UNIT 10
Practical Geometry of Circles

EXERCISE 10.1

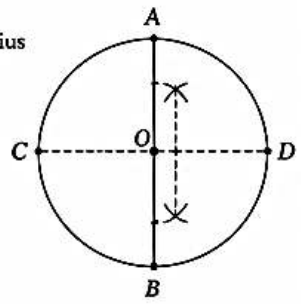
1. Construct a circle with the help of given radius and verify its centre by construction:
   (i) $r = 1.5$ cm (ii) $r = 1.7$ cm (iii) $r = 2$ cm

Solution

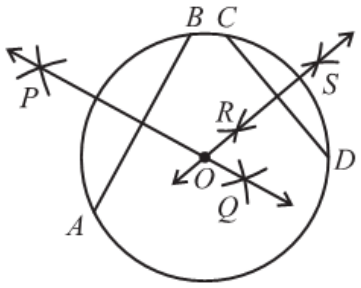
Given : Radius r
Required : To construct a circle of given radius and verify its centre.

Steps of Construction :

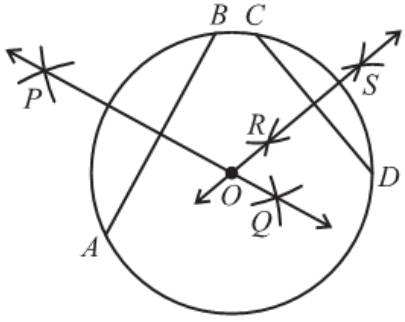
1. Mark a point O on the paper.
2. Open the compass equal to the given radius.
3. Place the needle at O and draw a circle.
4. Draw any chord AB of the circle.
5. Draw another chord CD.
6. Construct perpendicular bisectors of chords AB and CD.
7. Let the perpendicular bisectors intersect at point O.
8. Point O is the centre of the circle.



(i)

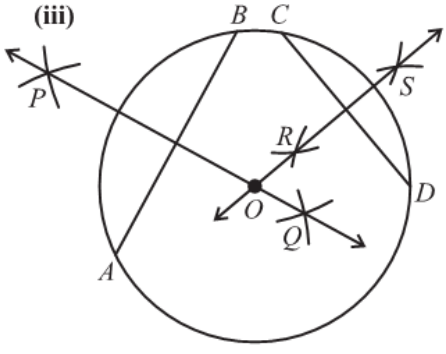


(ii)



Or according to book

(iii)



2. Take any three non-collinear points P, Q, R and construct a circle passing through these points.

Solution

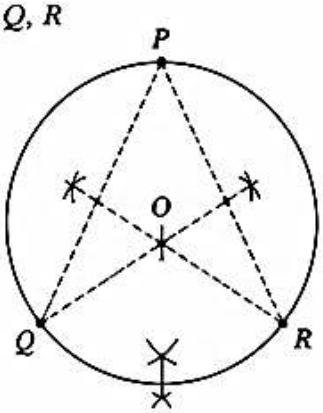
Or according to book

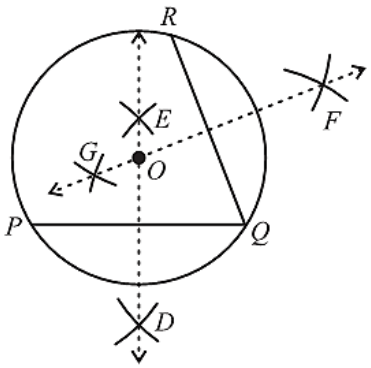
Given : Three non-collinear points P, Q, R

Required : To construct a circle passing through P, Q, R.

Steps of Construction :

1. Join PQ and QR.
2. Construct perpendicular bisector of PQ.
3. Construct perpendicular bisector of QR.
4. Let both bisectors intersect at point O.
5. With centre O and radius OP, draw a circle.
6. The circle passes through P, Q and R.





