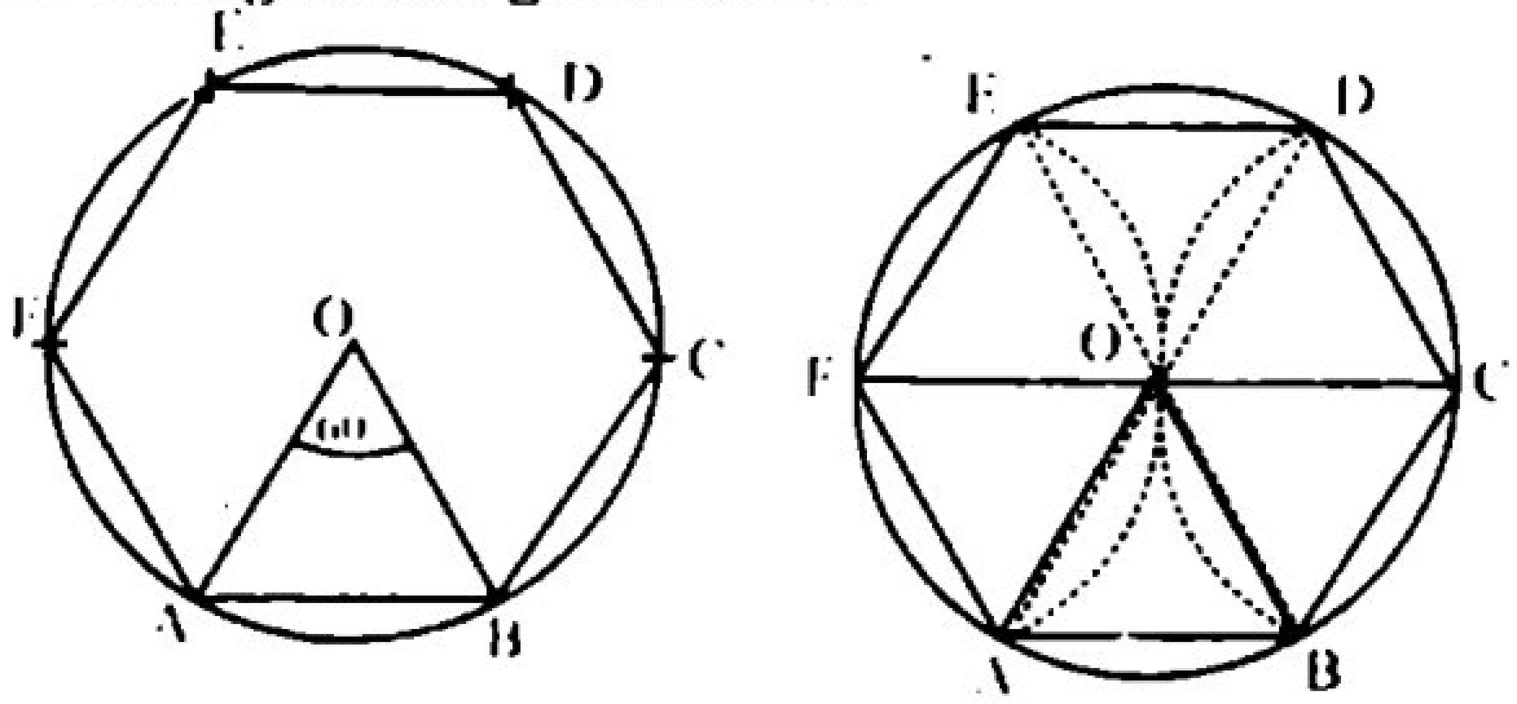
S, T and U respectively.

6. Thus PQRSTU is the circumscribed regular hexagon.

Inscribe a regular hexagon in a given circle.



Given:

A circle, with centre at O.

Steps of Construction:

1. Take any point A on the circle and point with O.
2. From point A, draw an arc of radius $\overline{AO}$ which intersects the circle at points B and F.
3. Join (O and A with points B and F.
4. ΔOAB and ΔOAF are equilateral therefore $\angle AOB$ and $\angle AOF$ are of measure $60°$ i.e., $m\overline{AO} = m\overline{AB} = m\overline{AF}$.
5. Produce $\overline{FO}$ to meet the circle at C. Join B to C. Since in $\angle BOC = 60°$ therefore $m\overline{BC} = m\overline{OA}$.
6. From C and F, draw arcs of radius $\overline{OA}$, which intersect the circle at points D and E.
7. Join C to D, D to E and E' to F ultimately. We have $m\overline{OA} = m\overline{OB} = m\overline{OC} = m\overline{OD} = m\overline{OE} = m\overline{OF}$

   Thus the figure ABCDEF is a regular hexagon inscribed in the circle.

SOLVED EXERCISE 13.2

1. Circumscribe a circle about a triangle ABC with sides

$|\overline{AB}| = 6$ cm , $|\overline{BC}| = 3$cm , $|\overline{CA}| = 4$cm

Also measure its circum radius.

Solution:

Given:

Three sides

$|\overline{AB}| = 6$cm, $|\overline{BC}| = 3$cm, $|\overline{CA}| = 4$cm.

