UNIT 11

Loci and Construction

Students' learning outcomes

At the end of the unit, the students will be able to:

- Construct a triangle having given two sides and the included angle.
- Construct a triangle having given one side and two of the angles.
- Construct a triangle having given two of its sides and the angle opposite to one of them.
- Draw angle bisectors, perpendicular bisectors, medians, altitudes of a given triangle and verify their concurrency.
- Draw loci and intersection of loci for set of points in two dimensions which are
  - at a given distance from a given point.
  - at a given distance from a given line
  - equidistant from two given points
  - equidistant from two given intersecting lines
  - solve real life problems using the loci and interesting loci.

(a) Construction of a triangle when measure of three sides is given

Example 1: Construct a triangle of sides 5.3cm, 5.9cm and 6.2cm.

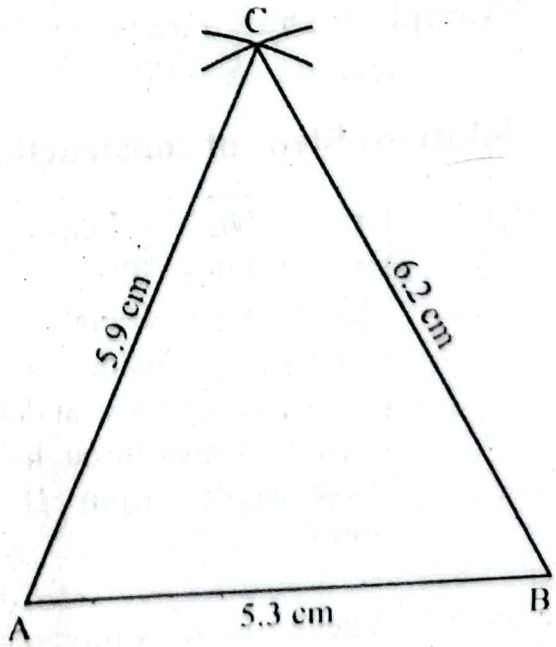
Solution: Steps of construction:

(i) Draw a line segment AB of length 5.3cm long.

(ii) Using a pair of compasses, draw two arcs with centres at points A and B of radii 5.9 cm and 6.2 cm respectively.

(iii) These two arcs intersect each other at point C.

(iv) Join A and B with C.



Hence, ΔABC is the required triangle.

NOTE: The angles 30°, 45°, 60°, 75°, 90°, 105°, 120°, 135° and 150° are constructed with the help a pair of compasses. Other angles are drawn using protractor.

Do you know?
When three sides are given, we can draw any length first.

(b) Construction of a triangle when the measure of two sides and their included angle are given

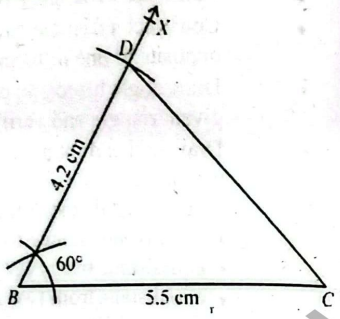
Example 2: Construct a triangle BCD in which measures of two sides are 5.5cm and 4.2cm and measure of their included angle is 60°.

Solution: Steps of construction

(i) Draw a line segment BC of length 5.5cm.

(ii) Draw an angle 60° at point B using a pair of compasses and draw a ray $\overrightarrow{BX}$ through this angle.

(iii) Draw an arc of radius 4.2cm with centre at point B intersecting $\overrightarrow{BX}$ at point D.



(iv) Join C and D.

Hence, ΔBCD is the required triangle.

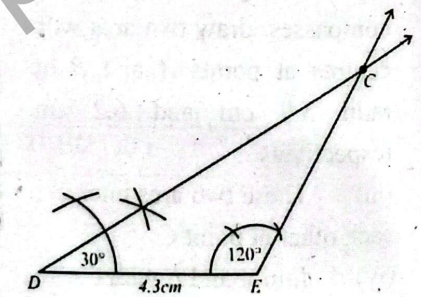
(c) Construction of a triangle when measure of one side and two angles are given

Example 3: Draw a triangle CDE when $m\overline{DE} = 4.3\ cm$, $m\angle D = 30°$ and $m\angle E = 120°$.

Solution: Steps of construction:

(i) Draw $m\overline{DE} = 4.3$ cm.

(ii) Draw angles 30° and 120° at points D and E respectively using a pair of compasses and draw two rays through these angles from D and E.



(iii) These two rays intersect each other at point C.

Hence, ΔCDE is the required triangle.

(d) Construction of a triangle when measure of two sides and angle opposite to one of them is given

Consider the given two cases:

(i) If the measure of one angle is greater than or equal to 90°.

(ii) If the measure of angle is less than 90°.

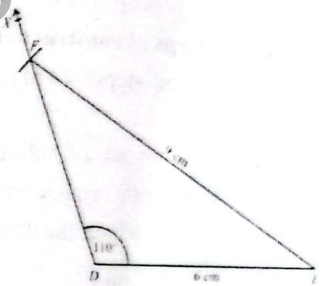
Example 4: Construct a triangle DEF when $m\overline{DE} = 6\ cm$, $m\angle D = 110°$ and $m\overline{EF} = 9\ cm$.

Solution: Steps of construction:

(i) Draw $m\overline{DE} = 6$ cm.

(ii) Construct $m\angle D = 110°$ using protractor and draw $\overrightarrow{DX}$ through this angle.

(iii) Draw an arc of radius 9cm with centre at point E intersecting $\overrightarrow{DX}$ at point F.



(iv) Join E and F.

Hence, ΔDEF is the required triangle

If the given angle opposite to the given side is obtuse, only one triangle is possible.

