Chapter 16
Constructions

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 =7cm.

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 4 cm and mark that point as A.
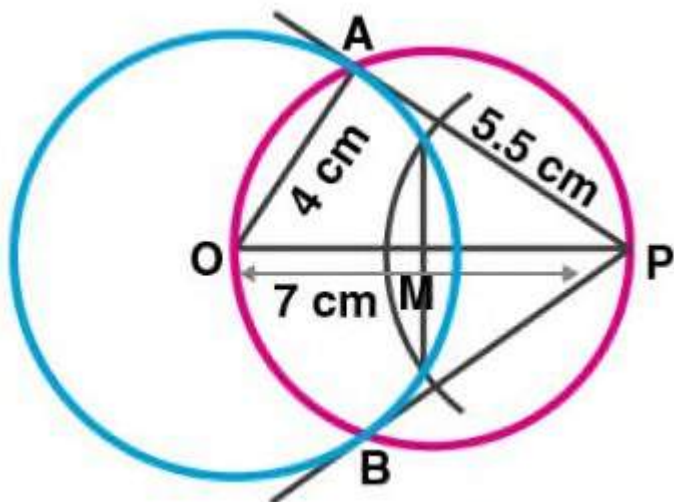
Step 2: Take a point P such that OP = 7 cm.

Step 3: Bisect OB at M.

Step 4 : With center M and diameter OP, draw another circleintersecting that 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 5.5 cm.

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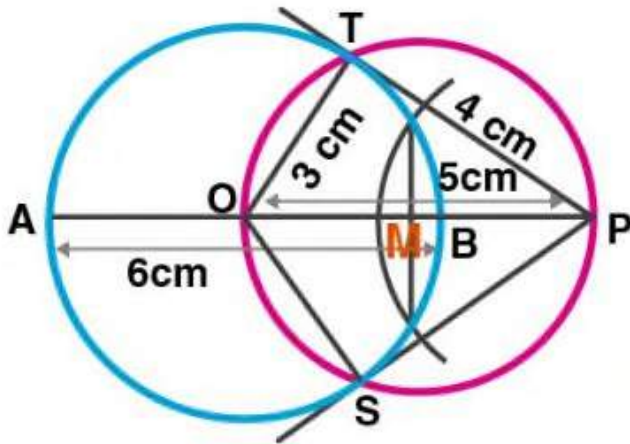
3. Construct a tangent to a circle of radius 4cm from a point on the concentric circle of radius 6 cm and measure its length. Also, verify the measurement by actual calculation.
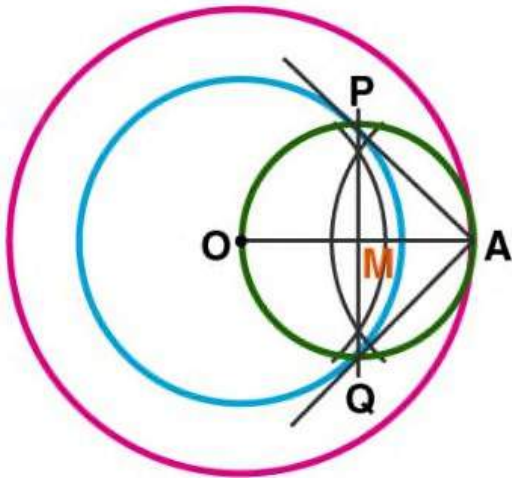
Solution:

Steps to construct :

Step 1 : Mark a point O.

Step 2 : With center O and radius 4 cm and 6 cm, 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 7cm from its centre. Draw tangents to the circle from tthese two points P and Q.