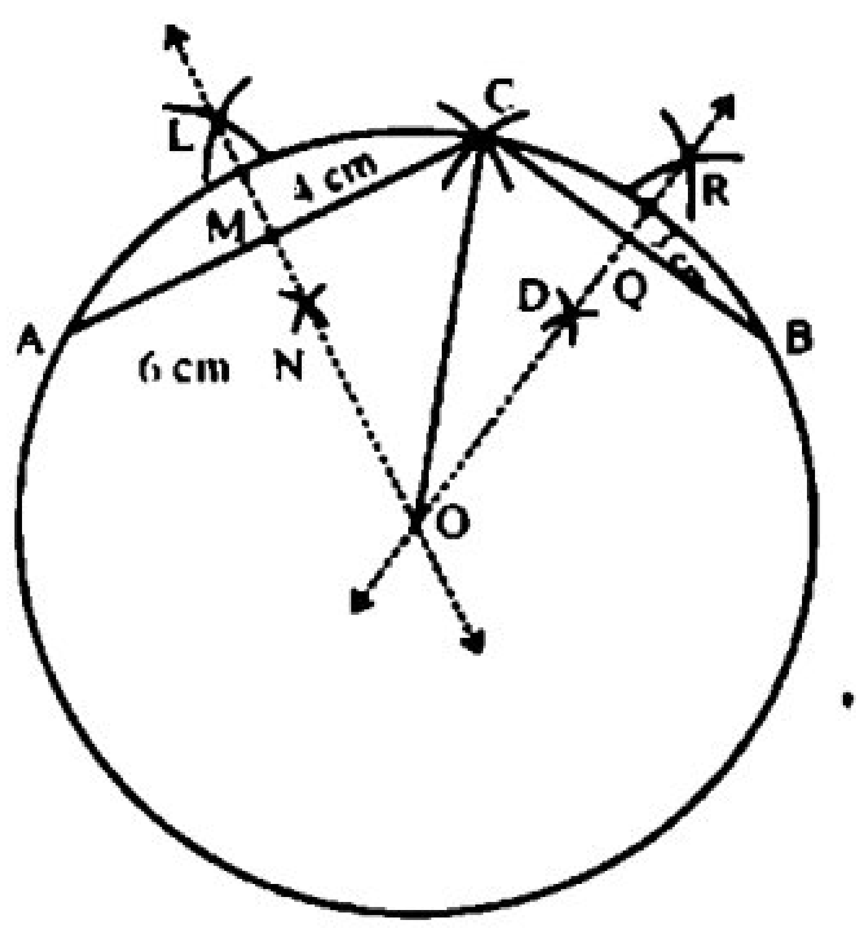
Required:

To construct a circumscribed circle about a triangle using given informations.

Steps of Construction:

1. Draw a line segment |AB| = 6cm
2. With centre at A, draw an arc of radius 4cm.
3. With centre at B, draw an arc of radius 3cm which cuts the previous are at point C.
4. Join C with A and B.
5. Thus ABC is the required triangle.
6. Draw $\overline{LMN}$ as perpendicular bisector of side $\overline{AB}$.
7. Draw $\overline{PQR}$ as perpendicular bisector of side $\overline{BC}$.
8. $\overline{LN}$ and $\overline{PR}$ intersect at point O.
9. With centre O and radius m$\overline{OA}$ = $\overline{OB}$ = m$\overline{OC}$, draw a circle.
10. This circle will pass through A, B and C where as O is circum center of the circumscribed circle

    Here m $\overline{OA}$ = m $\overline{OB}$ = m $\overline{OC}$ = 3.3 cm.



2. Inscribe a circle in a triangle ABC with sides. |$\overline{AB}$| = 5 cm, |$\overline{BC}$| = 3 era, |$\overline{CA}$| = 3 cm. Also measure its in-radius.

Solution:

Given:

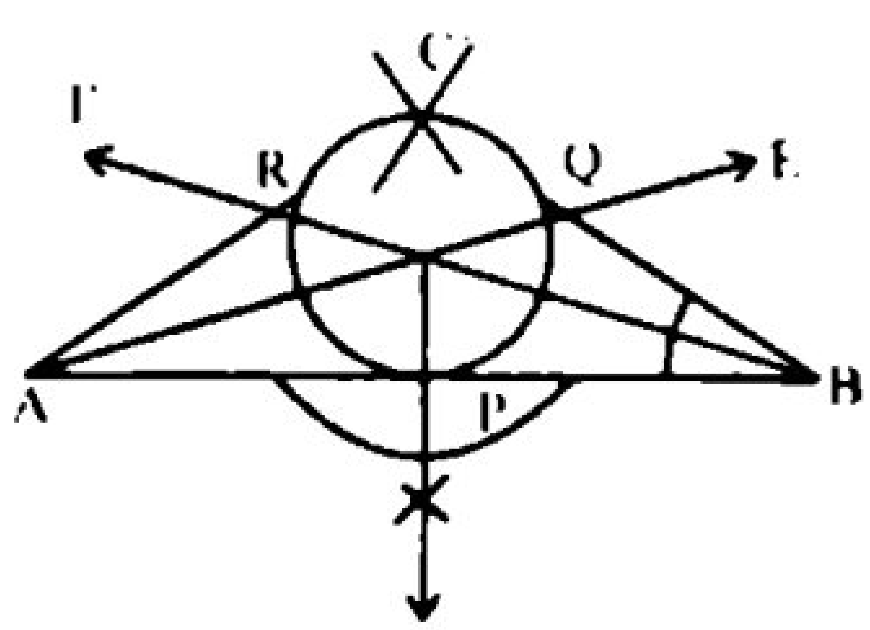
Three sides
|AB| = 6cm, |BC| = 3cm, |CA| = 4cm.

Required:

To construct an inscribed circle about a triangle using given informations.

Steps of Construction:

1. Draw a line segment |$\overline{AB}$| = 5cm
2. With centre at A, draw an arc of radius 3cm.
3. With centre at B, draw an arc of radius 3cm which cuts the previous are at point C.
4. Join C with A and B.
5. Thus ABC is the required triangle.
6. Draw $\overline{AE}$ and $\overline{BF}$ to bisect the angles BAC and ABC.
7. O is the centre of the inscribed circle.
8. From O draw $\overline{OP}$ perpendicular to $\overline{BC}$.



9. With centre O and radius $\overline{OP}$ draw a circle.
10. This circle is the inscribed circle of triangle ABC.

    Here $m\overline{OP} = m\overline{OQ} = m\overline{OR}$ = 1 cm (approximately).

3. Describe a circle opposite to vertex A to a triangle ABC with sides $|\overline{AB}| = 6$ cm, $|\overline{BC}| = 4$ cm, $|\overline{CA}| = 3$ cm. Find its radius also.