3. Draw an arc ABC and complete a circle by finding its centre.

Solution

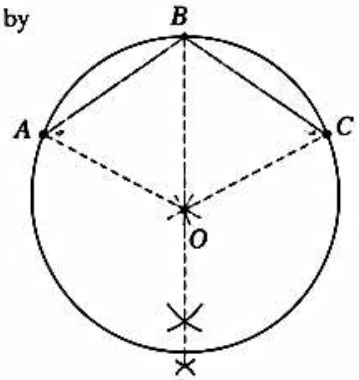
Or according to book

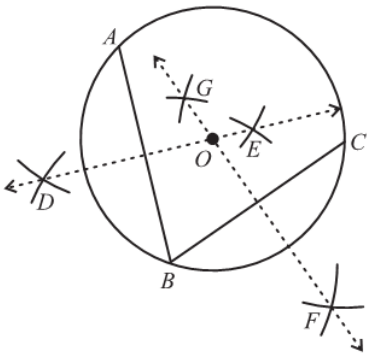
Given : An arc ABC

Required : To complete the circle by finding its centre.

Steps of Construction :

1. Join AB and BC.
2. Construct perpendicular bisector of chord AB.
3. Construct perpendicular bisector of chord BC.
4. Let the bisectors intersect at point O.
5. With centre O and radius OA, draw the complete circle.





4. Draw an arc PQR and complete a circle without finding its centre.

Solution

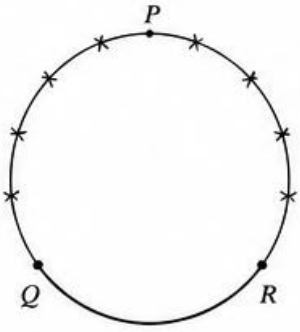
Or according to book

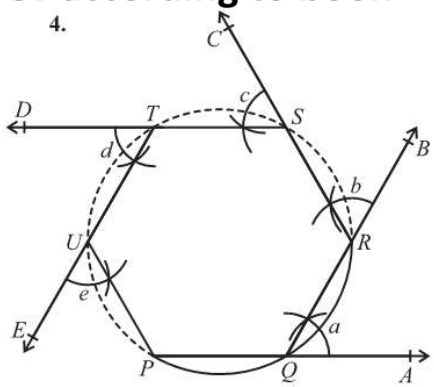
Given : An arc PQR

Required : To complete the circle without finding its centre.

Steps of Construction :

1. Choose point P and Q on the arc.
2. Draw equal chords on both sides of the arc.
3. Continue marking equal distances along the boundary using compass.
4. Join the successive points smoothly.
5. Thus the complete circle is obtained without locating the centre.





5. Take any three non-collinear points (locations of the lamp posts in the park), construct a circle passing through all these points.

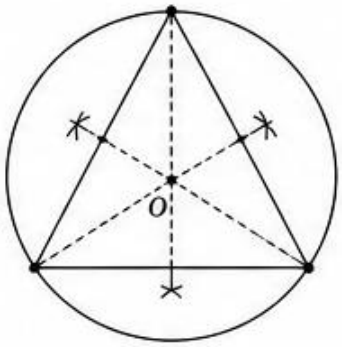
Solution

Given : Three non-collinear points (lamp posts)

Required : To construct a circle passing through all three points.

Steps of Construction :

1. Join the three points to form a triangle.
2. Draw perpendicular bisector of one side.
3. Draw perpendicular bisector of another side.
4. Let the bisectors meet at point O.
5. With centre O and radius equal to distance from O to any point, draw a circle.
6. The circle passes through all three lamp posts.



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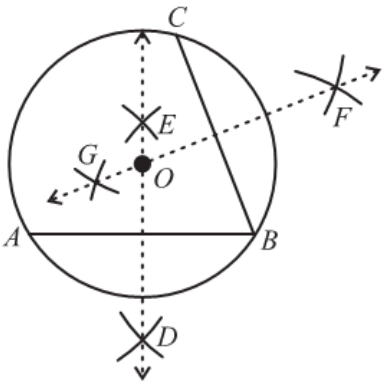


6. A part of the Ferris wheel rim is visible as an arc. Using any three points on the arc, construct the circle by finding its centre.

