

EXERCISE 16.1

1. Use a ruler and compass only in this question.

(i) Draw a circle, centre O and radius 4 cm.

(ii) Mark a point P such that $OP = 7$ cm.

Construct the two tangents to the circle from P . Measure and record the length of one of the tangents.

Solution:

Steps to construct:

Step 1: Draw a circle with center O and radius 4cm and mark that point as A .

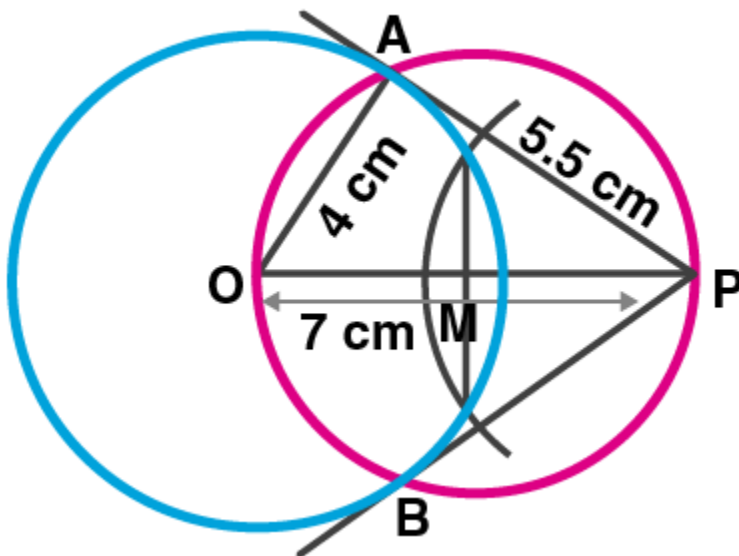
Step 2: Take a point P such that $OP = 7$ cm.

Step 3: Bisect OP at M .

Step 4: With center M and diameter OP , draw another circle intersecting the given circle at A and B .

Step 5: Join PA and PB . Hence PA and PB are pair of tangents to the circle.

Step 6: On measuring PA , it is equal to 5.5cm.



2. Draw a line $AB = 6$ cm. Construct a circle with AB as diameter. Mark a point P at a distance of 5 cm from the mid-point of AB . Construct two tangents from P to the circle with AB as diameter. Measure the length of each tangent

Solution:

Steps to construct:

Step 1: Draw a line segment $AB = 6$ cm.

Step 2: Draw its perpendicular bisector bisecting it at point O .

Step 3: With center O and radius OB , draw a circle.

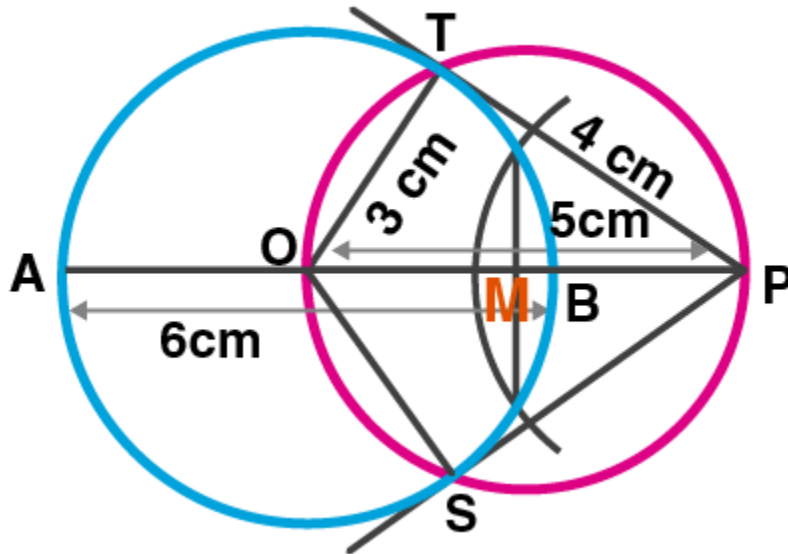
Step 4: Extend AB to point P such that $OP = 5\text{cm}$.

Step 5: Draw its perpendicular bisector intersecting it at point M.

Step 6: With center M and radius OM, draw a circle which intersects the given circle at T and S.

Step 7: Join OT, OS, PT and PS. Hence, PT and PS are the required tangents to the given circle.