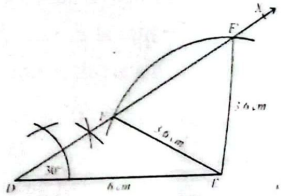
Example 5:

Construct triangles DEF and DEF' when $m\overline{DE} = 6cm$, $m\angle D = 30°$ and $m\overline{EF} = 3.6$ cm

Solution: Steps of construction:

(i) Draw $m\overline{DE} = 6$cm.

(ii) Construct an angle 30º at point D using a pair of compasses and draw $\overrightarrow{DX}$ through this angle.



(iii) Draw an arc of radius 3.6 cm with centre at point E.

(iv) This arc intersects $\overrightarrow{DX}$ at two points F and F'.

(v) Join F and F' with E.

We get two triangles DEF and DEF'.

This is known as **ambiguous** case.

Do you know?
The **Ambiguous Case** (SSA) occurs when we are given two sides and the angle opposite one of these is less than 90°.

Example 6: In the above example if we take:

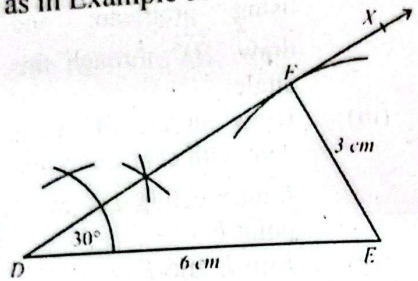
(a) $m\overline{EF} = 3cm$ (b) $m\overline{EF} = 2.5cm$

Solution: Steps of construction:

Follow the same steps (i) and (ii) as in Example 5.

Case (a)

(i) Draw an arc of radius 3cm with centre at point E which touches $\overline{DX}$ at point F.

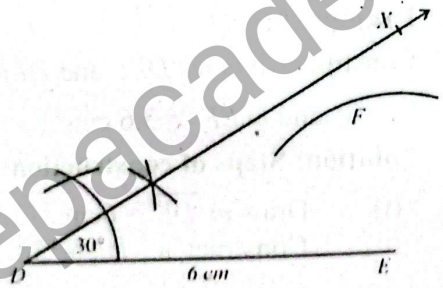


(ii) Join E with F. Here, $\overline{EF}$ will be perpendicular to $\overline{DX}$.

Hence, ΔDEF is the required triangle, which is a right angled triangle.

Case (b)

(i) If we take $m\overline{EF}$ = 2.5cm less than 3cm and draw an arc of radius 2.5cm with centre at E.



(ii) This arc does not intersect $\overline{DX}$.

So, in this case, no triangle can be formed.

We considered three cases when acute angle is given.

- If $m\overline{EF} > 3$ cm, two triangles are possible.
- If $m\overline{EF} = 3$ cm, only one triangle is possible.
- If $m\overline{EF} < 3$ cm, no triangle is possible.

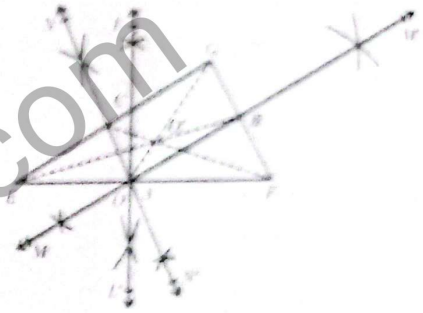
Example 7: Draw perpendicular bisector of the triangle EFG with $m\overline{EF} = 5$ cm, $m\overline{FG} = 2.5$cm and $m\overline{EG} = 4.3$ cm.

Solution: First we draw perpendicular bisectors and then medians.

Steps of construction:

i. Draw ΔGEF as explained in the previous examples.

ii. Draw two arcs above and below $\overline{EF}$ with more than half of $m\overline{EF}$ with centre at E.



iii. Draw two arcs above and below $\overline{EF}$ with radius more than half of $m\overline{EF}$ with centre at F.

iv. Draw a line through the points of intersection of the arcs in steps (ii) and (iii), we get the perpendicular bisector LL' of the side $\overline{EF}$ at A.

v. Draw two more perpendicular bisectors MM' and NN' of the sides $\overline{FG}$ and $\overline{EG}$ at B and C respectively.

vi. Join the point G with opposite midpoint A so $\overline{GA}$ is the median.

vii. Join the point F with opposite midpoint C, we get median $\overline{FC}$ and join point E with opposite midpoint B, we get median $\overline{EB}$.

Hence, we see that the perpendicular bisector $\overline{LL'}$, $\overline{MM'}$ and $\overline{NN'}$ are concurrent at point O or A and the medians $\overline{GA}$, $\overline{EB}$ and $\overline{FC}$ are concurrent at point O'.

Circumcenter: The point of concurrency of perpendicular bisector of the sides of a triangle is called circumcenter.

Centroid: The point of concurrency of the medians of a triangle is called centroid of the triangle.

Example 8: Draw angle bisector of a triangle FGH if:

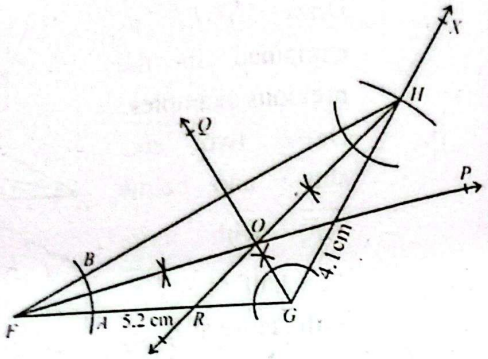
$m\overline{FG} = 5.2$ cm, $m\overline{GH} = 4.1$ cm and $m\angle FGH = 120°$

Solution: We first construct triangle FGH, then draw its angle bisector.

Steps of construction:

(i) Construct ΔFGH with given lengths and angle.

(ii) Draw an arc of suitable radius with centre at point F intersecting sides FG and FH at points A and B.



(iii) Draw two arcs with centres at points A and B with suitable radius.