Solution

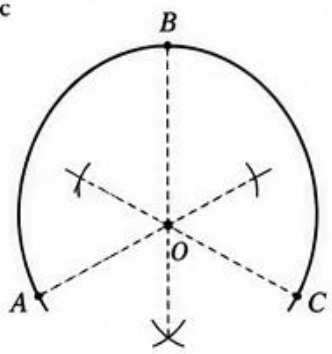
Or according to book

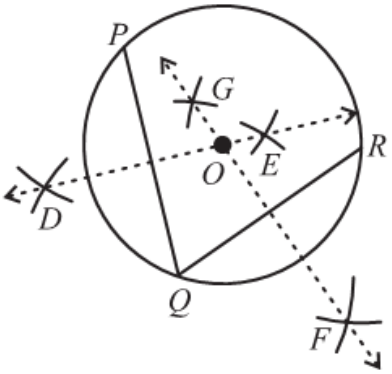
Given : Three points A, B, C on the arc

Required : To construct the circle and find its centre.

Steps of Construction :

1. Mark any three points A, B, C on the arc.
2. Join AB and BC.
3. Draw perpendicular bisector of AB.
4. Draw perpendicular bisector of BC.
5. Let the bisectors intersect at O.
6. With centre O and radius OA, draw the complete circle.





7. ABC an arc of a fountain, complete a circle without finding its centre.

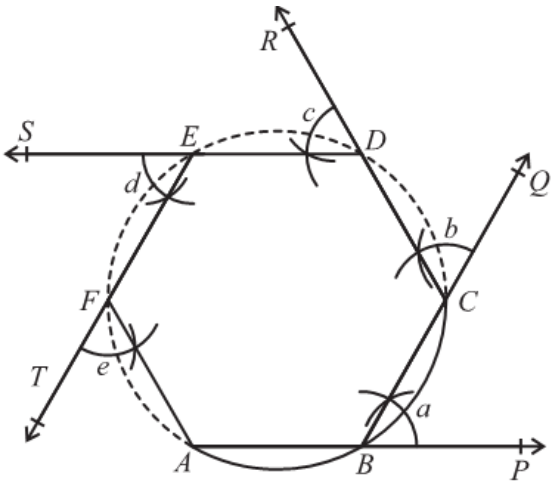
Solution

Given : Arc ABC

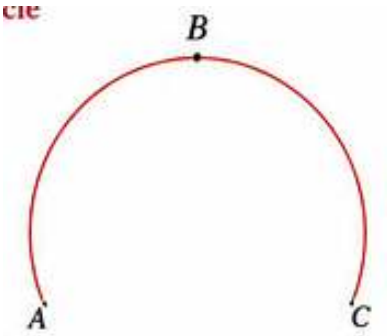
Required : To complete the circle without finding its centre.

Steps of Construction :

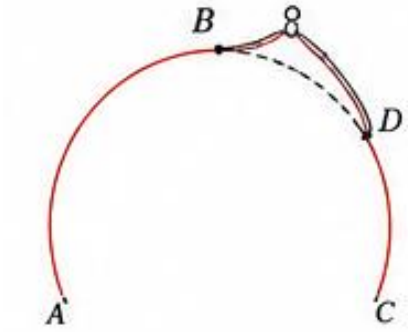
1. Select equal points on the given arc.
2. Using compass, continue taking of equal chord lengths around the arc.
3. Mark successive points carefully.
4. Join all points smoothly to form the circle.
5. Hence the complete circle is obtained without locating the centre.



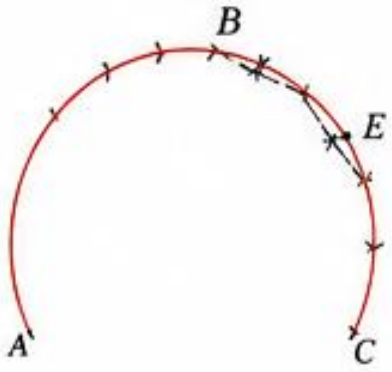
Explanation to Question 7



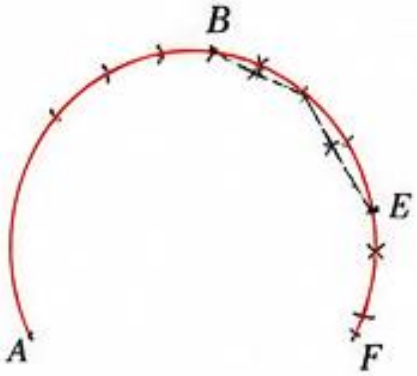
Given arc ABC



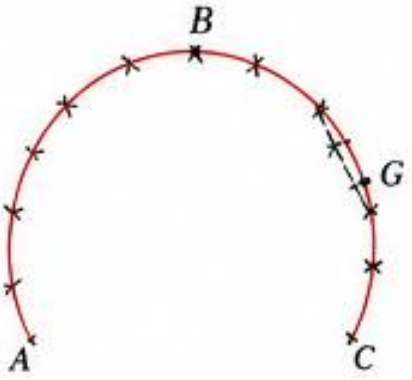
1. *Take any point D on the arc. With centre A, mark off AD on the arc.*