Step 8: On measuring each tangent is 4cm long. $PT = PS = 4\text{cm}$.



3. Construct a tangent to a circle of radius 4cm from a point on the concentric circle of radius 6 cm and measure its length. Also, verify the measurement by actual calculation.

Solution:

Steps to construct:

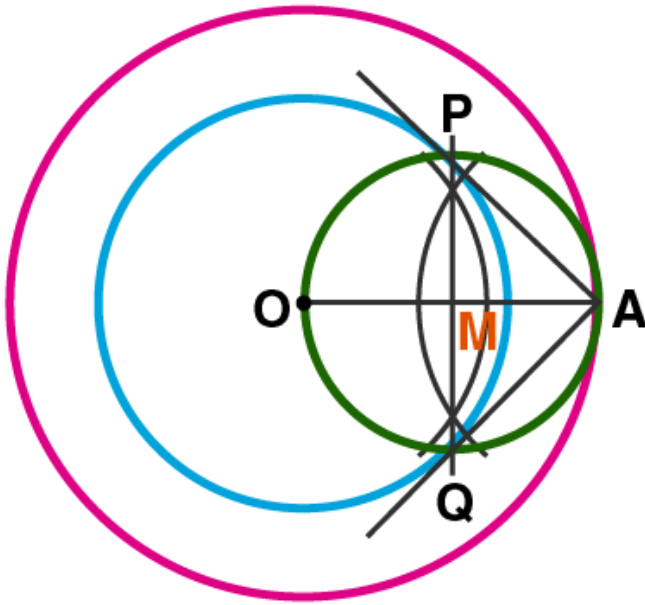
Step 1: Mark a point O.

Step 2: With center O and radius 4cm and 6cm, draw two concentric circles.

Step 3: Join OA and mark its mid-point as M.

Step 4: With center M and radius MA, draw another circle which intersects the first circle at P and Q.

Step 5: Join AP and AQ. Hence, AP and AQ are the required tangents to the first circle from point A.



4. Draw a circle of radius 3 cm. Take two points P and Q on one of its extended diameter each at a distance of 7 cm from its centre. Draw tangents to the circle from these two points P and Q.

Solution:

Steps to construct:

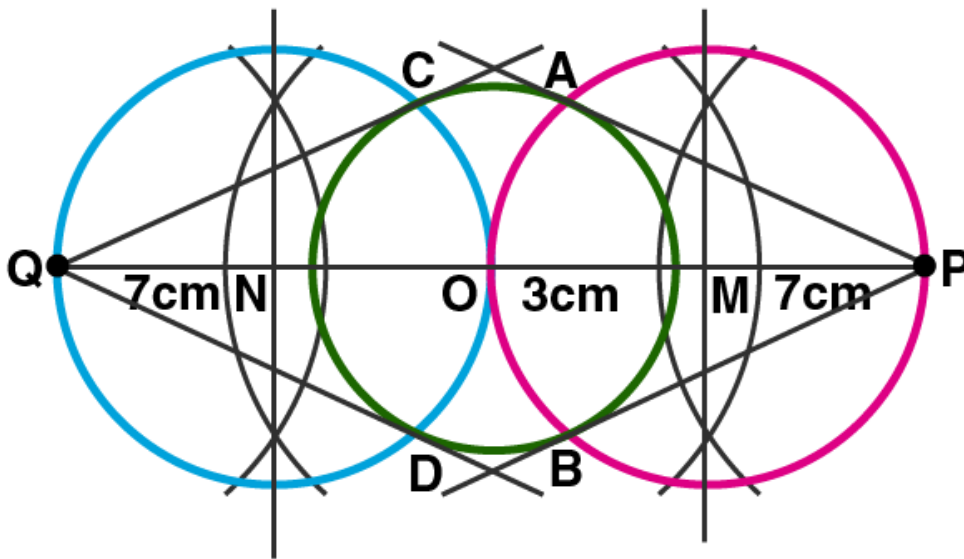
Step 1: Consider a point O on a line, with center O, and radius 3cm, draw a circle.

Step 2: Extend its diameters on both sides and cut off $OP = OQ = 7\text{cm}$.

Step 3: Mark the mid-points of OP and OQ as M and N respectively.

Step 4: With Centers M and N and OP and OQ as diameters, draw circles which intersect the given circle at A, B and C, D respectively.

