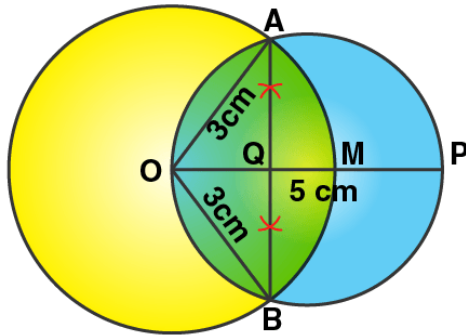


Exercise 19

Page No: 292

1. Draw a circle of radius 3 cm. Mark a point P at a distance of 5 cm from the centre of the circle drawn. Draw two tangents PA and PB to the given circle and measure the length of each tangent.

Solution:



Steps of construction:

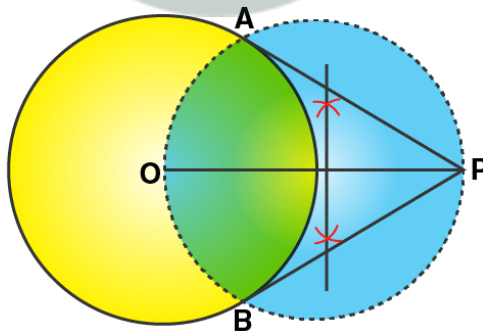
- i) Draw a circle with centre O and radius 3 cm.
- ii) Take a point P from O, such that $OP = 5$ cm.
- iii) Now, draw a bisector of OP which intersects OP at M.
- iv) With centre M, and radius OM, draw a circle which intersects the given circle at A and B.
- v) Join AP and BP.

Thus, AP and BP are the required tangents.

On measuring, we get $AP = BP = 4$ cm.

2. Draw a circle of diameter of 9 cm. Mark a point at a distance of 7.5 cm from the centre of the circle. Draw tangents to the given circle from this exterior point. Measure the length of each tangent.

Solution:



Steps of construction:

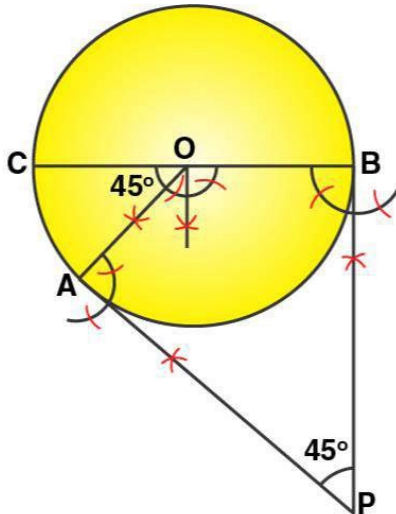
- i) Taking O as the centre, draw a circle of diameter 9 cm (radius = 4.5 cm).
- ii) Mark a point P outside the circle, such that $PO = 7.5$ cm.
- iii) Taking OP as the diameter, draw a circle such that it cuts the earlier circle at A and B.
- iv) Now, join PA and PB.

Hence, PA and PB are required tangents.

On measuring, we get $PA = PB = 6$ cm.

3. Draw a circle of radius 5 cm. Draw two tangents to this circle so that the angle between the tangents is 45° .

Solution:

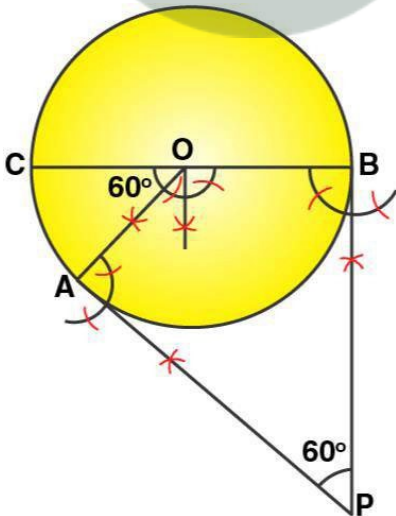


Steps of construction:

- i) With centre O, draw a circle with radius $BC = 5$ cm
- ii) Draw arcs making an angle of $180^\circ - 45^\circ = 135^\circ$ at O such that $\angle AOB = 135^\circ$
- iii) At A and B, draw two rays making an angle of 90° at each point which meet each other at point P, outside the circle.
- iv) Then, AP and BP are the required tangents which make an angle of 45° with each other at P.