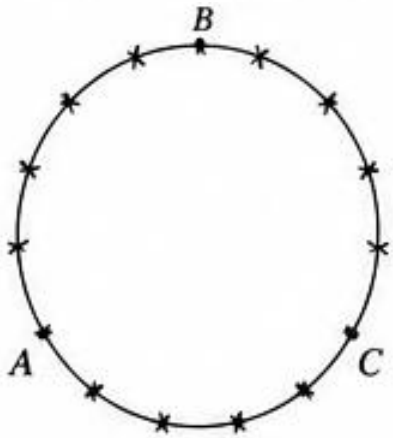
2. *With centre D, mark off DE equal to AD.*



3. *With centre E, mark off EF equal to AD.*



4. *Continue in the same way until you reach near point A.*



5. Join all the points smoothly to get the complete circle.

EXERCISE 10.2

1. Draw tangent to $\overset{\frown}{APB}$ at point P, when P is midpoint of the arc.

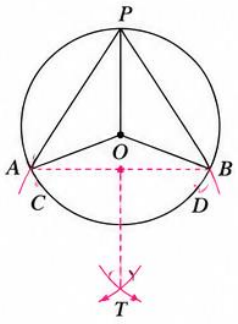
Solution

Given: A circle with centre O. Arc APB with P ndpoint of the arc.

Required: Tangent to $\overset{\frown}{APB}$ at P.

Steps of Construction:

1. Join OA and OB.
2. Join OP.
3. With O as centre, draw a circle with any radius to cut OA at C and OB at D.
4. With C and D as centres and equal radius (greater than $\frac{1}{2}CD$), draw arcs to intersect at T.
5. Join PT.
   PT is the required tangent.



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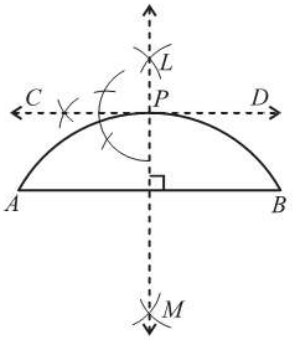


2. Draw tangent to $\overset{\frown}{PQR}$ at point P, when P is endpoint of the arc.

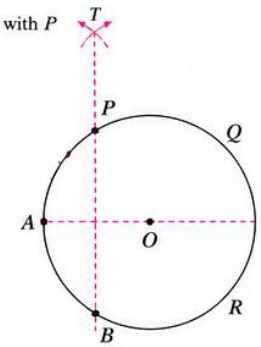
Solution

Given: A circle with centre O. Arc PQR with P endpoint of the arc.

Required: Tangent to $\overset{\frown}{PQR}$ at P.

Steps of Construction:

1. Join OP.
2. With O as centre, draw a circle with any radius to cut the given circle at A and B.
3. With A and B as centres and equal radius (greater than $\frac{1}{2}AB$), draw arcs to intersect at T.
4. Join PT.
   PT is the required tangent.



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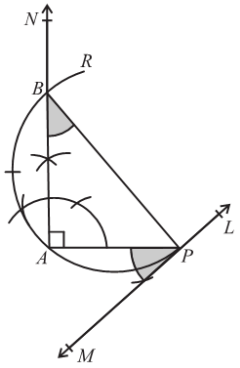


3. Draw tangent to $\overset{\frown}{ABC}$ from a point P, when P is outside the arc.

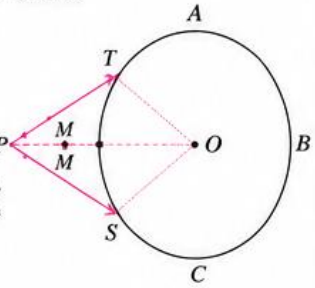
Solution

Given: A circle with centre O. Point P outside the circle.