Step 5: Join PA, PB, QC, QD. Hence, PA, PB and QC, QD are the required tangents.



5. Draw a line segment AB of length 8 cm. Taking A as centre, draw a circle of radius 4 cm and taking B as centre, draw another circle of radius 3 cm. Construct tangents to each circle from the centre of the other circle.

Solution:

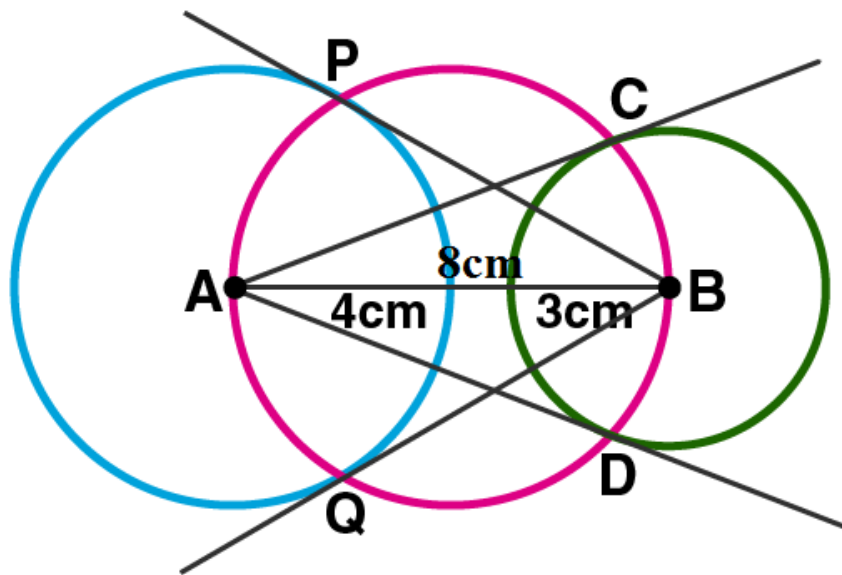
Steps to construct:

Step 1: Draw a line segment $AB = 8\text{ cm}$.

Step 2: With center as A and radius 4 cm, with center as B and radius 3 cm, draw circles.

Step 3: Draw the third circle AB as diameter which intersects the given two circles at C and D, P and Q respectively.

Step 4: Join AC, AD, BP, BQ. Hence, AC and AD, BP and BQ are the required tangents.



EXERCISE 16.2

1. Draw an equilateral triangle of side 4 cm. Draw its circumcircle.

Solution:

Steps to construct:

Step 1: Draw a line segment $BC = 4\text{cm}$.

Step 2: With centers B and C, draw two arcs of radius 4cm which intersects each other at point A.

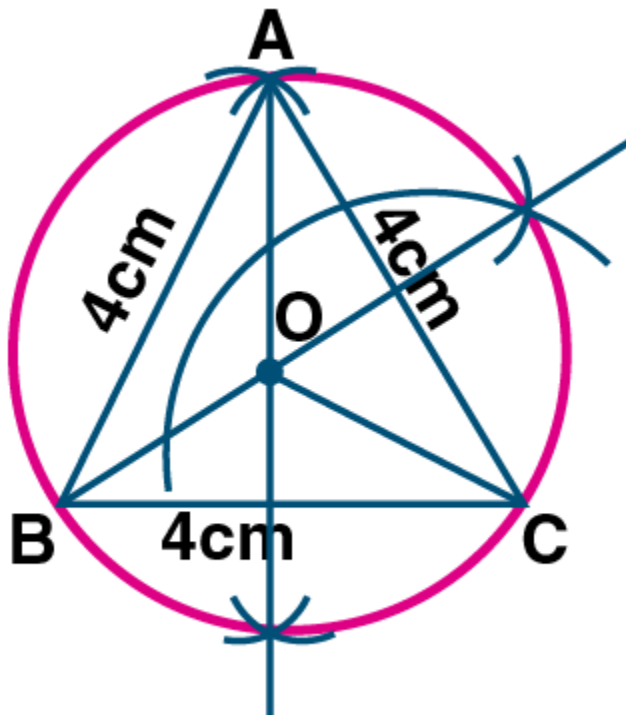
Step 3: Join AB and AC.

Step 4: Draw the right bisector of BC and AC intersecting each other at point O.