(iv) Draw a ray from F passing through the point of intersection of the arcs in step (iii). Which is the required angle bisector $\overrightarrow{FP}$ of the angle F.

(v) Draw two more angle bisectors $\overrightarrow{GQ}$ and $\overrightarrow{HR}$ of the angles G and H.

We see that all the angle bisectors $\overrightarrow{FP}$, $\overrightarrow{GQ}$ and $\overrightarrow{HR}$ intersect at one point O. i.e, the angle bisectors of the triangle are concurrent.

Example 9:

Construct a triangle GHI in which $m\overline{GH} = 5.7$cm, $m\angle G = 68°$ and $m\angle H = 50°$. Prove that altitudes of the ΔGHI are concurrent.

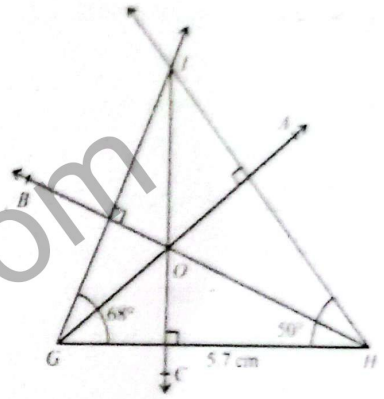
Solution: First, we construct $\&GHI$ using the given measurements and then draw altitudes of the triangle.

Steps of construction.

(i) Construct ΔGHI using the given measurements.

(ii) Draw perpendicular $\overrightarrow{GA}$ from G to the opposite side $\overline{HI}$.

(iii) Draw two more perpendiculars $\overrightarrow{HB}$ and $\overrightarrow{IC}$. The first is from point H to the opposite side $\overline{GI}$ and the other is from point I to the opposite side $\overline{GH}$.



So, $\overrightarrow{GA}$, $\overrightarrow{HB}$ and $\overrightarrow{IC}$ are the altitudes of ΔGHI and they intersect at one point O. i.e., the altitudes of ΔGHI are concurrent.

EXERCISE 11.1

1. Construct ΔABC with the given measurements and verify that the perpendicular bisectors of the triangle are concurrent.

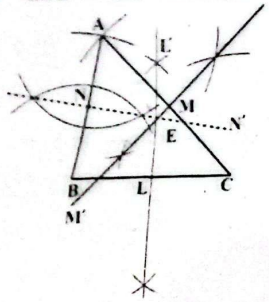
   (i) $m\overline{AB} = 5$ cm, $m\overline{BC} = 6$ cm and $m\overline{AC} = 7$ cm

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

Solution: (i)

1- Draw a ΔABC with the given measurement of sides $BC = 6$cm

2- Draw LL', MM' and NN' respective perpendicular bisectors of BC and CA and AB intersecting at one point E.



This indicates that the perpendicular bisectors of sides of a

triangle are concurrent.

Solution (ii)

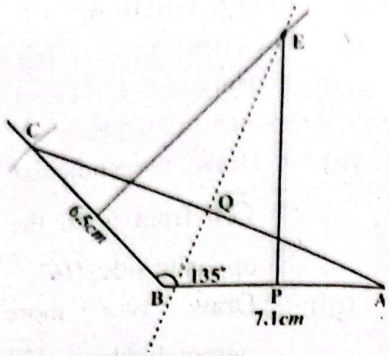
1- Draw a line segment $AB = 7.1$ cm.

2- Draw an angle $\angle ABC = 135°$ at B.

3- Cut $BC = 6.5$cm.

4- Join AC.

ΔABC is the required triangle with given measurement.



5- Draw PE perpendicular bisector of the side AB. QE as perpendicular bisector of the side AC and RE perpendicular bisector of side BC. All the bisector meet at E. Hence, the perpendicular by sectors of the sides of a triangle are concurrent.

2. Construct ΔLMN of the following measurements and verify that the medians of the triangle are concurrent.

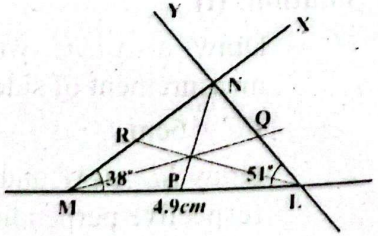
$m\overline{LM} = 4.9$ cm, $m\angle L = 51°$ and $m\angle M = 38°$

$m\overline{MN} = 4.8$ cm, $m\angle N = 30°$ and $m\overline{LM} = 8.1$ cm

Solution (i)

1- Draw a line segment LM equal to 4.9cm.

2- Draw angles $\angle LMX = 38°$ and angle $\angle MLY = 51°$ at the vertices M and L.



Cutting each other at the point N. LMN is the required triangle. Determine the midpoints P, Q and R of the sides ML, LN and NM of the sides of the ΔABC.

3- Join P and Q and R with the opposite vertices PN, MQ and LR are the Medians of the triangle which are concurrent at C.

Solution (ii)

1- Draw a line segment NM 4.8 cm

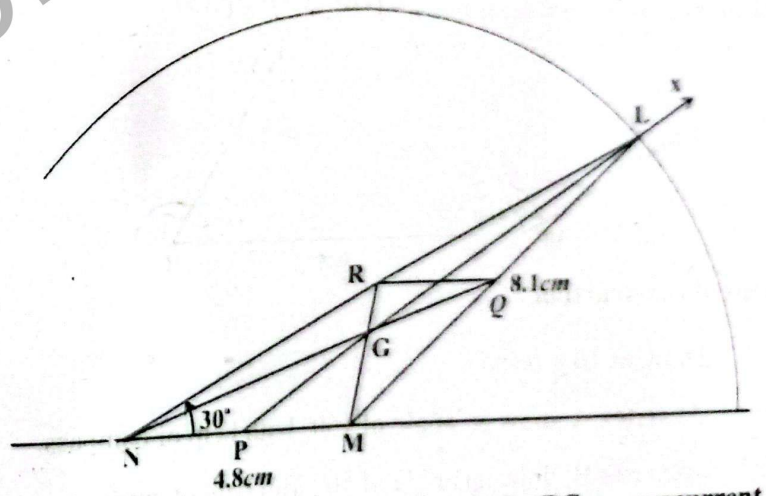
2- At N draw an $\angle MNX = 30°$

3- With M as centre draw an arc 8.1cm. Cutting NX at L.

