cm to represent 10m, Find the points where the mango tree should be planted.

Sol.



"A" denotes apple tree. "B" denotes banana tree. Distance between apple tree and banana trees = 90m (9cm)

By given conditions, M_1 and M_2 are points where mango trees should be planted.

REVIEW EXERCISE 11

Q.1. Four options are given against each statement. Encircle the correct option.

(i) A triangle can be constructed if the sum of the measure of any two sides is _____ the measure of the third side.

- (a) less than (b) greater than
(c) equal to (d) greater than and equal to

Sol. (b)

(ii) An equilateral triangle _____.

- (a) can be isosceles (b) can be right angled
(c) can be obtuse angled
(d) has each angle equal to 50°

Sol. (a)

(iii) If the sum of the measures of two angles is less than 90° , then the triangle is _____.

- (a) equilateral (b) acute angled
(c) obtuse angled (d) right angled

Sol. (c)

(iv) The line segment joining the midpoint of a side to its opposite vertex in a triangle is called _____.

- (a) median (b) perpendicular bisector
(c) angle bisector (d) circle

Sol. (a)

(v) The angle bisectors of a triangle intersect at _____.

- (a) one point (b) two points
(c) three point (d) four point

Sol. (a)

(vi) Locus of all points equidistant from a fixed point is _____.

(a) circle

(b) perpendicular bisector

(c) angle bisector

(d) parallel lines

Sol. (a)

(vii) Locus of points equidistant from two fixed points is _____.

(a) circle

(b) perpendicular bisector

(c) angle bisector

(d) parallel lines

Sol. (b)

(viii) Locus of points equidistant from a fixed line is/are _____.

(a) circle

(b) perpendicular bisector

(c) angle bisector

(d) parallel lines

Sol. (d)

(ix) Locus of points equidistant from two intersecting lines is _____.

(a) circle

(b) perpendicular bisector

(c) angle bisector

(d) parallel lines

Sol. (c)

(x) The set of all points which is farther than 2 km from a fixed point B is a region outside a circle of radius _____ and centre at B.

(a) 1 km

(b) 1.9 km

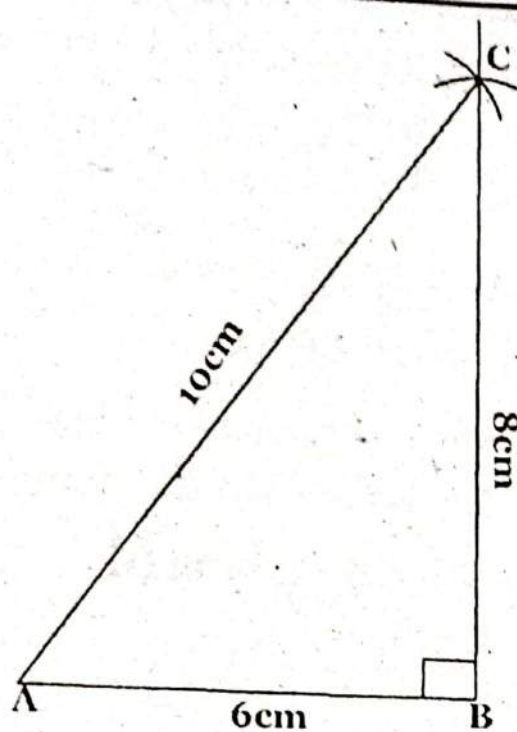
(c) 2 km

(d) 2.1 km

Sol. (c)

Q.2. Construct a right angled triangle with measures of sides 6cm, 8cm and 10 cm.