Solution:

Given:

Three sides

$|\overline{AB}| = 6cm, |\overline{BC}| = 4cm, |\overline{CA}| = 3cm$

Required:

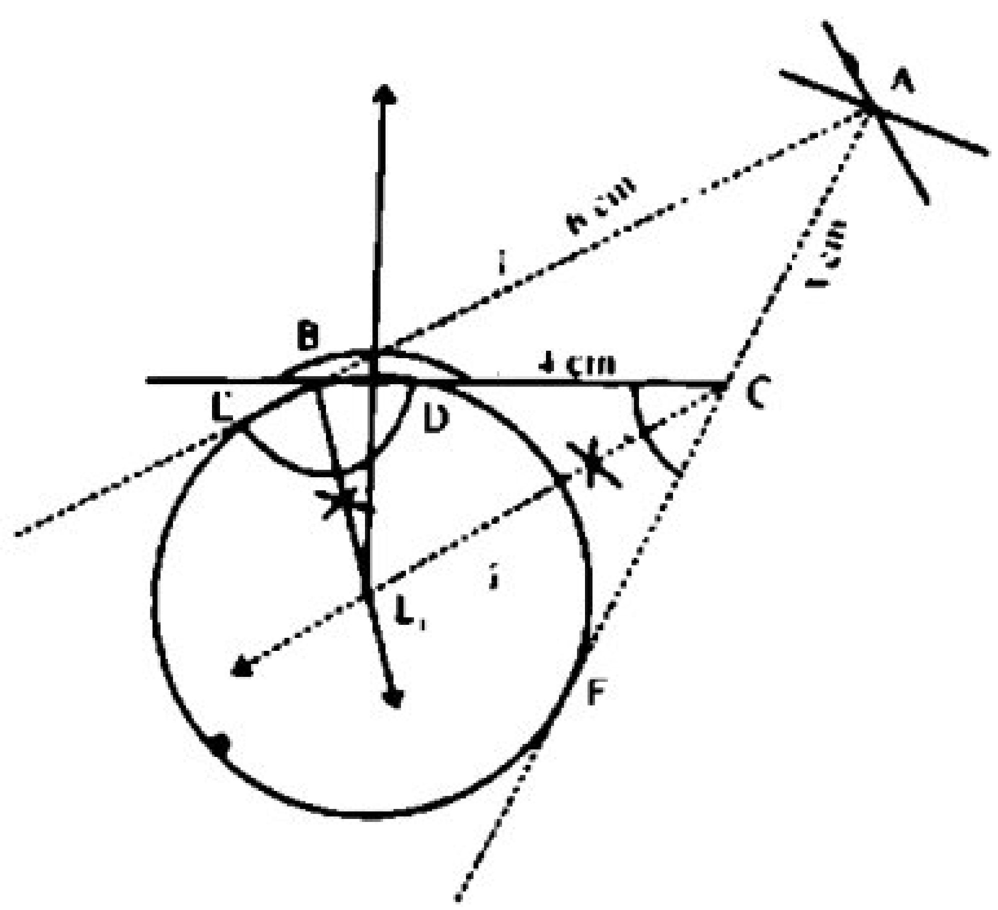
To construct an scribe circle opposite to vertex A to a triangle using given informations.

Steps of Construction:

1. Draw a line segment $|\overline{BC}| = 4cm$.
2. With centre at B, draw an arc of 6cm.
3. With centre at c, draw an arc of 3cm which cuts the previous are at point A.
4. Join A with B and C.
5. Thus ABC is the required triangle.
6. Produce the sides AB and BC of ΔABC.
7. Draw bisectors of exterior angles ABC and ACB.

   These bisectors of exterior angles meet at I.
8. From I, draw perpendicular an side BC of ΔABC.

   Which I, D intersect BC at D. I, D is the radius of the described circle with centre at I.
9. Draw the circle with radius I, D and centre at I, that will touch the side BC of the ΔABC externally and the produced sides AB and AC.



4. Circumscribe a circle about an equilateral triangle ABC with each side of length 4cm.

Solution:

Given:

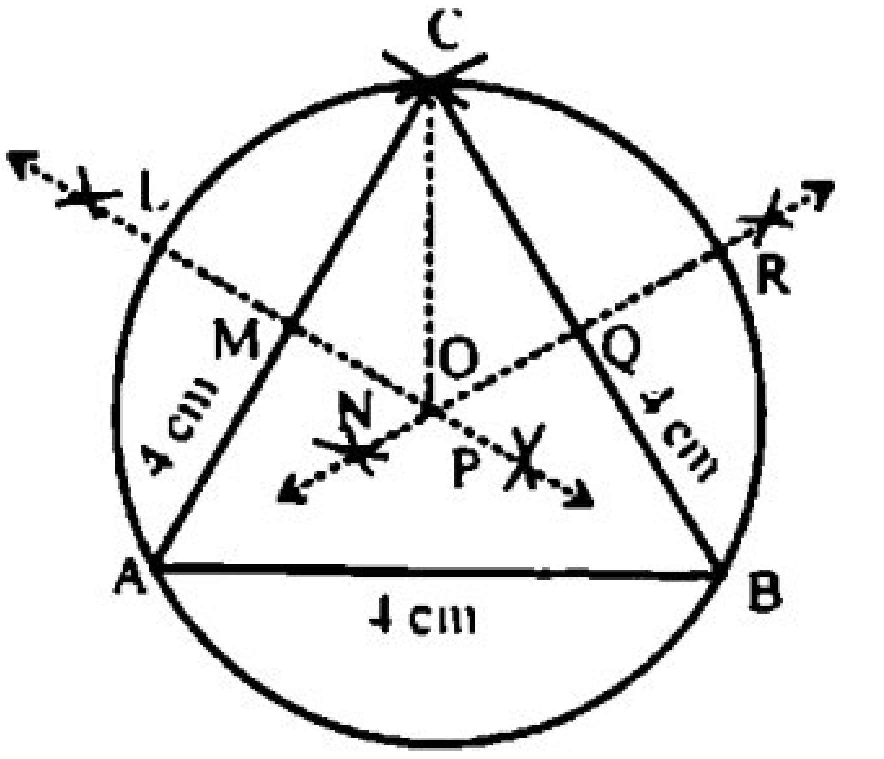
Equilateral triangle ABC with each side of length 4cm.