4. Draw a circle of radius 4.5 cm. Draw two tangents to this circle so that the angle between the tangents is 60° .

Solution:



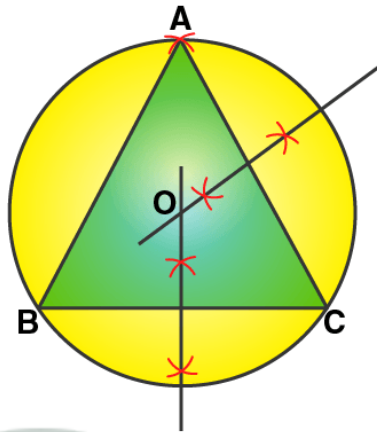
Steps of Construction:

- i) With centre O, draw a circle with radius $BC = 4.5$ cm
- ii) Draw arcs making an angle of $180^\circ - 60^\circ = 120^\circ$ at O such that $\angle AOB = 120^\circ$

Chapter 19: Constructions (Circles)

- iii) At A and B, draw two rays making an angle of 90° at each point which meet each other at point P, outside the circle.
iv) Then, AP and BP are the required tangents which make an angle of 60° with each other at P.

5. Using ruler and compasses only, draw an equilateral triangle of side 4.5 cm and draw its circumscribed circle. Measure the radius of the circle.



Solution:

Steps of construction:

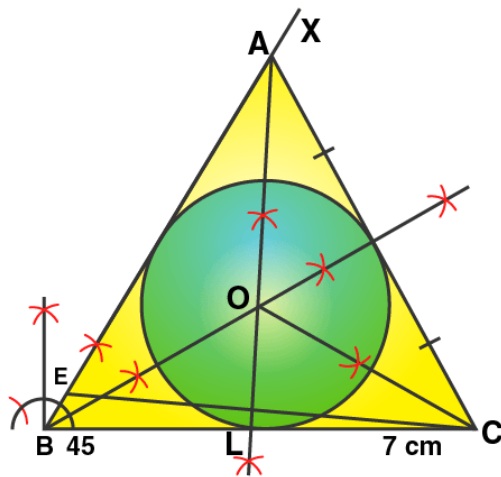
- Draw a line segment $BC = 4.5$ cm
- With centres B and C, draw two arcs of radius 4.5 cm which intersect each other at A.
- And join AC and AB.
- Draw the perpendicular bisectors of AC and BC which intersect each other at O.
- With centre O, and radius OA or OB or OC draw a circle which will pass through A, B and C. Then, this is the required circumcircle of triangle ABC.

On measuring the radius, we get $OA = 2.6$ cm

6. Using ruler and compasses only.

- Construct triangle ABC, having given $BC = 7$ cm, $AB - AC = 1$ cm and $\angle ABC = 45^\circ$.
- Inscribe a circle in the $\triangle ABC$ constructed in (i) above.

Solution:



Steps of construction:

i) Construction of triangle:

- Draw a line segment $BC = 7$ cm
- At B, draw a ray BX making an angle of 45° and cut off $BE = AB - AC = 1$ cm
- Join EC and draw the perpendicular bisector of EC intersecting BX at A.
- Finally, join AC.

Thus, $\triangle ABC$ is the required triangle.