Sol. Let $m\overline{AB} = 6\text{cm}$, $m\overline{BC} = 8\text{cm}$, $m\overline{CA} = 10\text{cm}$

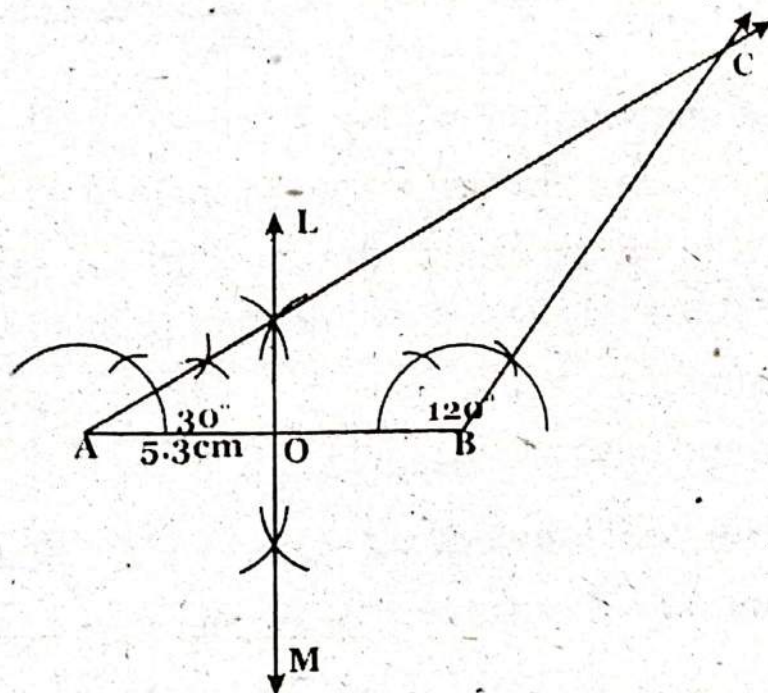


Construction Steps

- (i) Draw a line segment $\overline{AB} = 6\text{cm}$.
- (ii) Take point B as centre, draw an arc of radius 8cm.
- (iii) Take point A as centre, draw an arc of radius 10cm which cuts first arc to produce point C.
- (iv) Join B and A to point C.
So right angled triangle ABC is formed.

Q.3. Construct a triangle ABC with $\overline{AB} = 5.3\text{cm}$, $m\angle A = 30^\circ$ and $m\angle B = 120^\circ$. Draw the locus of all points which are equidistant from A and B.

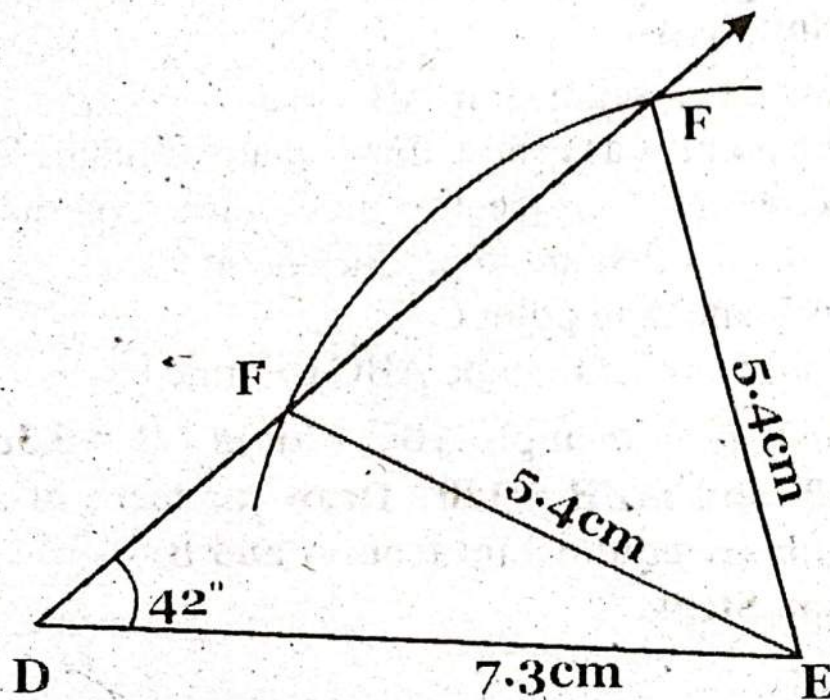
Construction Steps



- (i) Draw a line segment $\overline{AB} = 5.3\text{cm}$
- (ii) With the help of pair of compasses, construct $m\angle A = 30^\circ$ and $m\angle B = 120^\circ$
- (iii) Both angle arms intersect each other to produce point C.
So $\triangle ABC$ (obtuse) is formed.
- (iv) Draw perpendicular bisector of side \overline{AB} to find locus of all points which are equidistant from A and B.