Required:

To construct a circumscribed circle about an equilateral triangle using given information.

Steps of Construction:

1. Draw a line segment |AB| = 4cm
2. With centre at A, draw an arc of radius 4cm.
3. With centre at B, draw an arc of radius 4cm which cuts the previous arc at point C.
4. Join C with A and B.
5. Thus $\overline{ABC}$ is the required triangle.
6. Draw $\overline{LMN}$ as perpendicular bisector to of side AC.
7. Draw $\overline{PQR}$ as perpendicular bisector of side $\overline{BC}$.
8. $\overleftrightarrow{LN}$ and $\overleftrightarrow{PQ}$ intersect at point O.
9. With centre at O and radius $m\overline{OA} = m\overline{OB} = m\overline{OC}$, draw a circle.
10. This circle will pass through A, B and C whereas O is circumvcenter of the circumscribed circle.



5. Inscribe a circle in an equilateral triangle ABC with each side of length 5cm.

Solution:

Given:

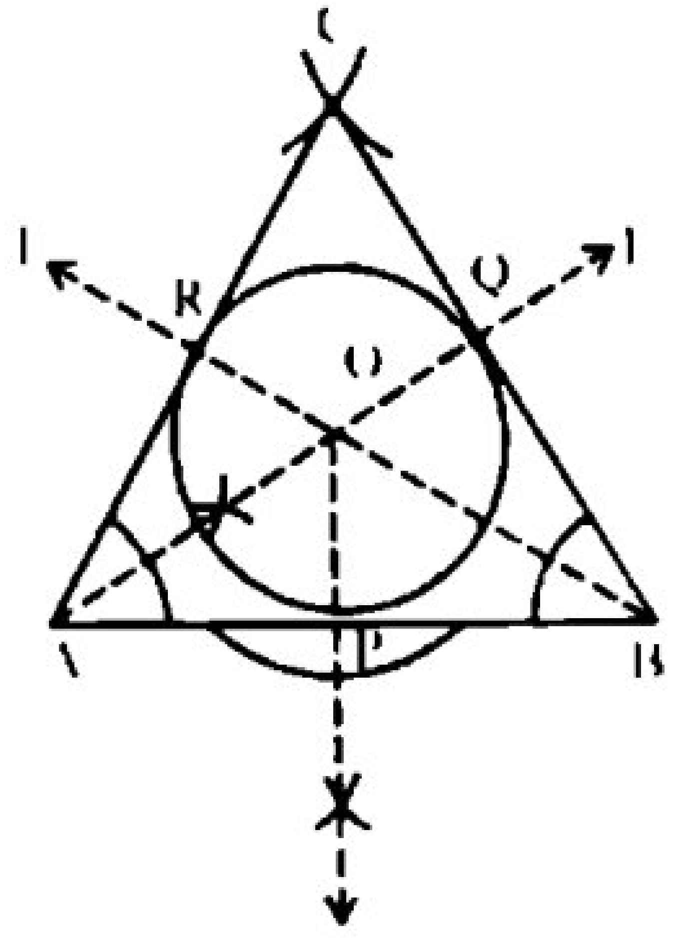
Equilateral triangle ABC with each side of length 5 cm.

Required:

To construct an inscribed circle about a triangle using given informations.

Steps of Construction:

1. Draw a line segment $|\overline{AB}|$ = 5cm
2. With centre at A, draw an arc of radius 5cm.
3. With centre at B, draw an arc of radius 5cm which cuts the previous arc at point C.
4. Join C with A and B.
5. Thus ABC is the required triangle.
6. Draw $\overline{AE}$ and $\overrightarrow{BF}$ to bisect the angles BAC and ABC.
7. O is the centre of the inscribed circle.
8. From O draw $\overrightarrow{OP}$ perpendicular to $\overline{BC}$.
9. With centre O and radius $\overline{OP}$ draw a circle.
10. This circle is the inscribed circle of triangle ABC.



6. **Circumscribe and inscribe circles with regard to a right angle triangle with sides, 3cm, 4cm and 5cm.**

Solution:

Given:

Three sides

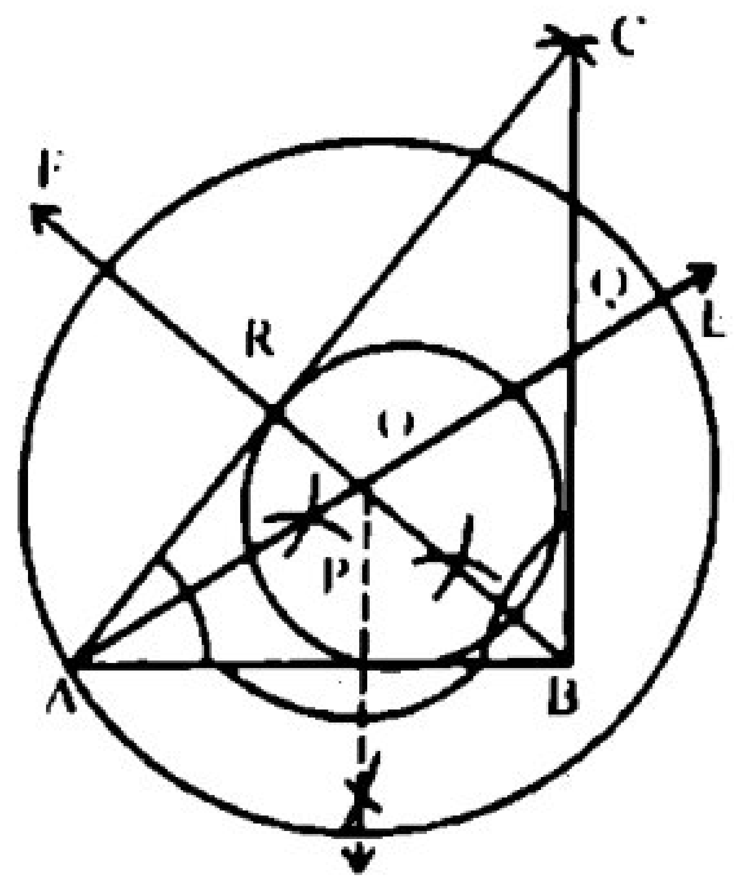
$|\overline{AB}| = 3cm$, $|\overline{BC}| = 4cm$, $|\overline{CA}| = 5cm$.