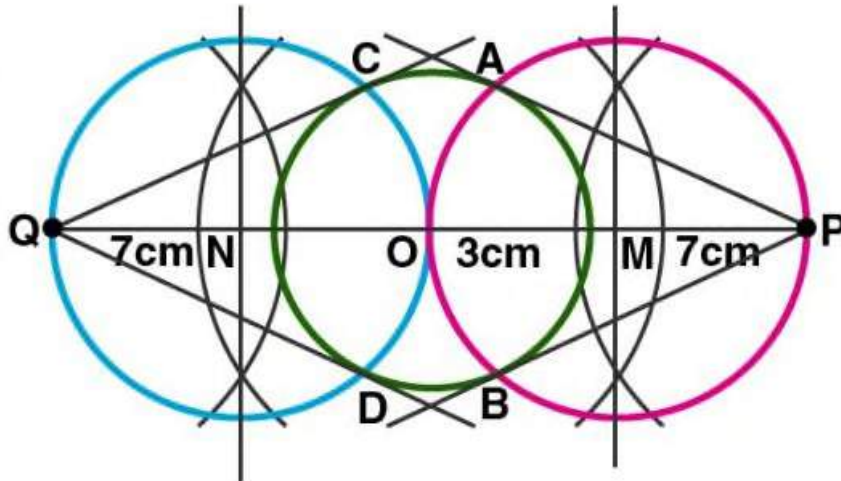**Solution:**

Steps to construct :

Step 1 : Consider a point O one 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 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 8cm. 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.
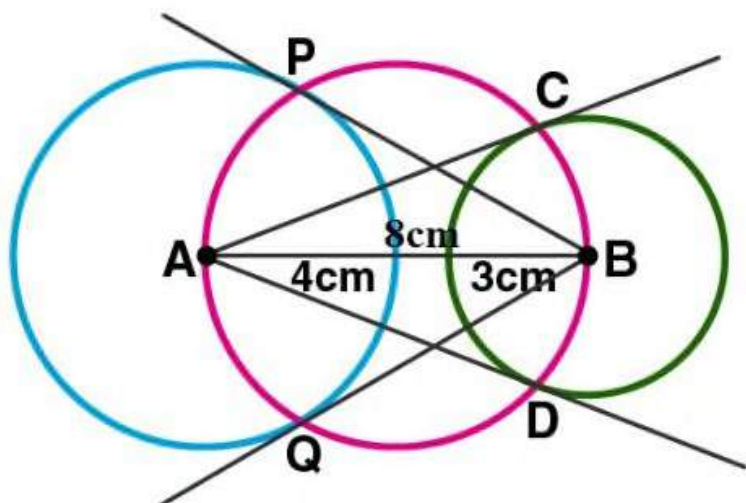
Solution:

Steps to construct :

Step 1 : Draw a line segment AB = 8 cm.

Step 2 : With center as A and radius 4cm, 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 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.
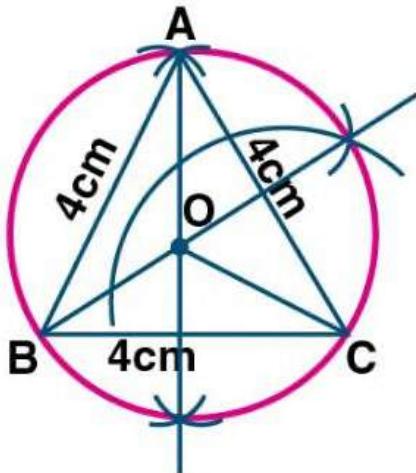
2. Using a ruler and a pair of compasses only, construct :

(i) A triangle ABC given AB = 4cm, BC = 6 cm and $\angle ABC = 90°$.

(ii) A circle which passes through the points A, B and C and mark its centre as O.
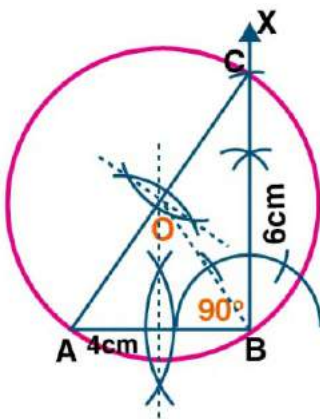
Solution:
Steps to construct :

Step 1 : Draw a line segment AB = 4 cm.