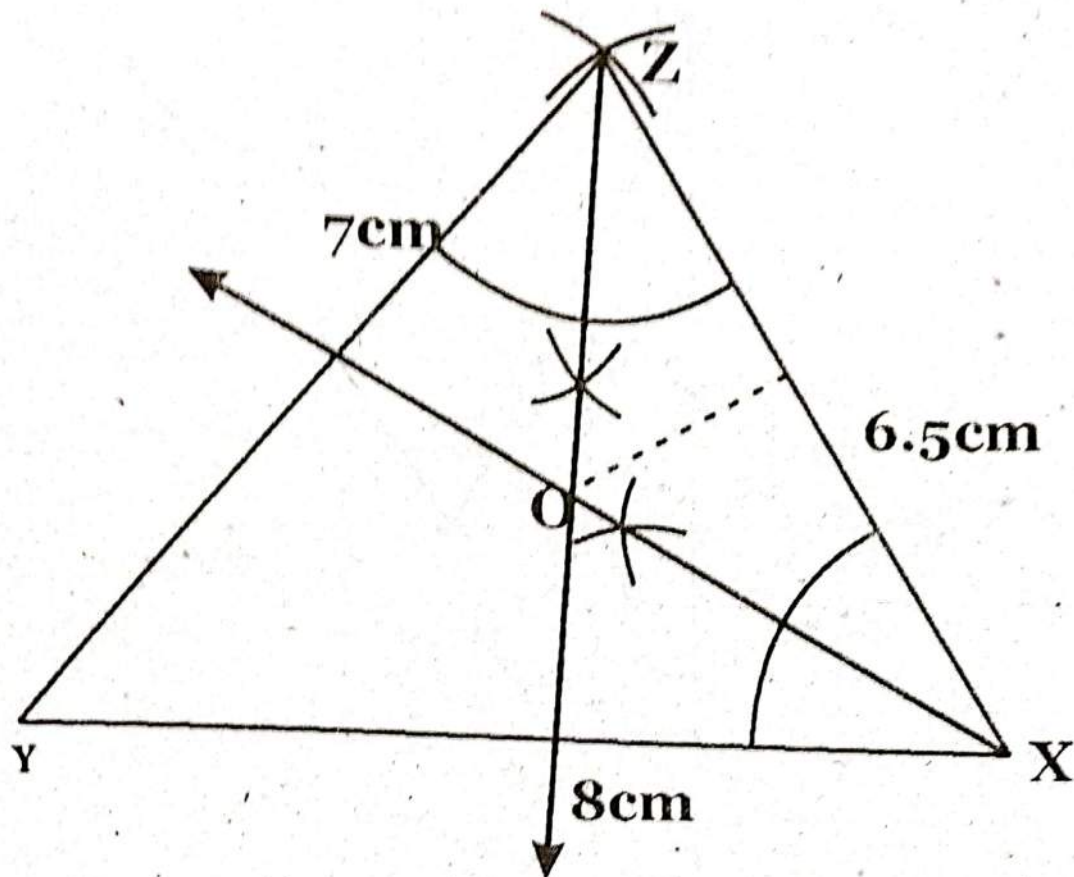
Q.4. Construct a triangle with $m\overline{DE} = 7.3\text{cm}$, $m\angle D = 42^\circ$ and $m\overline{EF} = 5.4\text{cm}$.