4- Join ML.

ΔLMN is the required Δ.

Find P, Q, R midpoint of the sides of MN, ML and NL. Join LP, NQ and MR. All the three medians are concurrent at the point G. G is known as centroid of the triangle.



3. Verify that the angle bisectors of ΔABC are concurrent with the following measurement:

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

(ii) $m\overline{AB} = 6$ cm, $m\angle A = 150°$ and $m\angle B = 60°$

Solution: (i)

1- Draw a line segment $4.5cm$ and name it AB.

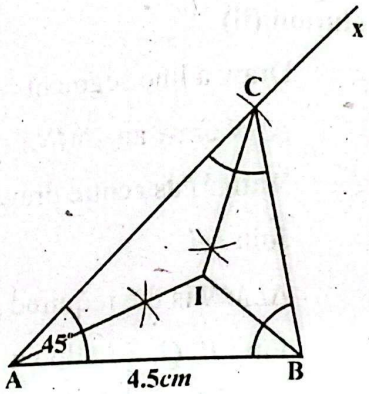
2- At the point A draw a live AX making an angle of 45° with AB.

3- Cut a line segment AC equal to 5.3cm from AX.

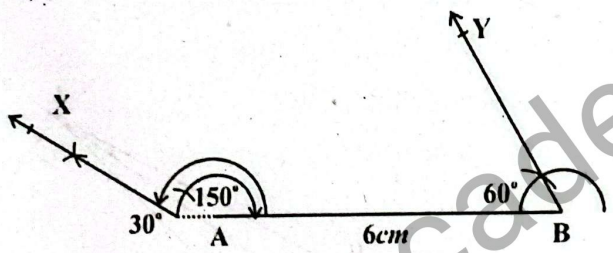
4- Join BC.

ABC is the required ΔABC.

Draw angle bisector AI, BI and CI of the angles A, B and C meeting each other at I.



Solution: (ii) $m\overline{AB} = 6cm,\ m\angle A = 150^o, m\angle B = 60^o$



Steps of construction

i. Draw $m\overline{AB} = 6cm$

ii. At vertex A, draw an angle of 150° with help of compass.

iii. At vertex B, draw an angle of 60° with help of compass.

iv. We observe that construction of required triangle according to given measurements is not possible.

$\because \quad 150^o + 60^o = 210^o > 180^o$

4. Given the measurements of ΔDEF: $m\overline{DE}$ = 4.8 cm, $m\overline{EF}$ = 4cm and $m\angle E = 45^\circ$, draw altitudes of ΔDEF and find orthocentre.

Orthocentre: The point of concurrency of the Altitudes is called orthocentre.

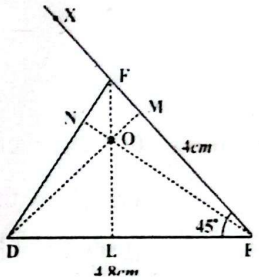
Solution: 1- Draw a line segment DE equal to 4.8 cm.

2- Draw a line DX making an angle equal to 45° with DE.

3- Cut DE and join FD.

4- ΔDEF is the required triangle with the given measurements.

Orthocentre is the altitude of the Δ from the three vertices upon the opposite sides, all the altitude are concurrent and the point of concurrency is known as orthocentre of the triangle.



Draw $FL \perp DE$; $EN \perp DF$ and $DM \perp EF$ are the three altitudes of the Δ. and O is the point of concurrency of these altitudes.

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

(i) ΔBCD ; $m\overline{BC} = 5$ cm, $m\angle B = 62^\circ$ and $m\overline{CD} = 4.7$ cm

(ii) ΔKLM ; $m\overline{LM} = 6$ cm, $m\angle M = 42^\circ$ and $m\overline{LN} = 5$ cm

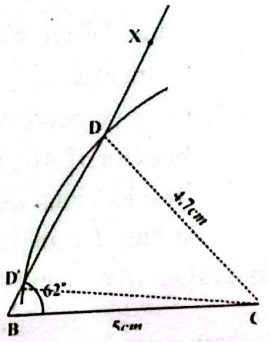
Solution: (i)

1- Draw a line segment BC equal to 5 cm.

2- Draw an angle $\angle CBX = 62^\circ$.

3- With centre C draw an arc equal to the side $CD = 4.7$cm.

This arc cuts the arm of the angle at two points D and D'. Hence, it is an ambiguous case.

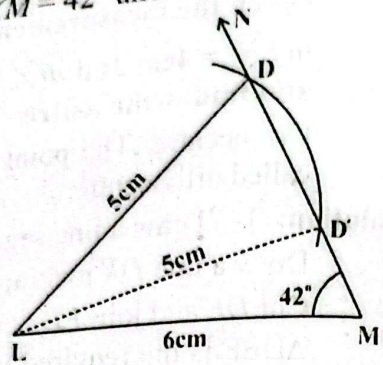


Sol: (ii) ΔKLM; $m\overline{LM} = 6$ cm, $m\angle M = 42°$ and $m\overline{LN} = 5$ cm

Steps of Construction

(i) Construct triangle with given measurements.

(ii) An arc of length 5cm intersects angle arm at two distinct point D and D'. So we have two triangles named as ΔLMN and $\Delta LMN'$



Example 10: Construct a rectangle $ABCD$ with $mAB = 5$ cm and $mBC = 3.2$ cm. Draw the locus of all points which are:

(i) at a distance of 3.1 cm from point A.