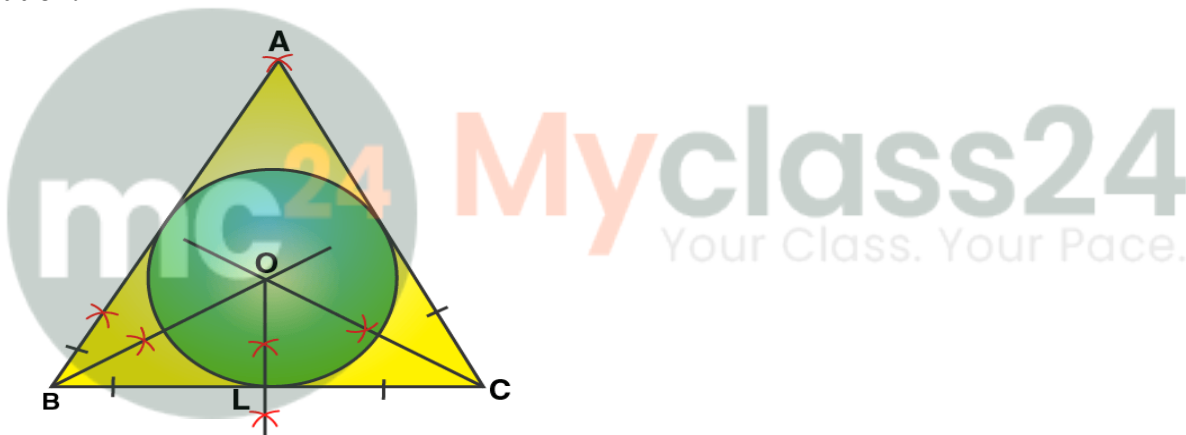
ii) Construction of incircle:

- Draw the angle bisectors of $\angle ABC$ and $\angle ACB$ which intersect each other at O.
- From O, draw perpendicular OL to BC.
- With O as centre and OL as radius draw a circle which touches the sides of the $\triangle ABC$. This is the required in-circle of $\triangle ABC$.

On measuring, we get the radius $OL = 1.8$ cm

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

Solution:



Steps of Construction:

- Draw a line segment $BC = 5$ cm
- With centres as B and C, draw two arcs of radius 5 cm each which intersect each other at A.
- Then, join AB and AC.
- Draw angle bisectors of $\angle B$ and $\angle C$ which intersect each other at O.
- Draw $OL \perp BC$, from O.
- Now with centre O and radius OL, draw a circle which will touch the sides of $\triangle ABC$.

On measuring the radius, we have $OL = 1.4$ cm.

8. Using ruler and compasses only,

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

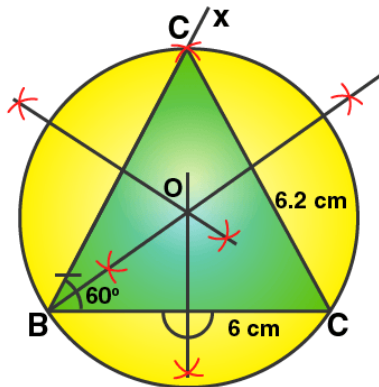
Base $AB = 6$ cm, $BC = 6.2$ cm and $\angle CAB = 60^\circ$

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

(iii) Draw a perpendicular from O to AB which meets AB in D.

(iv) Prove that $AD = BD$

Solution:



Steps of construction:

- i) Draw a line segment $AB = 6$ cm
 - ii) Draw a ray at A, making an angle of 60° with BC.
 - iii) With B as centre and radius = 6.2 cm draw an arc which intersects AX ray at C.
 - iv) Join BC.
- Then, $\triangle ABC$ is the required triangle.
- v) Draw the perpendicular bisectors of AB and AC intersecting each other at O.
 - vi) With centre O, and radius as OA or OB or OC, draw a circle which will pass through A, B and C.
 - vii) From O, draw $OD \perp AB$.