Required:

To construct an inscribed circle about a triangle using given information's.

Steps of Construction:

1. Draw a line segment |AB| = 3cm
2. With centre at A, draw an arc of radius 4cm.
3. With centre at B, draw an arc of radius 5cm which cuts the previous are at point C.
4. Join C with A and B.
5. Thus ABC is the required triangle.
6. Draw $\overrightarrow{AE}$ and $\overrightarrow{BF}$ to bisect the angles BAC and ABC.
7. O is the centre of the inscribed circle.
8. From O draw $\overline{OP}$ perpendicular to $\overline{BC}$.
9. With centre O and radius $\overline{OP}$ draw a circle.
10. This circle is the inscribed circle of triangle ABC.
11. Drop $\overline{OP} \perp AB$.
12. Take O as centre and draw a circle of radius $m\overline{OA}$. This circle passes through vertices A, B and C.
13. This circle is the circum scribe circle of triangle ABC.



7. **In and about a circle of radius 4cm describe a square.**

(i) In a circle of radius 4cm describe a square:

Solution:

Given:

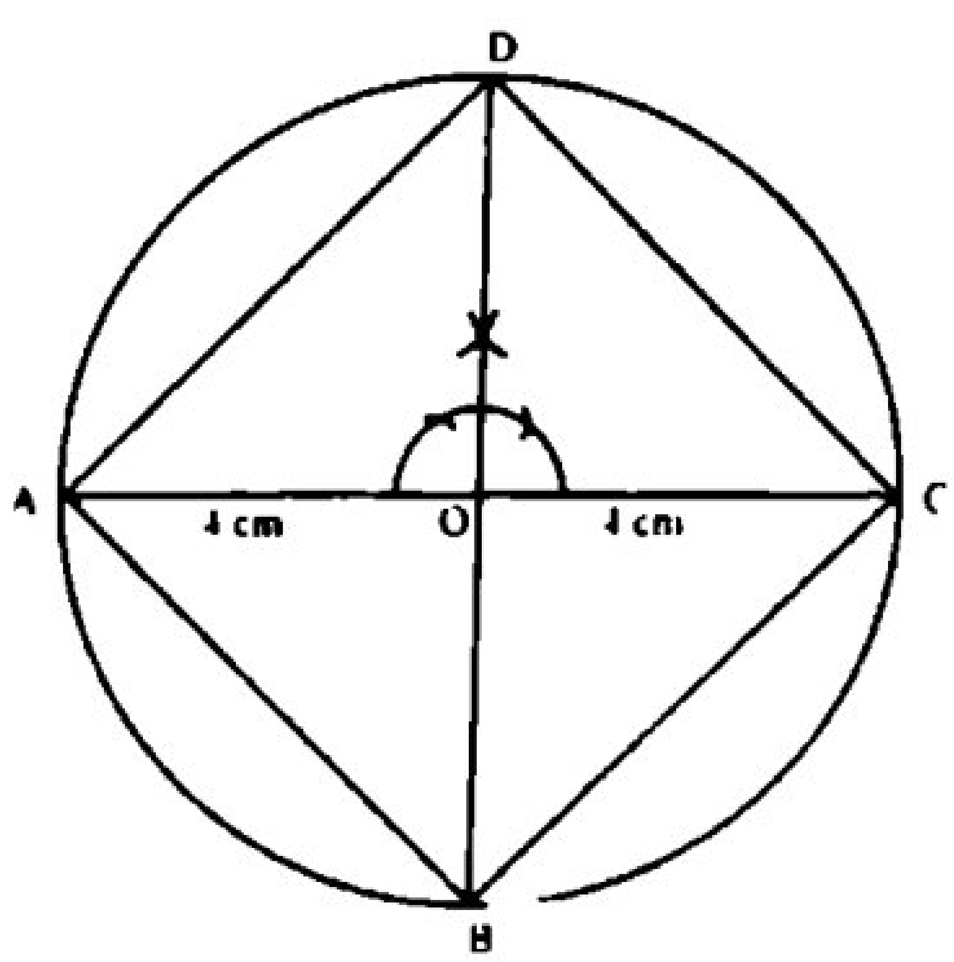
A circle of radius 4cm.

Required:

Draw a square inside the circle.

Steps of Construction:

1. Draw circle of radius 4cm with O as a centre.
2. Through O draw two diameters $\overline{AC}$ and $\overline{BD}$ which bisect each other at right angle.
3. Join A with B, B with C, C with D and D with A.