Required: Tangent to $\overset{\frown}{ABC}$ from P.

Steps of Construction:

1. Join OP and draw its midpoint M.
2. With M as centre and MO as radius, draw a circle to cut the given circle at T and S.
3. Join PT and PS.
   PT and PS are the required tangents.



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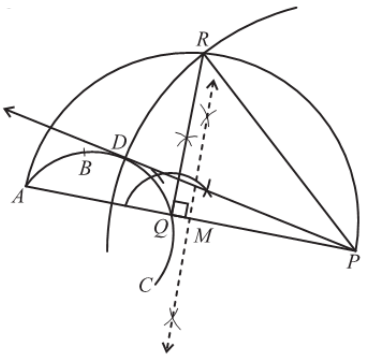


4. Draw a circle of radius 1.3 cm and draw a tangent at point P, when P lies on its circumference.

Solution

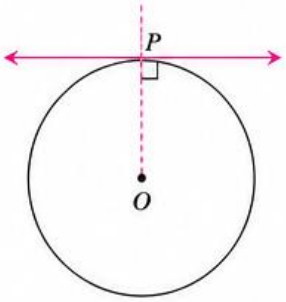
Given: Radius $r = 1.3$ cm.
Point P on the circle.

Required: Tangent at P.

Steps of Construction:

1. With O as centre, draw a circle of radius 1.3 cm.
2. Mark any point P on the circumference.
3. Draw OP.
4. Through P, draw a line perpendicular to OP.

The line is the required tangent.



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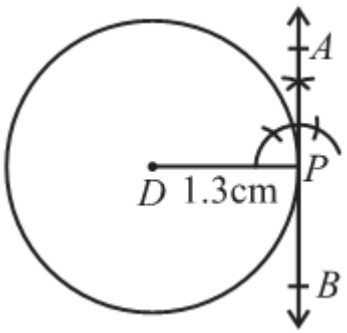


5. Draw a circle of radius 1.5 cm and draw a tangent at point P, when P is at a distance of 8 cm from its centre.

Solution

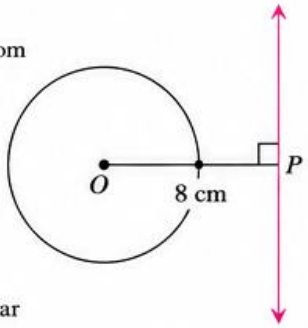
Given: Radius $r = 1.5$ cm.
Point P at a distance 8 cm from centre O.

Required: Tangent at P.

Steps of Construction:

1. Draw $OP = 8$ cm.
2. With O as centre, draw a circle of radius 1.5 cm.
3. Through P, draw a line perpendicular to OP.

The line is the required tangent.



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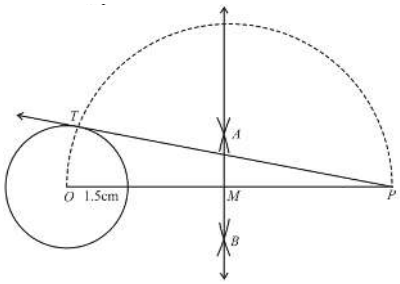


6. Draw a circle of radius 1.6 cm. Draw two tangents that meet an angle of 30°.

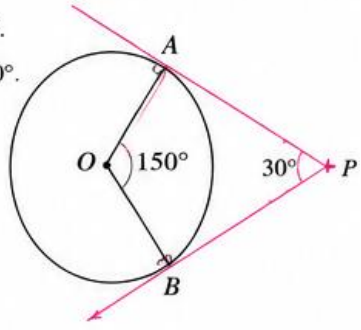
Solution

Given: Radius $r = 1.6$ cm.
Angle between tangents = 30°.

Required: Two tangents meeting at 30°.

Steps of Construction:

1. Draw a circle with centre O and radius 1.6 cm.
2. At O, construct $\angle AOB = 150°$.
3. Bisect $\angle AOB$ to get OC.
4. Through A and B, draw lines perpendicular to OA and OB respectively. Let them meet at P. Then $\angle APB = 30°$.