Proof: In right $\triangle OAD$ and $\triangle OBD$

$$OA = OB \quad [\text{Radii of same circle}]$$

$$OD = OD \quad [\text{Common}]$$

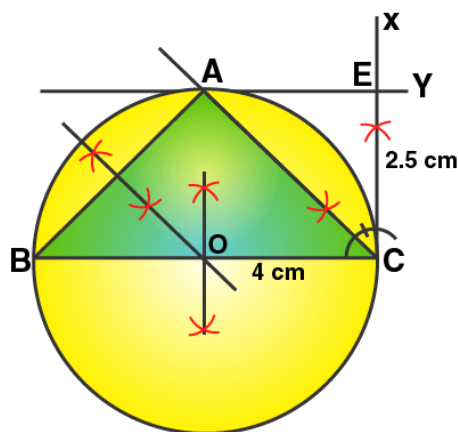
$\triangle OAD \cong \triangle OBD$ by RHS congruence criterion.

Hence, by CPCT

$$AD = BD$$

9. Using ruler and compasses only construct a triangle ABC in which $BC = 4$ cm, $\angle ACB = 45^\circ$ and perpendicular from A on BC is 2.5 cm. Draw a circle circumscribing the triangle ABC.

Solution:



Steps of Construction:

- i) Draw a line segment $BC = 4$ cm.
 - ii) At C , draw a perpendicular line CX and from it, cut off $CE = 2.5$ cm.
 - iii) Draw another perpendicular line EY from E .
 - iv) From C , draw a ray making an angle of 45° with CB , which intersects EY at A .
 - v) Join AB .
- Then, $\triangle ABC$ is the required triangle.
- vi) Draw perpendicular bisectors of sides AB and BC intersecting each other at O .
 - vii) With centre O , and radius OB , draw a circle which will pass through A , B and C .
- On measuring, we have the radius $OB = OC = OA = 2$ cm.

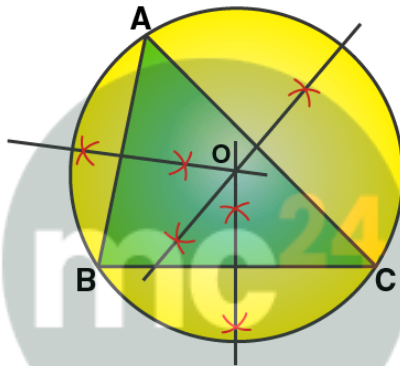
10. Perpendicular bisectors of the sides AB and AC of a triangle ABC meet at O .

(i) What do you call the point O ?

(ii) What is the relation between the distances OA , OB and OC ?

(iii) Does the perpendicular bisector of BC pass through O ?

Solution:



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- i) O is called the circumcentre of circumcircle of $\triangle ABC$.
- ii) OA , OB and OC are the radii of the circumcircle.
- iii) Yes, the perpendicular bisector of BC will pass through O .

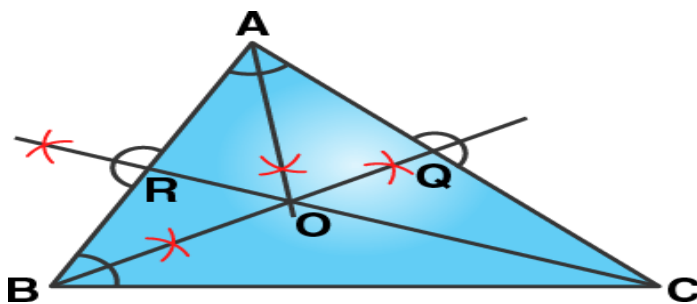
11. The bisectors of angles A and B of a scalene triangle ABC meet at O .

i) What is the point O called?

ii) OR and OQ are drawn perpendiculars to AB and CA respectively. What is the relation between OR and OQ ?