Step 5: Join OA, OB and OC.

Step 6: With center as O, and radius equal to OB or OC or OA, draw a circle which passes through points A, B and C.

Hence the required circumcircle of triangle ABC is given below.



2. Using a ruler and a pair of compasses only, construct:

(i) A triangle ABC given $AB = 4\text{ cm}$, $BC = 6\text{ cm}$ and $\angle ABC = 90^\circ$.

(ii) A circle which passes through the points A, B and C and mark its centre as O.
(2008)

Solution:

Steps to construct:

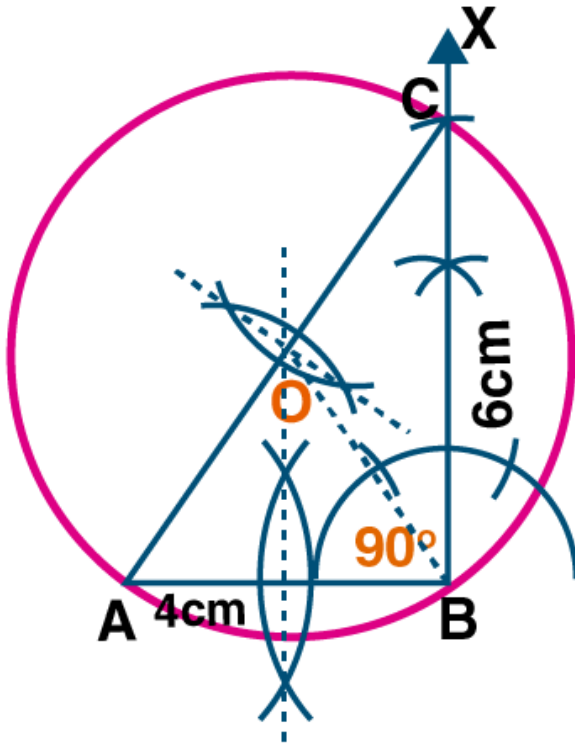
Step 1: Draw a line segment $AB = 4\text{cm}$.

Step 2: At point B, draw a ray BX making an angle of 90° and cut off $BC = 6\text{cm}$.

Step 3: Join AC.

Step 4: Draw the perpendicular bisectors of sides AB and AC intersecting each other at point O.

Step 5: With center as O, and radius equal to OB or OA or OC, draw a circle which passes through points A, B, C.



3. Construct a triangle with sides 3 cm, 4 cm and 5 cm. Draw its circumcircle and measure its radius.

Solution:

Steps to construct:

Step 1: Draw a line segment $BC = 4\text{cm}$.

Step 2: With Center as B and radius 3cm, with center as C and radius 5cm draw two arcs which intersect each other at point A.

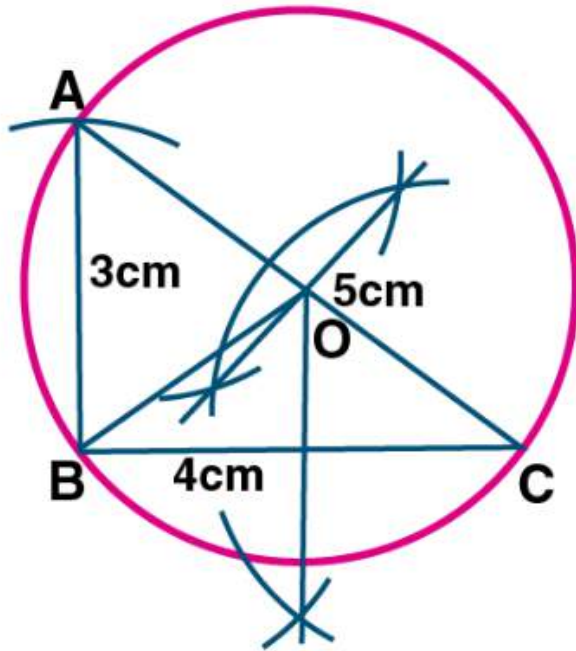
Step 3: Join AB and AC.

Step 4: Draw the perpendicular bisector of sides BC and AC which intersects each other at point O.

Step 5: Join OB.

Step 6: With center as O and radius OB, draw a circle which pass through A, B, C.

Step 7: On measuring the radius $OB = 2.5\text{cm}$.