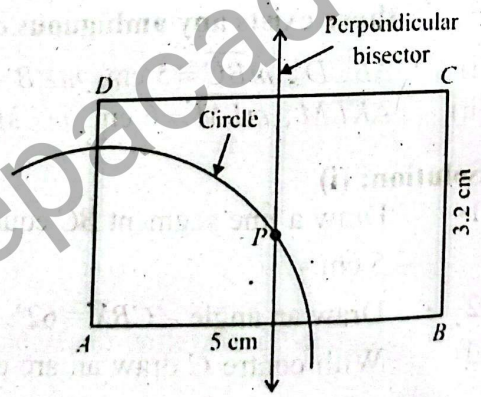
(ii) equidistant from A and B.

Label the point P inside the rectangle which is 3.1 cm from point A and equidistant from A and B.

Solution: Construct rectangle $ABCD$ with given lengths.

(i) Draw a circle of radius 3.1 cm with centre at A.

(ii) Draw perpendicular bisector of AB. The two loci intersect at P inside the rectangle which is 3.1 cm from point A and equidistant from A and B.

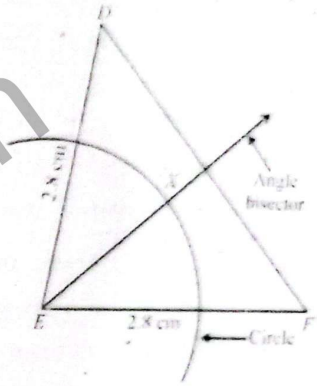


Example 11: Construct an isosceles triangle DEF with vertical angle 80° at E and $m\overline{EF} = m\overline{DE} = 4.8$cm. Draw the locus of all points which are:

(i) at a distance of 2.8cm from point E,

(ii) equidistant from $\overline{DE}$ and $\overline{EF}$.

Label the point X inside the triangle which is 2.8cm from point E and equidistant from $\overline{ED}$ and $\overline{EF}$.



Solution: Construct triangle DEF with given measurements.

(i) Draw a circle of radius 2.8 cm with centre at E.

(ii) Draw angle bisector of angle DEF. The two loci intersect at X inside the triangle which is 2.8 cm from points and equidistant from $\overline{ED}$ and $\overline{EF}$.

Example 12: A field is in the form of a triangle LMN with $m\overline{LM} = 69m$, $m\angle L = 60°$ and $m\angle M = 45°$.

(i) Construct ΔLMN with given measurements. **[Scale: 10m=1cm]**

(ii) Draw the locus of all points which are equidistant from L and M, equidistant from $\overline{LM}$ and $\overline{LN}$ and at a distance of 13 m from $\overline{LM}$ inside the triangular field.

(iii) Two trees are to be planted at points P and Q inside the field.

(a) Mark the position of point P which is equidistant from L and M and equidistant from $\overline{LM}$ and $\overline{LN}$.

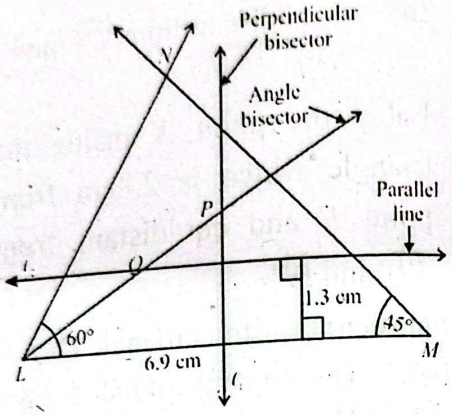
(b) Mark the position of point Q which is equidistant from $\overline{LM}$ and $\overline{LN}$ and 13m from $\overline{LM}$.

(c) Find the distance $m\overline{PQ}$.

Solution:

(i) Construct triangle LMN with given measurements using a scale of 10 m to represent 1 cm.

(ii) Draw perpendicular bisector ℓ_1 of $\overline{LM}$. Draw angle bisector of angle MLN. Draw a parallel line inside the triangle LMN, 1.3 cm from $\overline{LM}$.



(iii) (a) Label the point P which is equidistant from L and M and equidistant from $\overline{LM}$ and $\overline{LN}$. Mark the point P inside the triangle which is equidistant from L and M.

(b) Label the point Q which is equidistant from $\overline{LM}$ and $\overline{LN}$ and 1.3 cm from $\overline{LM}$.

(c) $m\overline{PQ} = 1.2 \times 10 = 12m$

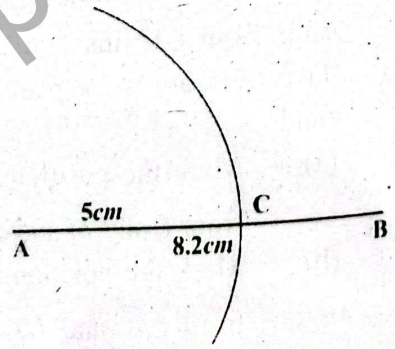
EXERCISE 11.2

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

Solution:

1- Draw a straight line segment such that $m\overline{AB} = 8.2cm$.

2- Take point A as centre, draw an arc of radius 5cm which cuts line segment $\overline{AB}$ at point C, So arc represents locus of points 5cm from point A.



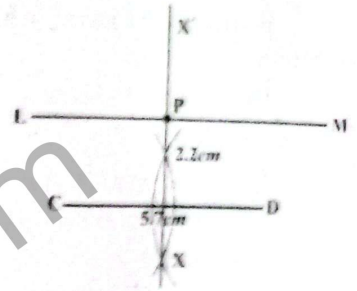
2. Construct a locus of point 2.2cm from line segment CD of measure 5.7cm.

Solution:

1- Draw a line segment 5.7 cm.

2- Draw right bisector XX' of CD.

Hence, P is a point equidistant from C and D at a distance of 2.2 cm from CD.