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

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 cm.

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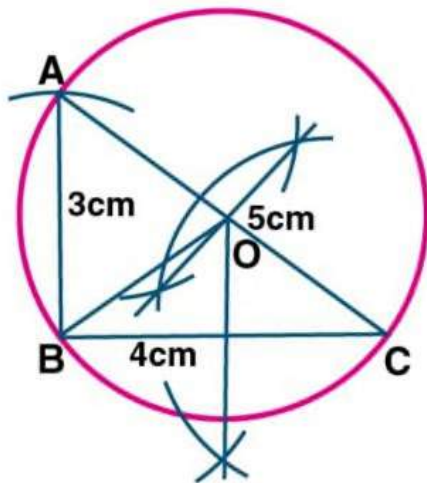
Step 3 : Join AB and AC.

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 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 $\angle CAB = 60°$

(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 :

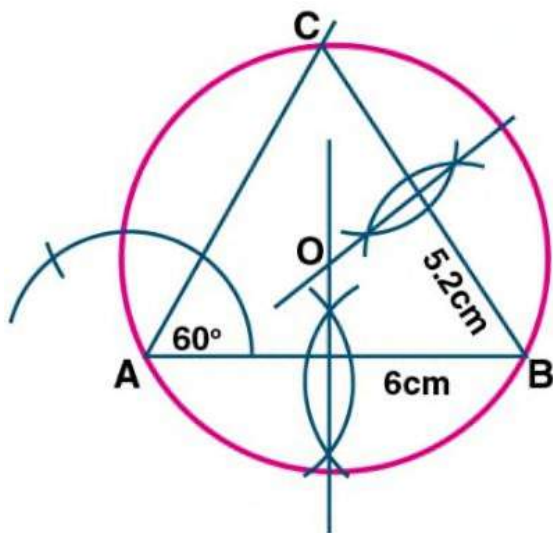**Step 1 :** Draw a line segment AB = 6cm.

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

Step 3 : With B as the center and radius 5.2 cm, 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 intersects 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 cm.

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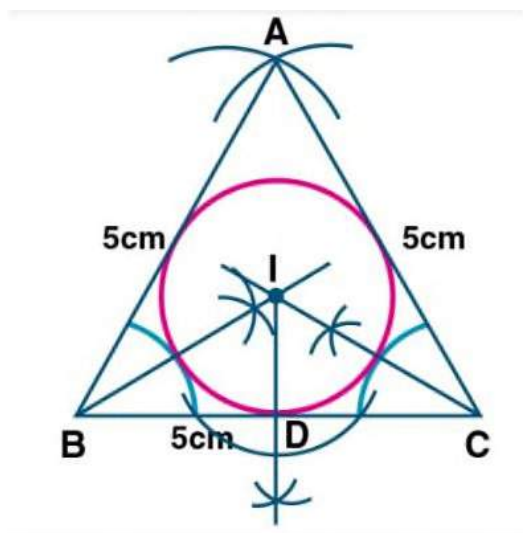
Step 3 : Join AB and AC.

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 cm (approx).