4. Using a ruler and compasses only:

(i) Construe a triangle ABC with the following data:

Base AB = 6 cm, AC = 5.2 cm and $\angle CAB = 60^\circ$.

(ii) In the same diagram, draw a circle which passes through the points A, B and C. and mark its centre O.

Solution:

Steps to construct:

Step 1: Draw a line segment AB = 6cm.

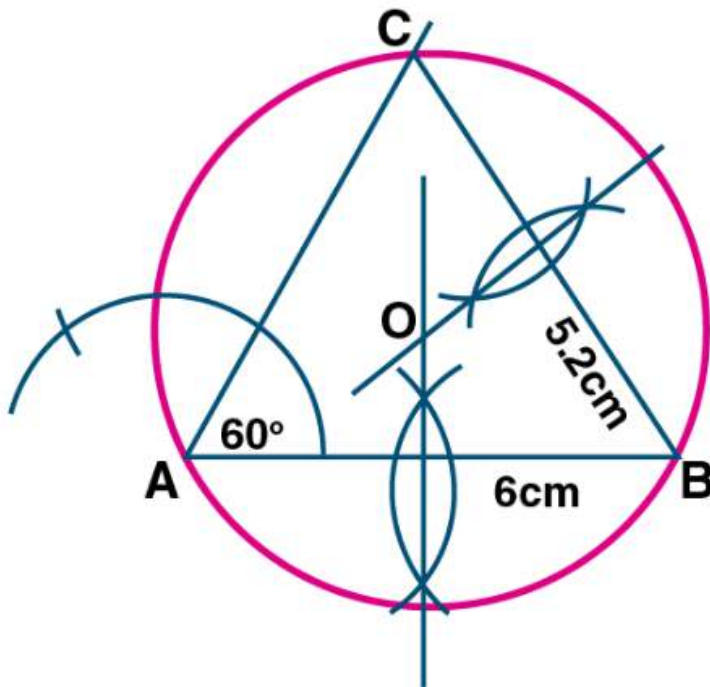
Step 2: At point A, draw a ray making an angle of 60° .

Step 3: With B as the center and radius 5.2cm, draw an arc which intersects the ray at C.

Step 4: Join BC.

Step 5: Draw the perpendicular bisector of sides AB and BC which intersect each other at point O.

Step 6: With center as O and radius OA, draw a circle which touches through the points A, B, C.



5. Using ruler and compasses only, draw an equilateral triangle of side 5 cm and draw its inscribed circle. Measure the radius of the circle.

Solution:

Steps to construct:

Step 1: Draw a line segment $BC = 5\text{cm}$.

Step 2: With Center as B and radius 5cm, with center as C and radius 5cm draw two arcs which intersect each other at point A.

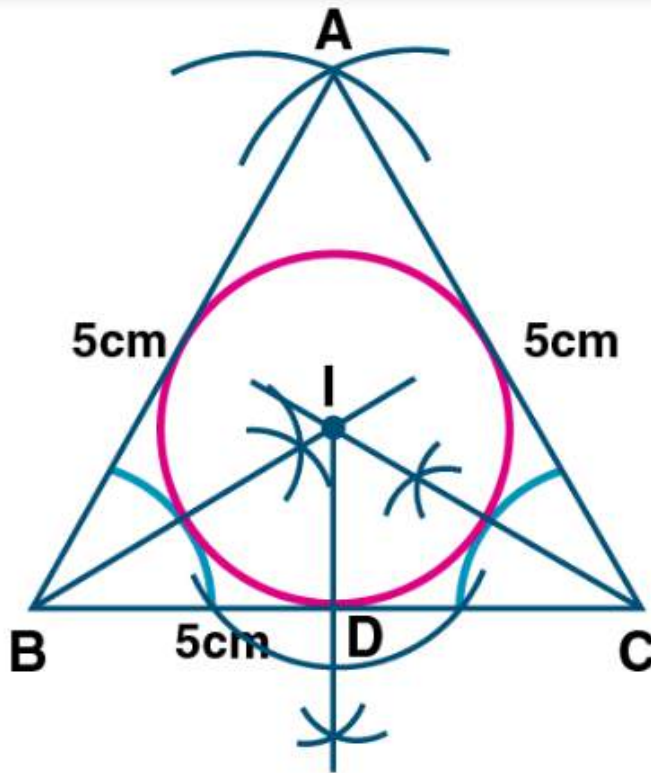
Step 3: Join AB and AC.