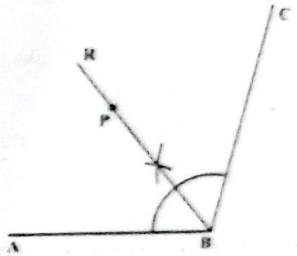


3. Construct an angle $ABC = 105°$. Construct a locus of a point P which moves such that it is equidistant from $\overline{BA}$ and $\overline{BC}$.

Solution:

1- Construct an angle 105° ΔABC.

2- Draw the angle bisector BR of the $\angle ABC$. Any point P on this bisector is at equidistant from AB and BC.

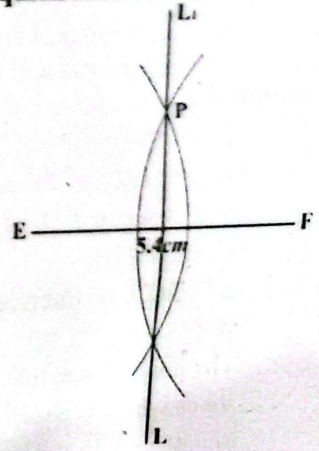


4. Two points E and F are 5.4 cm apart. Construct a locus of a point P which moves such that it is equidistant from E and F.

Solution:

1- Draw a line EF equal to 5.4cm.

2- Draw the perpendicular bisector LL_1 of EF. P which moves in such a way that its distance from E and F is always equal.



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

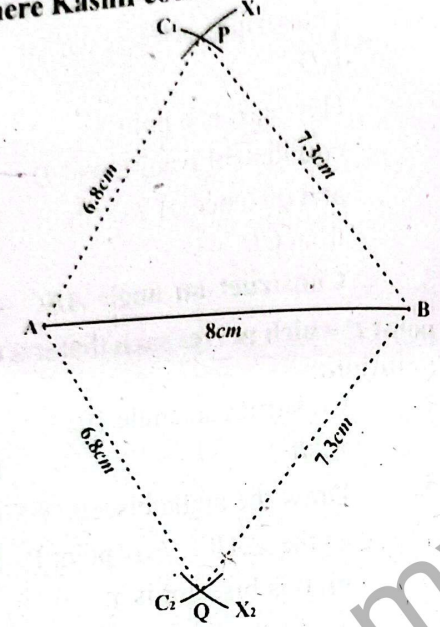
Solution:

1- Draw a line segment $AB = 8$cm in length.

2- With A as centre draw two arcs C_1 and C_2 at 6.8cm on both sides of A and B.

3- Draw an other arc X_1 and X_2 on both sides of AB. Cutting C_1 and C_2 at point P and Q.

Now, P is a point at 6.8km from A and 7.3 km from B. Similarly, Q is a point 7.3 km from B and 6.8 km from A.



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

(a) **equidistant from C and D**

(b) **equidistant from $\overline{CD}$ and $\overline{CE}$.**

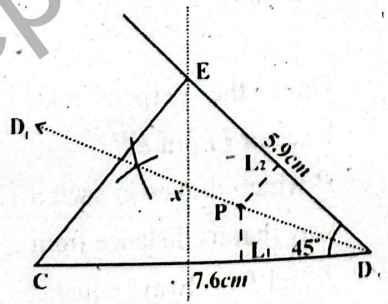
Mark the point X where the two loci intersect.

Solution:

1- Draw perpendicular bisector L_1L_2 of $\overline{DE}$ and angle bisector DD_1 of the angle D.

2- L_1L_2 and DD_1 intersect at P.

3- The point P is at the locus which is equidistant from D and E. On the line segments $\overline{CD}$ and $\overline{DE}$.



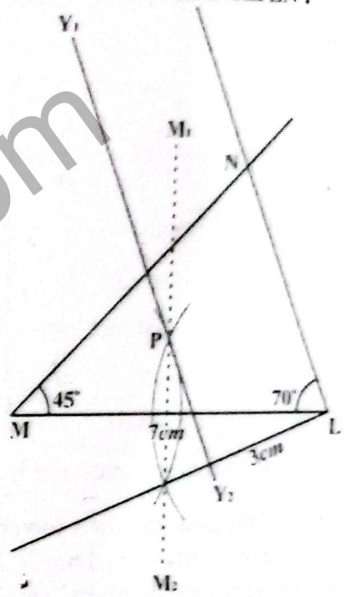
7. **Construct a triangle LMN with $m\overline{LM}$ = 7cm, $m\angle L = 70°$ and $m\angle M = 45°$. Find a point within the triangle LMN which is equidistant from L and M and 3 cm from $\overline{LN}$.**

Solution: 1- Draw a line segment $\overline{LM}$ 7cm in length and draw M_1M_2 as its perpendicular bisector.

2- Draw a line $Y_1Y_2 \parallel$ to LN at a distance of 3cm from LN.

3- Draw two lines at L and M making and angle 70° at L and 45° at M cutting each other at N.

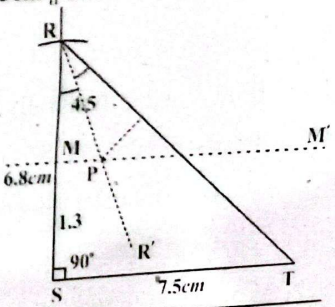
4- The perpendicular bisector M_1M_2 and Parallel line. Y_1Y_2 to LN cut each other P. which is a the locus at equal distance from L and M and at 3cm from $\overline{LN}$.



8. **Construct a right angled triangle RST with $m\overline{RS}$ = 6.8 cm, $m\angle S$ = 90° and $m\overline{ST}$ =7.5 cm. Find a point within the triangle RST which is equidistant from $\overline{RS}$ and $\overline{RT}$ and 4.5cm from R.**

Solution: 1- Draw a right angled triangle STR in which $\angle S = 90°$, $\overline{ST}$ = 7.5cm and $\overline{RM}$ = 4.5cm $\parallel ST$.