Construction Steps



- (i) Draw a line segment $m\overline{DE} = 7.3\text{cm}$
- (ii) With the help of protractor draw an angle of 42° at point D.
- (iii) Take point E as centre, draw an arc of radius 5.4cm which cuts angle arm at two distinct points F' and F.
- (iv) Join E to F' and F.
So two triangles are obtained.

Q.5. Construct a triangle XYZ with $m\overline{YX} = 8\text{cm}$, $m\overline{YZ} = 7\text{cm}$ and $m\overline{XZ} = 6.5\text{cm}$. Draw the locus of all points which are equidistant from \overline{XY} and \overline{XZ} .

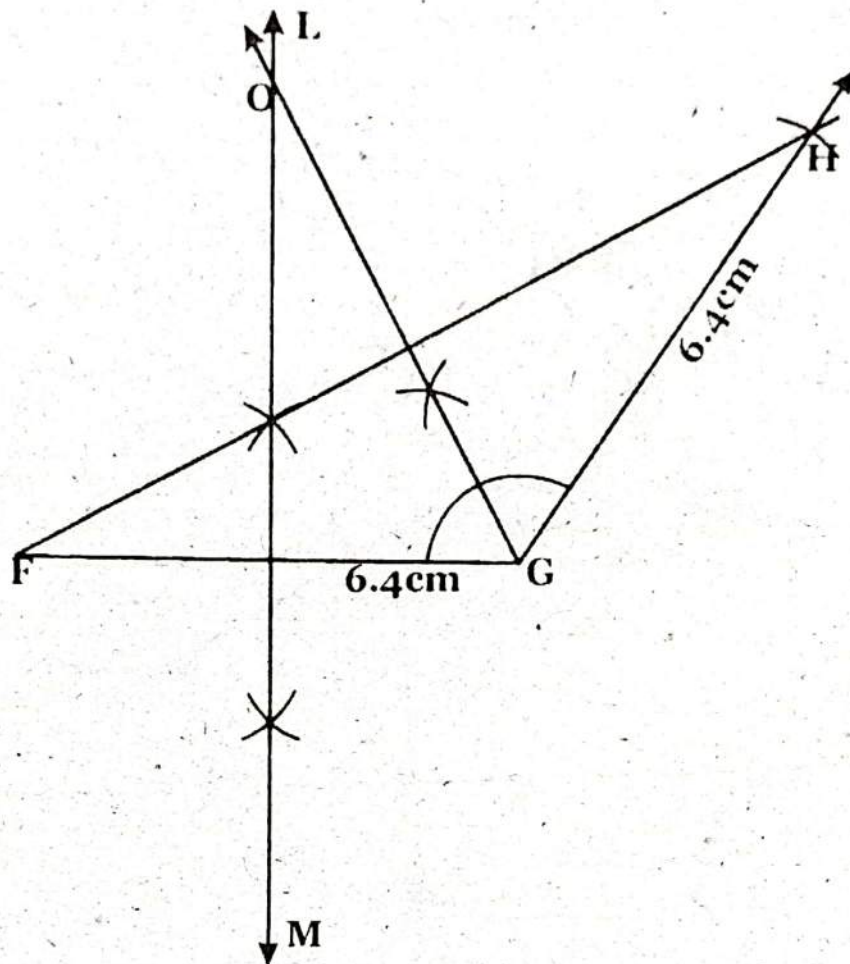


- (i) Draw a line segment $\overline{YX} = 8\text{cm}$
- (ii) Take point Y as centre, mark an arc of radius 7cm .
- (iii) Take point X as centre mark another arc which intersects first arc to produce point Z .
- (iv) Join Y and X to Z to complete the triangle XYZ .
- (v) Construct angle bisectors of $\angle X$ and $\angle Z$. The point of intersection of these angle bisectors give the locus of all points which are equidistant from \overline{XY} and \overline{XZ} .
Clearly shown in diagram.