4. Thus ABCD is the required square inscribed in the circle.

(ii) Above a circle of radius 4cm describe a square:

Solution:

Given:

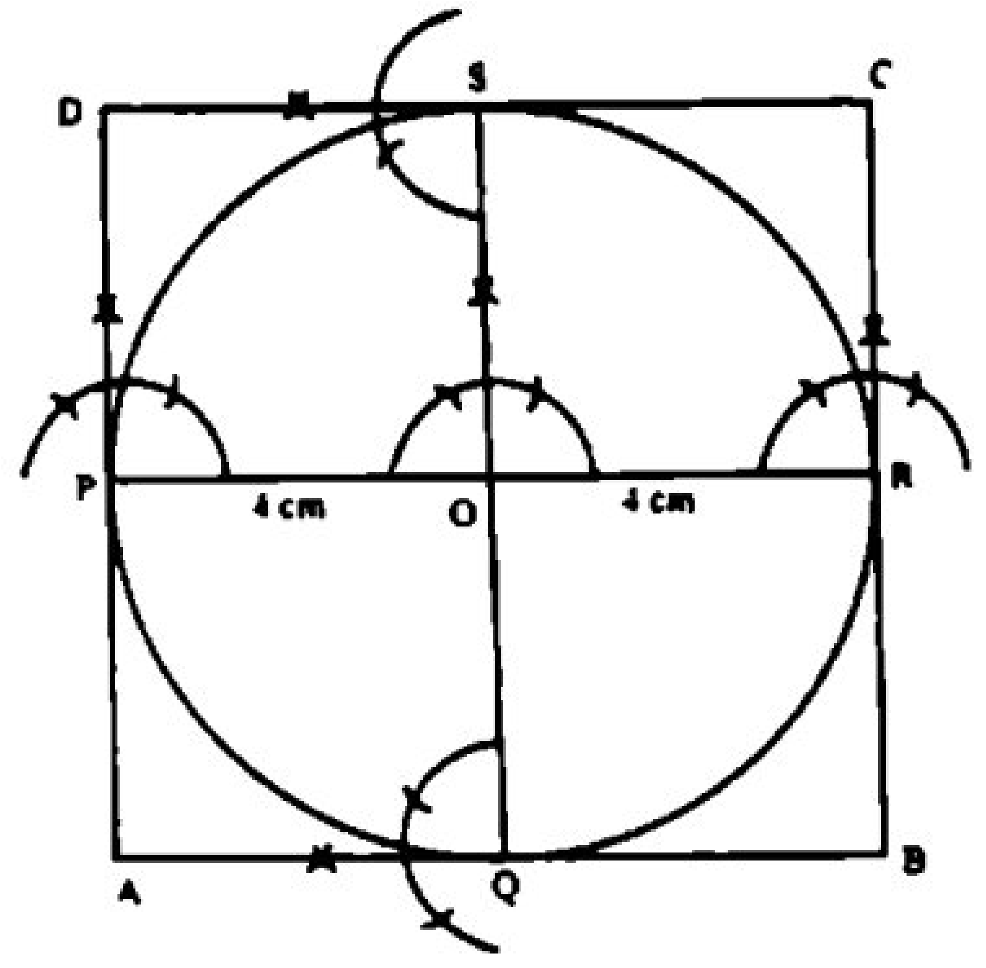
A circle of radius 4cm.

Required:

Draw a square inside the circle.

Steps of Construction:

1. Draw circle of radius 4cm with O as a centre.
2. Draw two diameters $\overline{PR}$ and $\overline{QS}$ which bisect each other at right angle.
3. At point P, Q, R and S draw tangents to meet each other at A, B, C and D. ABCD is the required circumscribed square.



8. In and about a circle of radius 3.5cm describe a regular hexagon.

(i) In a circle of radius 3.5 cm describe a square:

Solution:

Given:

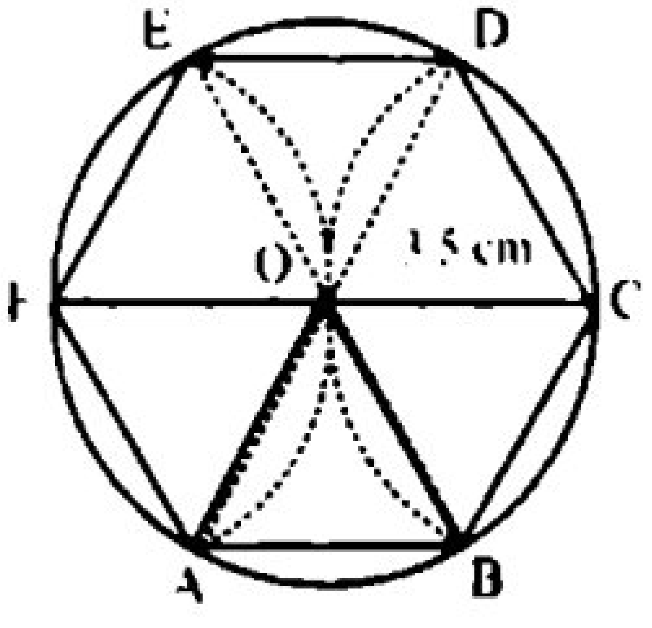
A circle of radius 3.5cm.

Required:

Draw a regular hexagon inside the circle.

Steps of Construction:

1. Take any point O.
2. Take O as centre of and draw a circle of radius 3.5 cm.
3. Take any point A on the circumference of the circle.
4. From point A, draw an arc of radius $\overline{OA}$ which intersects the circle at point B and F.
5. Join (O and A with points B and F.