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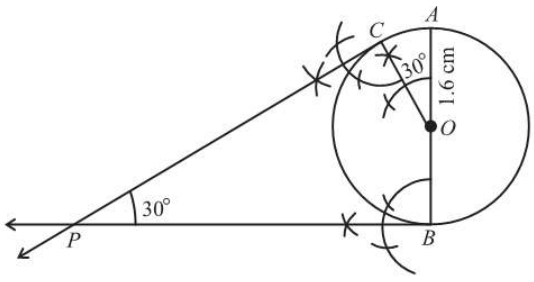


7. Draw a tangent to any point on a circular part of the track having radius = 2 cm.

Solution

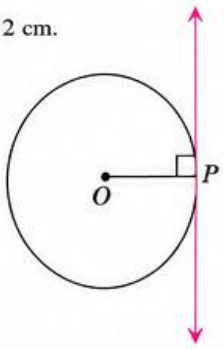
Given: Circular part of the track with radius 2 cm.
Point P on the track.

Required: Tangent at P.

Steps of Construction:

1. Draw OP, where O is the centre of the track.
2. Through P, draw a line perpendicular to OP.

The line is the required tangent.



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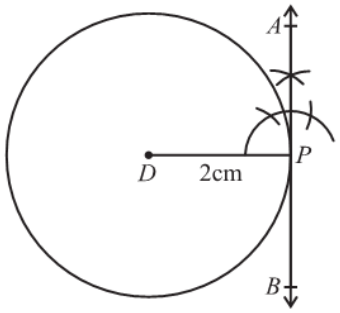


8. From a pulley point, construct two tangents to a machine wheel having $r = 2.1$cm, such that the angle between them is 30°.

Solution

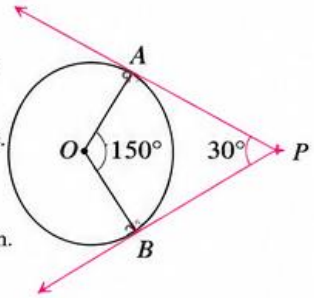
Given: Radius r = 2.1 cm.
Pulley point P such that angle between tangents = 30°.

Required: Two tangents from P to the circle.

Steps of Construction:

1. Draw a circle with centre O and radius 2.1 cm.
2. At O, construct $\angle AOB = 150°$.
3. Through A and B, draw lines perpendicular to OA and OB respectively. Let them meet at P.

Then PA and PB are the required tangents and $\angle APB = 30°$.



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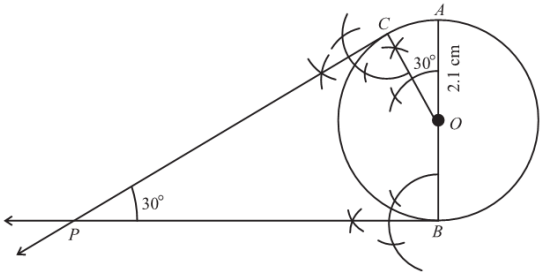
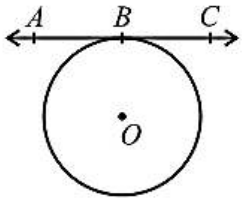


REVIEW EXERCISE 10

1. Four possible answers are given for the following questions. Choose the correct answer:

(i) In the adjacent figure, $\overleftrightarrow{ABC}$ is:



(a) a chord (b) an arc
(c) a tangent (d) a secant

(ii) There are _____ types of arcs.

(a) 2 (b) 3
(c) 4 (d) 5

(iii) Right bisector of the chord of a circle always passes through the:

(a) diameter (b) non-collinear points (c) radius (d) centre

(iv) A circle has only one:

(a) chord (b) centre (c) diameter (d) secant

(v) The point where two tangents meet outside a circle forms:

(a) a semicircle (b) a diameter (c) a radius (d) an angle

(vi) Two equal tangents from a point to a circle can be drawn when the point is _____ the circle.

(a) on (b) inside (c) outside (d) at centre of

(vii) Tangents drawn from a single external point to a circle are:

(a) unequal in length (b) perpendicular to each other
(c) equal in length (d) inside the circle

(viii) At least how many chords are needed to locate the centre of the circle?