Q.6. Construct a triangle FGH such that $m\overline{FG} = m\overline{GH} = 6.4\text{cm}$, $m\angle G = 122^\circ$. Draw the locus of all points which are:

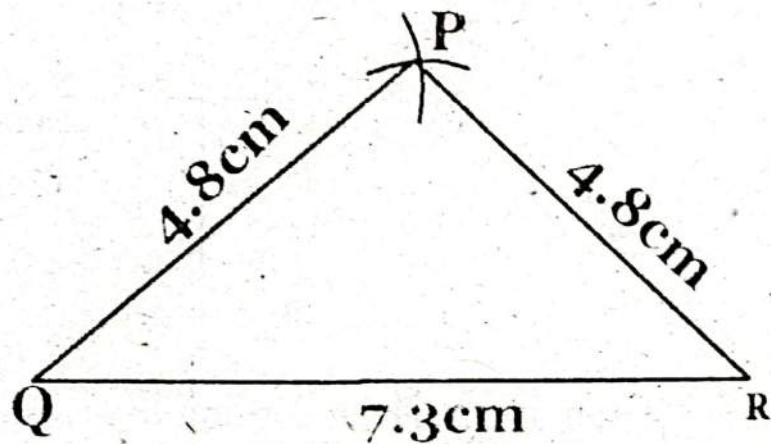
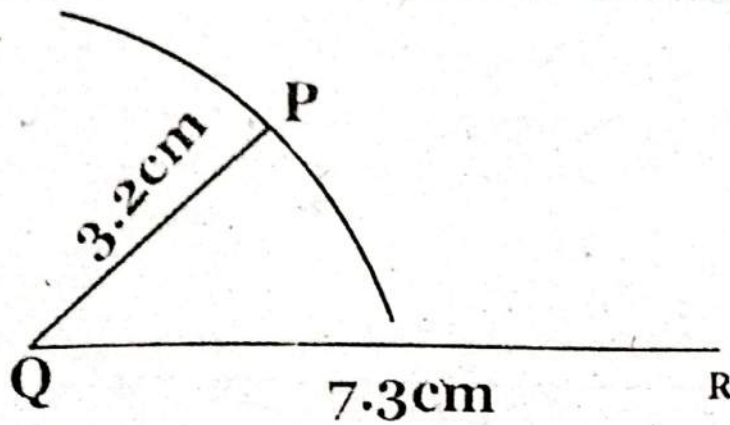
- (a) equidistant from F and G .
- (b) equidistant from \overline{FG} and \overline{GH} .
- (c) Mark the point where the two loci intersect.

Construction Steps



- (i) With given measurements, construct triangle.
 - (ii) Find perpendicular bisector \overleftrightarrow{LM} of side \overline{FG} . So locus of all points equidistant from points F and G lies on perpendicular bisector.
 - (b) Find angle bisector of 122° .
So locus of all points which are equidistant from \overline{FG} and \overline{GH} lies on angle bisector.
 - (c) Two loci intersect each other at point O.
- Q.7. Two houses Q and R are 73 metres apart Using a scale of 1 cm to represent 10m, construct the locus of a point P which moves such that it is:**
- (i) at a distance of 32 metres from Q
 - (ii) at a distance of 48 metres from the line joining Q and R

Sol.



Here Q and R represent two houses. Distance between them is 73m (7.3 cm)

(i) In first diagram,

Mark an arc of radius 3.2cm (32m) such that $\overline{QP} = 3.2\text{cm}$ (32m)