Step 4: Draw the angle bisector of angles B and C which intersects each other at point I.

Step 5: From I, draw a perpendicular ID on BC.

Step 6: With center as I and radius ID, draw a circle which touches the sides of the triangle internally.

Step 7: On measuring the radius $ID = 1.5\text{cm}$ (approx).



6. (i) Construct a triangle ABC with $BC = 6.4$ cm, $CA = 5.8$ cm and $\angle ABC = 60^\circ$. Draw its incircle. Measure and record the radius of the incircle.

(ii) Construct a $\triangle ABC$ with $BC = 6.5$ cm, $AB = 5.5$ cm, $AC = 5$ cm. Construct the incircle of the triangle. Measure and record the radius of the incircle. (2014)

Solution:

Steps to construct:

Step 1: Draw a line segment $BC = 6.4$ cm.

Step 2: Construct an angle of 60° at point B.

Step 3: With C as center and radius $CA = 5.8$ cm, draw an arc cutting BD at A.

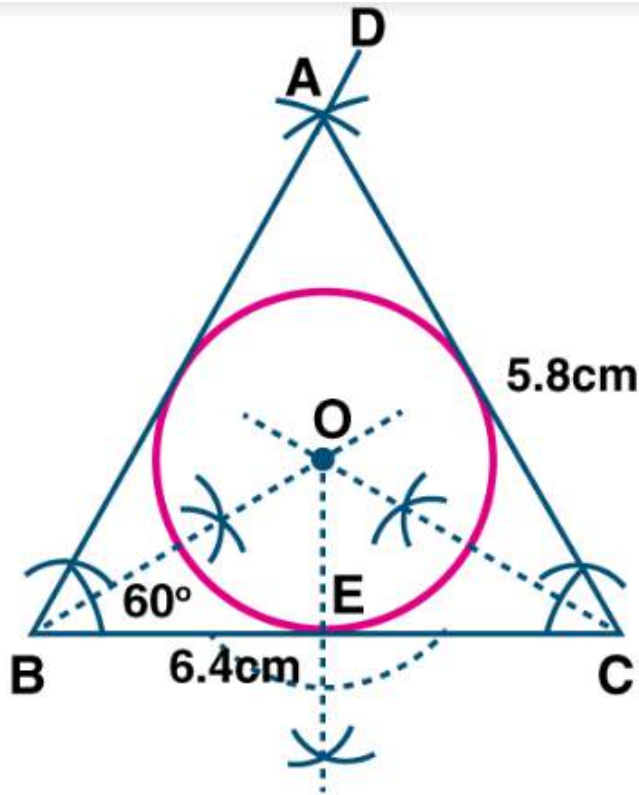
Step 4: Join AC.

Step 5: Draw the angle bisector of angle B and angle C which intersect each other at point O.

Step 6: Draw OE perpendicular to BC, intersecting BC at point E.

Step 7: With O as the center and OE as the radius draw the required incircle.

Step 8: On measuring the radius $OE = 1.5$ cm.



Steps to construct:

Step 1: Draw a line segment $BC = 6.5\text{cm}$.

Step 2: With B as center and C as center draw arcs $AB = 5.5\text{cm}$ and $AC = 5\text{cm}$.

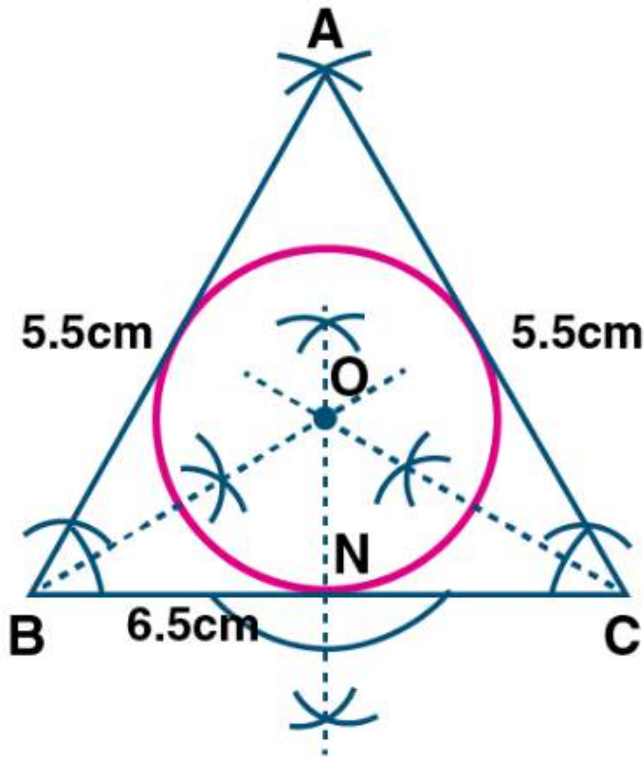
Step 3: Join AB and AC.