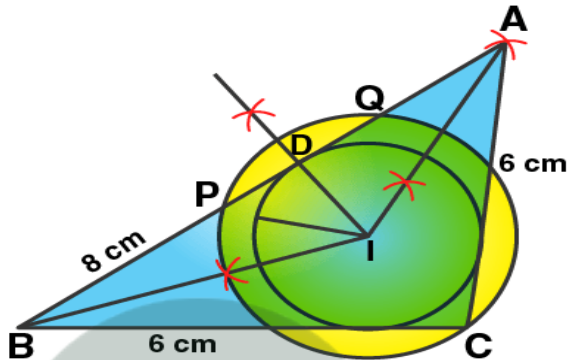
iii) What is the relation between angle ACO and angle BCO ?

Solution:



- i) O is called the incentre of the incircle of $\triangle ABC$.
 - ii) OR and OQ are the radii of the incircle and $OR = OQ$.
 - iii) OC is the bisector of angle C
- Thus, $\angle ACO = \angle BCO$

- 12. i) Using ruler and compasses only, construct a triangle ABC in which $AB = 8$ cm, $BC = 6$ cm and $CA = 5$ cm.**
- ii) Find its incentre and mark it I.**
- iii) With I as centre, draw a circle which will cut off 2 cm chords from each side of the triangle.**
- Solution:**



Steps of construction:

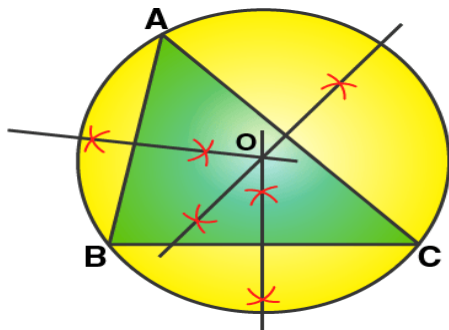
- i) Draw a line segment $BC = 6$ cm.
- ii) Draw an arc with centre B and radius 8 cm.
- iii) Draw another arc with centre C and radius 5 cm which intersects the first arc at A.
- iv) Join AB and AC.

Thus, $\triangle ABC$ is the required triangle.

- v) Draw the angle bisectors of $\angle B$ and $\angle A$ which intersect each other at I. Then I is the incentre of the triangle ABC.
- vi) Through I, draw $ID \perp AB$.
- vii) Now from D, cut off $DP = DQ = 2/2 = 1$ cm
- viii) With centre I, and radius IP or IQ, draw a circle which will intersect each side of triangle ABC cutting chords of 2 cm each.

- 13. Construct an equilateral triangle ABC with side 6 cm. Draw a circle circumscribing the triangle ABC.**

Solution:

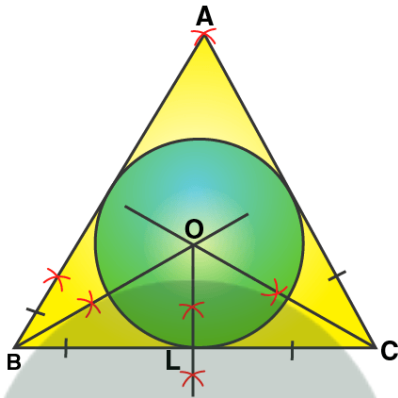


Steps of construction:

- i) Draw a line segment $BC = 6$ cm
- ii) Draw two arcs of radius 6 cm with centres B and C, which intersect each other at A.
- iii) Then, join AC and AB.
- iv) Draw perpendicular bisectors of AC, AB and BC intersecting each other at O.
- v) Draw a circle with centre O, and radius OA or OB or OC which will pass through A, B and C. Then, this is the required circumcircle of triangle ABC.

14. Construct a circle, inscribing an equilateral triangle with side 5.6 cm.

Solution:



Steps of Construction:

- i) Draw a line segment $BC = 5.6$ cm
- ii) With centres B and C, draw two arcs of 5.6 cm radius each which intersect each other at A.
- iii) And, join AB and AC.
- iv) Draw angle bisectors of $\angle B$ and $\angle C$ which intersect each other at O.
- v) From O, draw $OL \perp BC$.
- vi) Now with centre O and radius OL, draw a circle which will touch the sides of $\triangle ABC$. Thus, this is the required circle.