(ii) In second diagram,

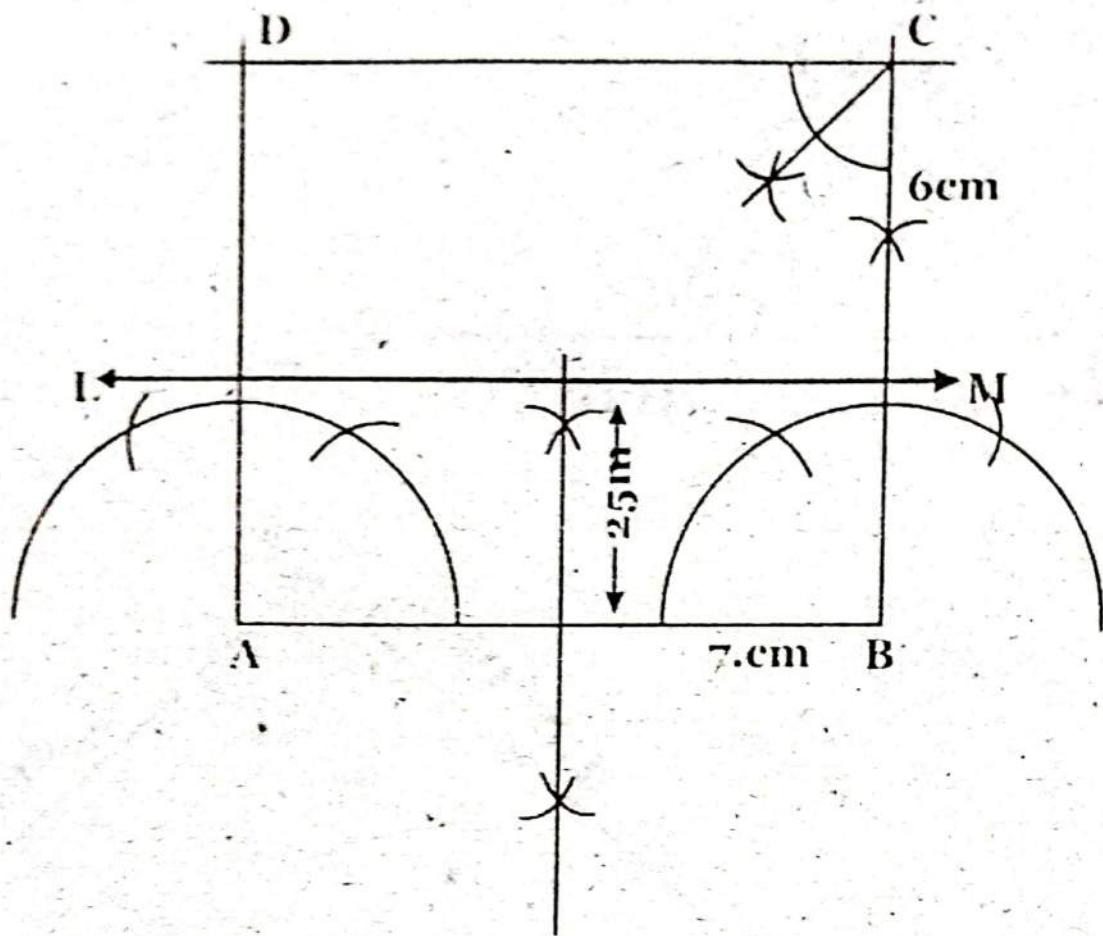
Take point Q as centre, mark an arc of radius 4.8cm (48m).

(iii) Take R as centre, mark an arc of same radius, which cuts first arc to produce point P.

Join Q to P & R to P.

Q.8. The field is in the form of a rectangle ABCD with $m\overline{AB} = 70\text{ m}$ and $m\overline{BC} = 60\text{m}$. Construct the rectangle ABCD using a scale of 1cm to represent 10m. Show the region inside the field which is less than 30m from C and farther than 25m from AB.

Construction



- (i) Draw rectangle according to measurements.
 - (ii) Construct perpendicular bisector of \overline{AB} .
 - (iii) Draw a parallel line \overleftrightarrow{LM} at a distance of 2.5cm from \overline{AB} .
 - (iv) Find angle bisector of $\angle C$.
- Shade the region in the field which is less than 30m (3cm) from C and farther than 25m (2.5cm) from \overline{AB} .