2- Draw at 1.3cm perpendicular distance a line MM' parallel to $S.T.$ Cutting the angle bisector RR' at point P. The point P is a required locus equidistant from $\overline{RS}$ and $\overline{RT}$ and 4.5cm from R.

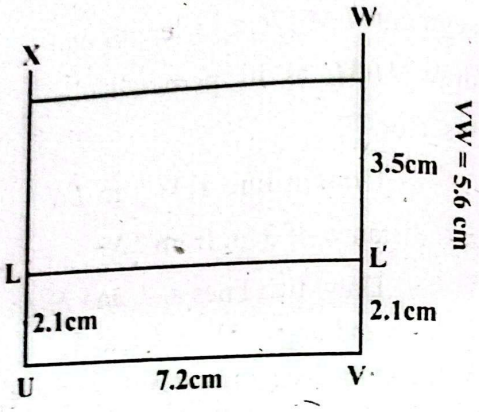


9. Construct a rectangle $UVWX$ with $m\overline{UV} = 7.2$cm and $m\overline{VW} = 5.6$ cm. Draw the locus of points at a distance of 2.1cm from $\overline{UV}$ and 3.5cm from W.

Solution:

1- Draw a rectangle $UVWX$ in which $UV = 7.2$ cm and $VW = 5.6$cm.

2- Draw a line $LL' \parallel$ to UV at R distance of 2.1 cm from VV or 3.5 cm from R.

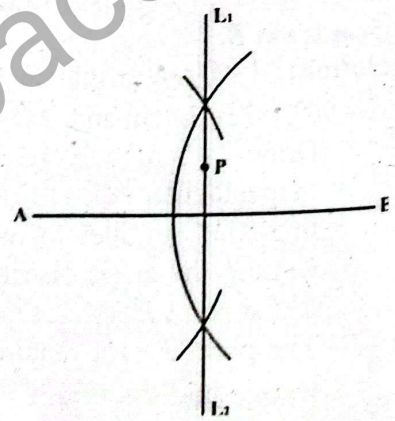


which is the required locus fulfilling conditions.

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.

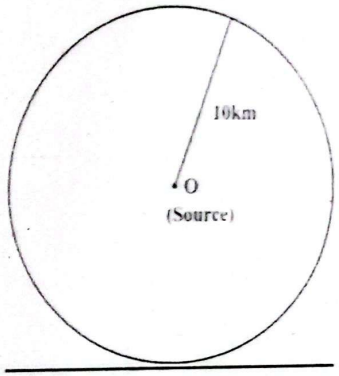
Solution:

Suppose A and B are the two towers. The G.P.S position is equidistant from A and B. Naturally, the position of G.P.S is on the perpendicular bisector of A and B i.e. L_1L_2.



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.

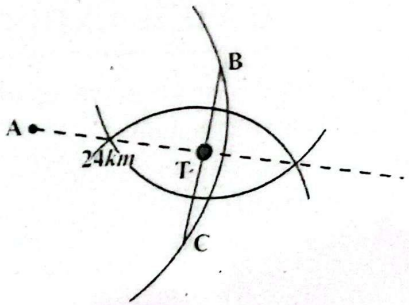
Solution: It is a circular region of 10 km radius with centre at the point of control the infected area.



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 10km, find where the treasure could be buried.

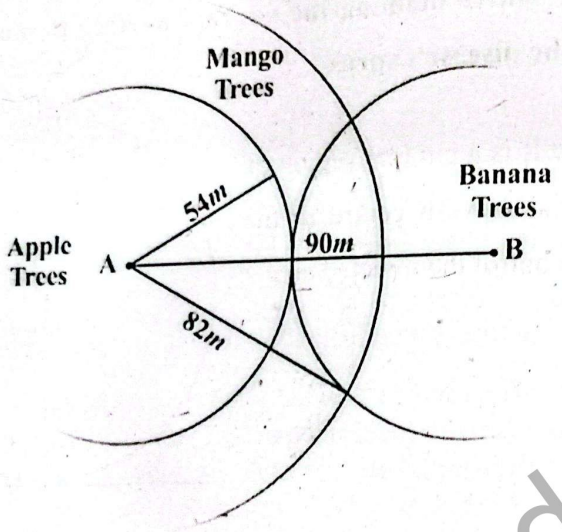
Solution:

The treasure in the shaded region on the perpendicular bisector of B and C. i.e. the shaded region of the island.



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' shows apple trees. 'B' shows banana tree. Distance between apple trees and banana trees is 90*m*.

The shaded area shows the position of mango trees.

REVIEW EXERCISE 11

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

(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°.

(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

(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

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

(a) one point (b) two points

(c) three points (d) four points

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

(a) circle

(b) perpendicular bisector

(c) angle bisector (d) parallel lines

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

(a) circle

(b) perpendicular bisector

(c) angle bisector (d) parallel lines

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

(a) circle

(b) perpendicular bisector

(c) angle bisector (d) parallel lines

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

(a) circle

(b) perpendicular bisector

(c) angle bisector (d) parallel lines

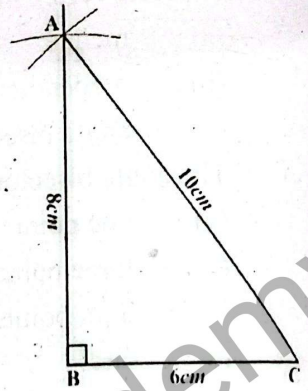
(x) The set of all points which is farther than 2 km from a fixed point B is a region outside a circle of radius _____ and centre at B.

(a) 1 km (b) 1.9 km

(c) 2 km (d) 2.1 km

(i)	(b)	(ii)	(a)	(iii)	(c)	(iv)	(a)	(v)	(a)
(vi)	(a)	(vii)	(b)	(viii)	(d)	(ix)	(c)	(x)	(c)

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



Solution:

1- Draw a line $\overline{BC}$ 6cm at B draw an angle $\angle CBA = 90°$.