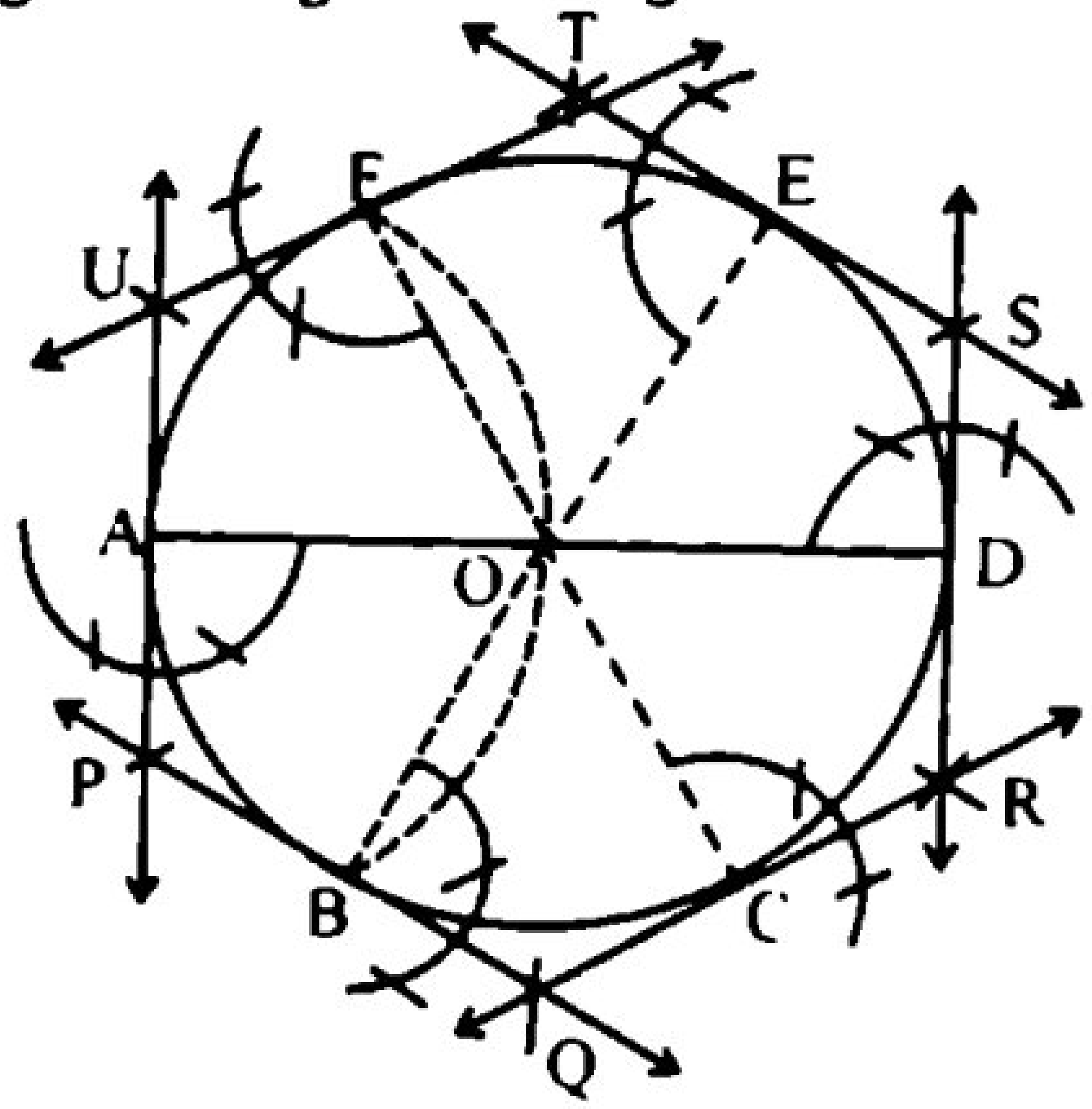
6. ΔOAB and ΔOAF are equilateral triangles therefore $\angle AOB$ and $\angle AOF$ are of measure $60°$ i.e., $m\overline{OA} = m\overline{AS} = m\overline{AF}$.

7. Produce $\overline{FO}$ to meet the circle at C. Join B to C, Since in $\angle BOC = 60°$ therefore $m\overline{BC} = m\overline{OA}$.

8. From C and F, draw arcs of radius $\overline{OA}$, which intersect the circle at points D and E.

9. Join C to D, D to E and F' to F ultimately. We have
$m\overline{OA} = m\overline{OB} = m\overline{OC} = m\overline{OD} = m\overline{OE} = m\overline{OF}$
Thus the figure ABCDEF is a regular hexagon inscribed in the circle.

(ii) Circumscribe a regular hexagon about a given circle.



Given:

A circle of radius 3.5 cm.

Steps of Construction:

1. Draw a diameter $\overline{AD} = 7$ cm.
2. From point A draw an arc of radius $\overline{AO} = 3.5$ cm(the radius of the circle), which cuts the circle at points B and F.
3. Join B with O and extend it to meet the circle at E.
4. Join F with O and extend it to meet the circle at C.
5. Draw tangents to the circle at points A, B, C, D, E and F intersecting one another at points P, Q, R, S, T and U respectively.
6. Thus PQRSTU is the circumscribed regular hexagon.

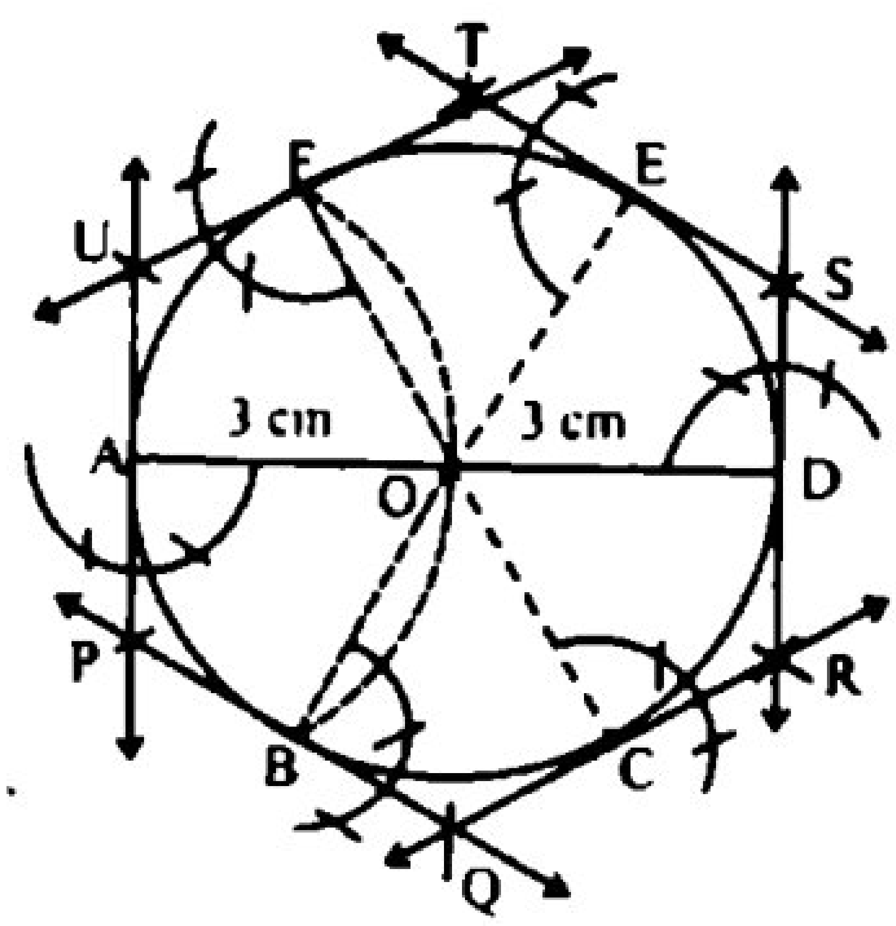
9. Circumscribe a regular hexagon about a circle of radius 3cm.