Step 4: Draw the angle bisectors of B and C. The bisectors meet at point O.

Step 5: With O as the center. Draw an incircle which touches all the sides of the triangle ABC.

Step 6: From point O draw a perpendicular to side BC which cuts at point N.

Step 7: On measuring the radius $ON = 1.5\text{cm}$.



7. The bisectors of angles A and B of a scalene triangle ABC meet at O.

(i) What is the point O called?

(ii) OR and OQ is drawn a perpendicular to AB and CA respectively. What is the relation between OR and OQ?

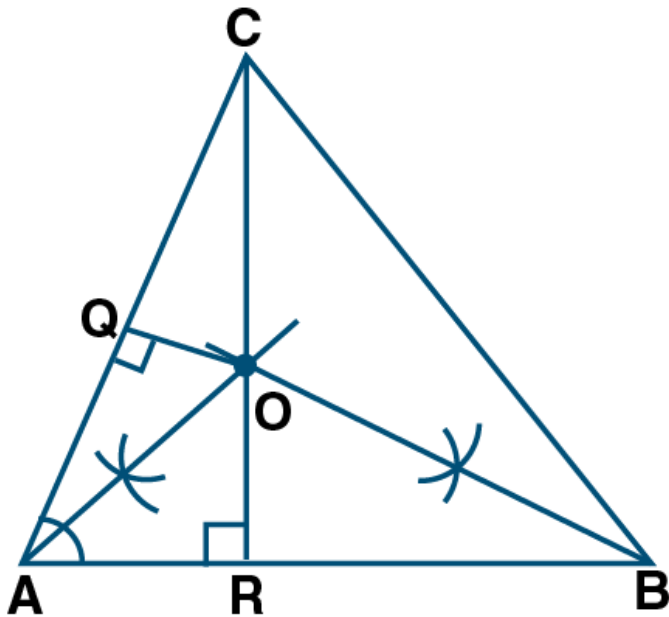
(iii) What is the relation between $\angle ACO$ and $\angle BCO$?

Solution:

(i) The point O where the angle bisectors meet is called the incenter of the triangle.

(ii) The perpendicular drawn from point O to AB and CA are equal. i.e., OR and OQ.

(iii) $\angle ACO = \angle BCO$. OC will bisect the $\angle C$.



8. Using ruler and compasses only, construct a triangle ABC in which $BC = 4$ cm, $\angle ACB = 45^\circ$ and the perpendicular from A on BC is 2.5 cm. Draw the circumcircle of triangle ABC and measure its radius.

Solution:

Steps to construct:

Step 1: Draw a line segment $BC = 4$ cm.

Step 2: At point B, draw a perpendicular and cut off $BE = 2.5$ cm.

Step 3: From, E, draw a line EF parallel to BC.

Step 4: From point C, draw a ray making an angle 45° which intersects EF at point A.