6. (i) Conduct a triangle ABC with BC = 6.4 cm, CA = 5.8 cm and ∠ABC = 60˚. Draw its incircle. Measure and record the radius of the incircle.
(ii) Construct a ∆ABC with BC = 6.5 cm, AB = 5.5 cm, AC = 5cm. Construct the incircle of the triangle. Measure and record the radius of the incircle.
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.
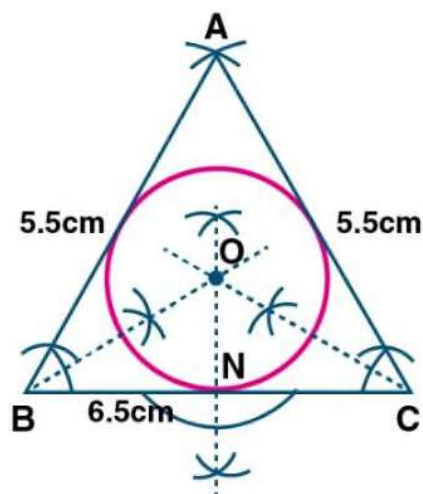**Step 4 :** Join AC.
Step 5 : Draw the angle bisector of angle B and angle C which intersect each other at pooint O.
Step 6 : Draw OE perpendicular to BC, intersecting BC at point E.
Step 7 : With O as the center and OE as the radius draw the required incircle.
Step 8 : On measuring the radious OE = 1.5 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 ?
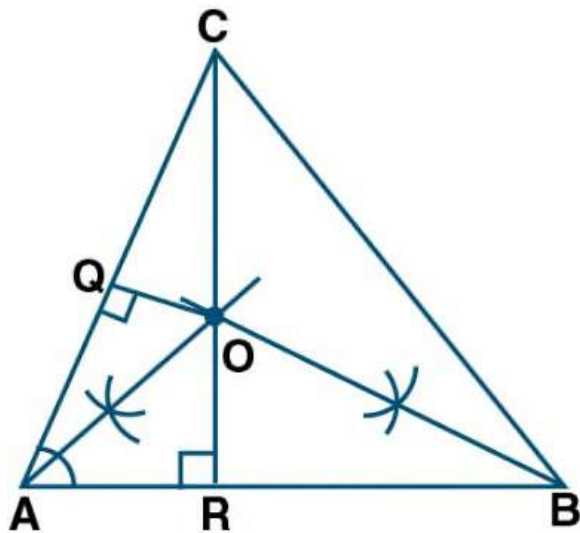
(iii) What is the relation between $\angle ACO$ and $\angle BCO$?

Solution :

(i) The Point O where the angle bisector 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, $\angle ACB = 45°$ 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.
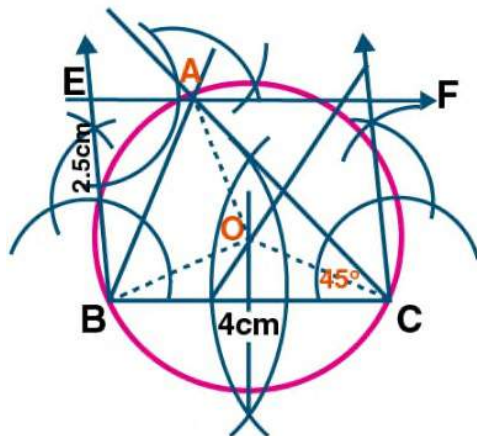
Step 5 : Join AB.

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 cm.

Step 2 : At points A and B draw rays making on angle of $120^°$ each and cutt off AF = BC = 4 cm.

Step 3 : At point C and F draw rays making on angle of $120^°$ each and cut off FE = CD = 4 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 verices of the hexagon.
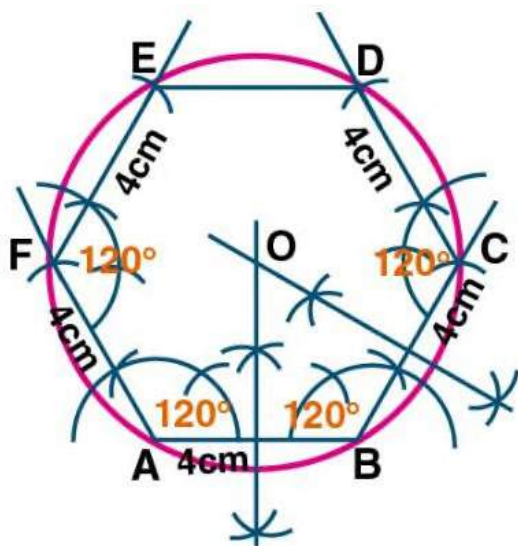
10. Draw a regular hexagon of side 4 cm and construct its incircle.

Solution :

Steps to construct :

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

Step 2 : Draw the angle bisector of A and B. which intersects 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 touched the sides of the hexagon.