Given:

A circle of radius 3 cm.

Steps of Construction:

1. Draw a diameter $\overline{AD} = 6$ cm.
2. From point A draw an arc of radius $\overline{AO} = 3$ cm (the radius of the circle), which cuts the circle at points B and F.
3. Join B with O and extend it to meet the circle at E.
4. Join F with O and extend it to meet the circle at C.
5. Draw tangents to the circle at points A, B, C, D, E and F intersecting one another at points P, Q, R, S, T and U respectively.
6. Thus PQRSTU is the circumscribed regular hexagon.



SOLVED EXERCISE 13.3

1. In an arc ABC the length of the chord |BC| = 2cm. Draw a secant |PBC| = 8cm, where P is the point outside the arc. Draw a tangent through point P to the arc.

Steps of Construction:

(i) Draw an arc $\widehat{ABC}$

(ii) Take a chord $\overline{BC} = 2$cm.

(iii) Produce $\overline{CB}$ towards B and take point P that $\overline{PBC}$ secant in 8cm.

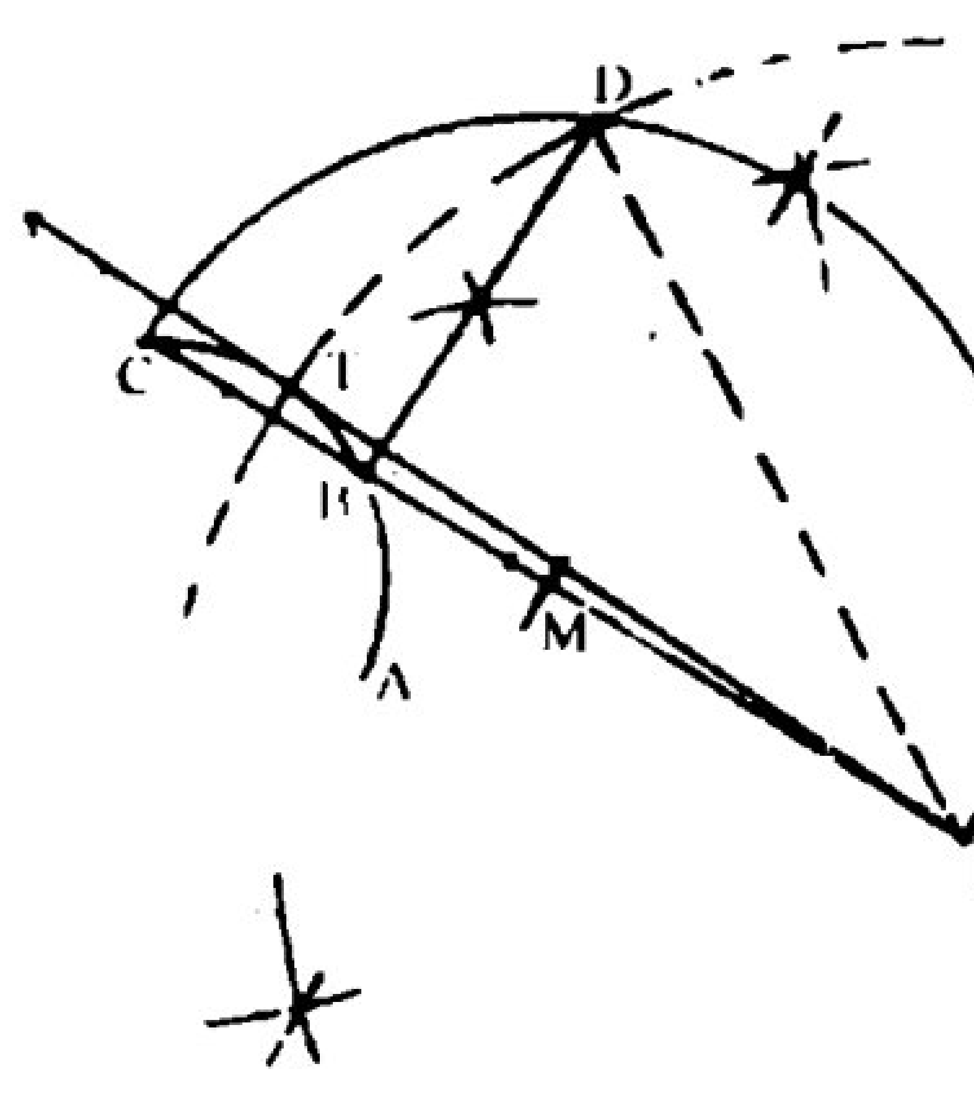
(iv) Find M, the midpoint of $\overline{CP}$.

(v) Take M as centre and draw a semi circle.

(vi) Draw $\overline{DB} \perp \overline{CP}$ which meets the semi circle at point D.

(vii) Take P as centre and draw an arc of radius m$\overline{PD}$, this arc intersect the given arc at T.

(viii) Join P to T and produce it.



Result:

$\overline{PT}$ is the required tangent.

2. Construct a circle with diameter 8cm. Indicate a point C, 5cms away om its circumference. Draw a tangent from point C to the circle without using its centre.