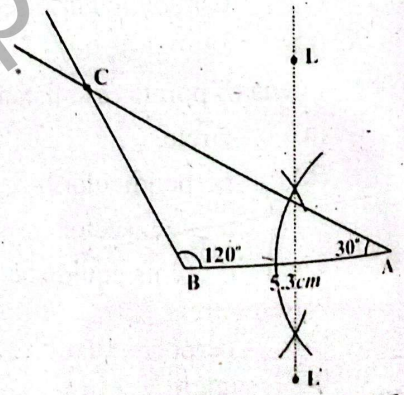
2- Cut $BA = 8$cm.

3- Join A and C.

ΔABC is a right angle with $\angle B = 90°$.

3. Construct a triangle ABC with $m\overline{AB} = 5.3$cm, $m\angle A = 30°$ and $m\angle B = 120°$.

Draw the locus of all points which are equidistant from A and B.



Solution:

1- Construct a triangle ABC with given dimensions.

2- Draw perpendicular bisector of side AB. The bisector LL' so drawn is equidistant from the vertices A and B.

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

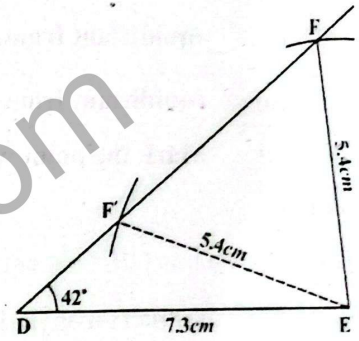
Solution:

1- Draw a line segment DE equal to 7.3 cm.

2- Draw $\angle D = 42°$.

3- Cut EF equal to 5.4 cm.

4- There are two triangles DEF and DEF'. So, this is an ambiguous case.



5. Construct a triangle XYZ with $m\overline{YX} = 8$cm, $m\overline{YZ} = 7$cm and $m\overline{XZ} = 6.5$ cm.

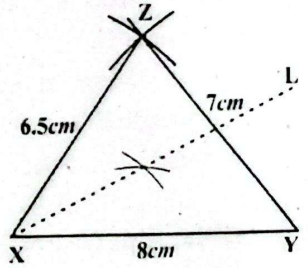
Draw the locus of all points which are equidistant from $\overline{XY}$ and $\overline{XZ}$.

Solution:

1- Draw a line segment XY 8cm in length.

2- Draw two arcs 7cm and 6.5cm from Y and X respectively crossing each other at Z.

3- Join XZ and Z. ΔXYZ is the required triangle.



4- Draw angle bisector XL of angle X. XL is the **locus** of all points equidistant from $\overline{XZ}$ and $\overline{YZ}$.

6. **Construct a triangle FGH such that $m\overline{FG} = m\overline{GH} = 6.4$ cm, $m\angle G = 122°$.**

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.**

Solution:

1- Draw a line $GH = 6.4$ cm.

2- At G construct on angle 122° and cut the side $\overline{GF}$ equal to 6.4cm.

3- Join F with H.

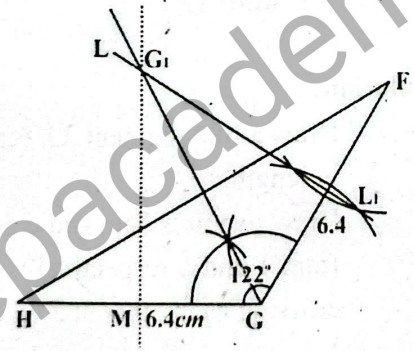
ΔFGH is the required triangle.

4- Draw GG_1 angle bisector of $\angle G$.

5- Draw perpendicular bisector LL_1 of side FG. Which meets the angle bisector at G.

F and G are at equal distance from G_1.

Similarly $FG_1 = HG_1$



Distance of G_1 from FG and HG_1 is the common point of two Loci.

7. **Two houses Q and R are 73 metres apart. Using a scale of 1cm to represent 10m, construct the locus of a point P which moves such that it is:**

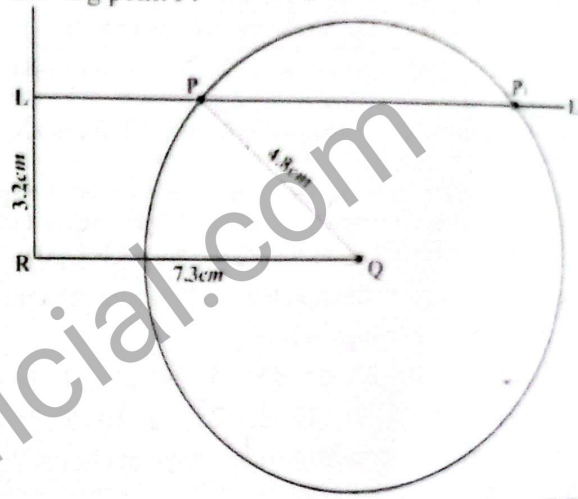
(i) **at a distance of 48 metres from Q.**

(ii) **at a distance of 32 metres from the line joining Q and R.**

Solution: 1- Draw a line segment $\overline{QR}$ 7.3cm length. (73m)

2- Draw a line LL' parallel to QR at a distance of 3.2cm from the line QR (32m distance).

3- The two loci meet at P and P_1 which are on the loci of the moving point P.



8. **The field is in the form of a rectangle $ABCD$ with $m\overline{AB} = 70m$ and $m\overline{BC} = 60m$. 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 $\overline{AB}$.**

Solution:

1- Draw a rectangle $ABCD$ with dimension 7.00 cm × 6cm.

2- Draw a quarter circle with radius 3cm and centre C.

3- Draw a line $LM \parallel$ to AB at 2.5 cm.

4- The shaded region is less than 30m from C and 25m away from the line $\overline{AB}$.