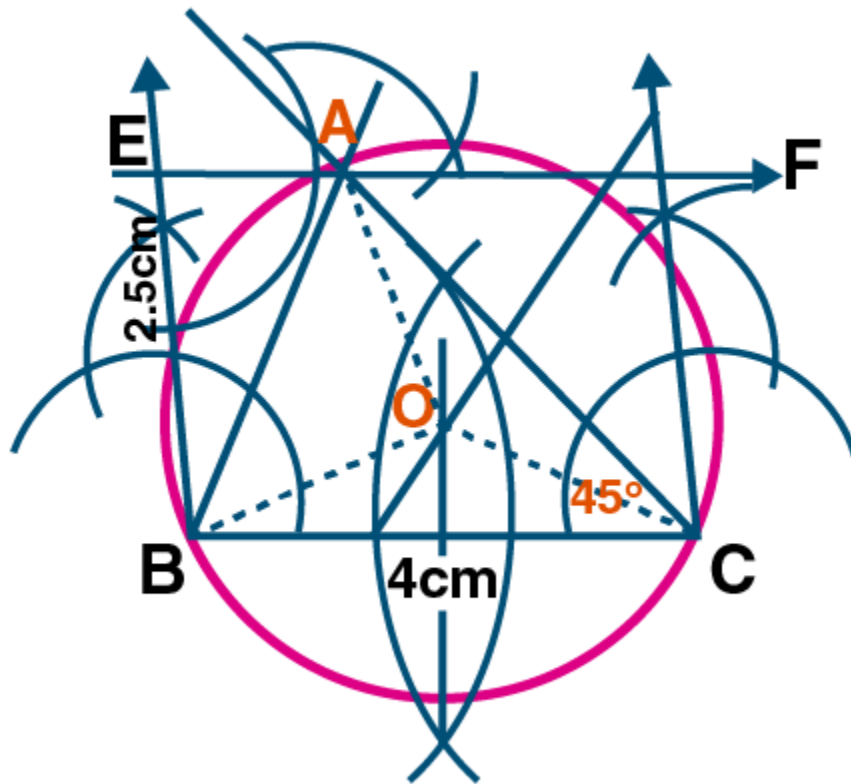
Step 5: Join AB.

Step 6: Draw the perpendicular bisectors of sides BC and AC intersecting each other at point O.

Step 7: Join OB, OC and OA.

Step 8: With O as the center and radius OB or OC or OA draw a circle which passes through points A, B, C.

Step 9: On measuring the radius $OB = 2$ cm.



9. Construct a regular hexagon of side 4 cm. Construct a circle circumscribing the hexagon.

Solution:

Steps to construct:

Step 1: Draw a line segment $AB = 4\text{cm}$.

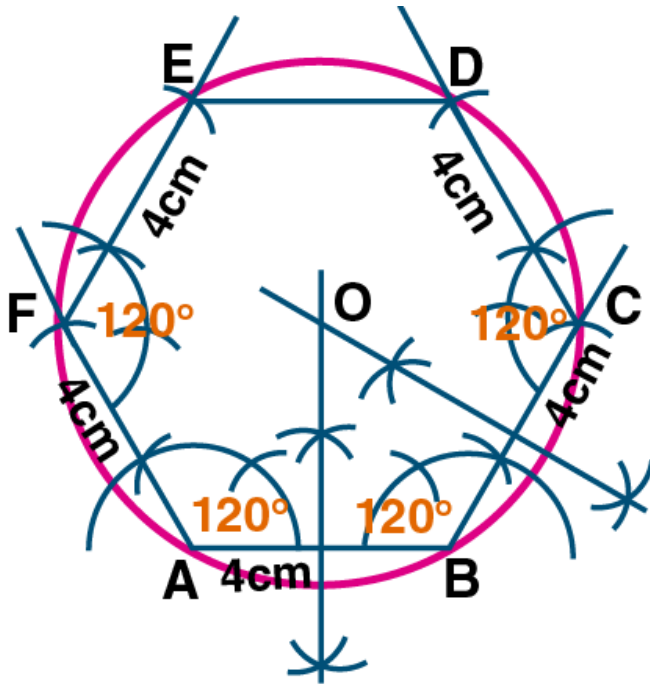
Step 2: At points A and B draw rays making an angle of 120° each and cut off $AF = BC = 4\text{cm}$.

Step 3: At point C and F draw rays making an angle of 120° each and cut off $FE = CD = 4\text{cm}$.

Step 4: Join ED. The required ABCDEF hexagon is formed.

Step 5: Draw perpendicular bisectors of sides AB and BC intersecting each other at point O.

Step 6: With O as the center and radius equal OA or OB draw a circle which passes through the vertices of the hexagon.



10. Draw a regular hexagon of side 4 cm and construct its incircle.

Solution:

Steps to construct:

Step 1: Draw a regular hexagon of sides 4cm.

Step 2: Draw the angle bisector of A and B, which intersect each other at point O.

Step 3: Draw OL perpendicular to AB.

Step 4: With O as the center and radius OB, draw a circle which touches the sides of the hexagon.