(a) 1 (b) 2 (c) 3 (d) 4

(ix) To draw a tangent at middle point of an arc, first step is to:

(a) join endpoints of an arc
(b) draw radius
(c) draw a line perpendicular to chord
(d) draw an angle

(x) The angle between the radius and a tangent at the point of contact is:

(a) 30° (b) 60° (c) 90° (d) 120°

2. Draw a circle of radius 1.4 cm and draw a tangent at point P, when P lies on its circumference.

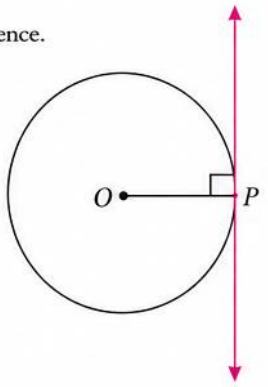
Solution

Given: Radius $r = 1.4$ cm
Point P on the circumference.

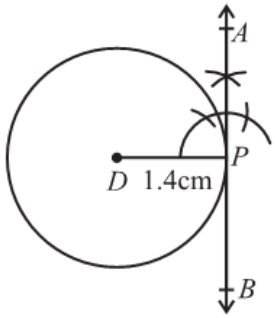
Required: Tangent at P.

Steps of Construction:

1. With O as centre, draw a circle of radius 1.4 cm.
2. Mark any point P on the circumference.
3. Draw OP.
4. Through P, draw a line perpendicular to OP.
   The line is the required tangent.



Or according to book



3. Draw a circle of radius 1.2 cm and draw a tangent at point P, when P is at a distance of 5 cm from the centre.

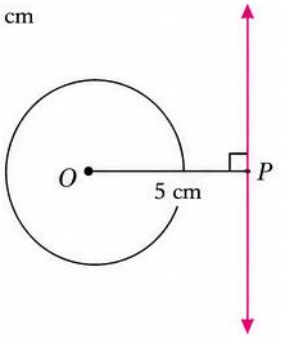
Solution

Given: Radius $r = 1.2$ cm
Point P is at a distance 5 cm from the centre O.

Required: Tangent at P.

Steps of Construction:

1. Draw $OP = 5$ cm.
2. With O as centre, draw a circle of radius 1.2 cm.
3. Through P, draw a line perpendicular to OP.
   The line is the required tangent.



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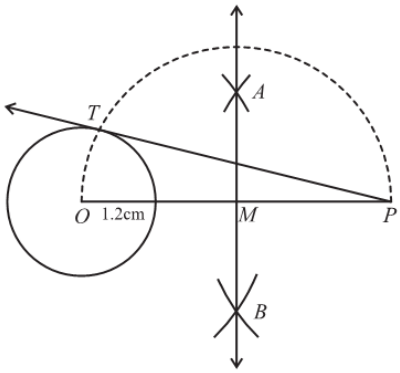


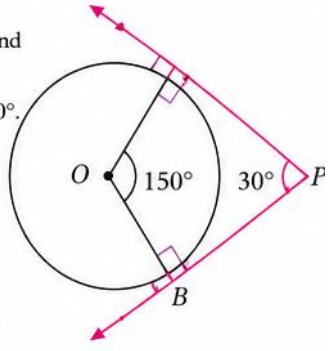
4. Draw a circle of radius 1.7 cm. Draw two tangents that meet an angle of 30°.

Solution

Required: Two tangents meeting at 30°.

Steps of Construction:

1. Draw a circle with centre O and radius 1.7 cm.
2. At O, construct $\angle AOB = 150°$.
3. Draw OA and OB.
4. Through A, draw a line perpendicular to OA.
   Through B, draw a line perpendicular to OB.
   Let the two lines meet at P.
   Then $\angle APB = 30°$.



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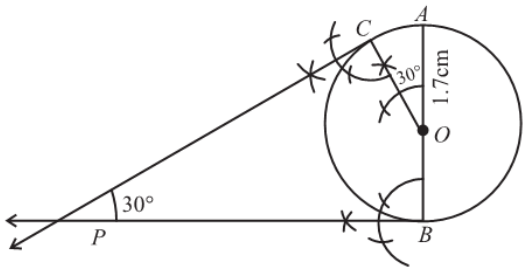


5. Take a part of the circular track, use chords and perpendicular bisectors to complete a circular track.

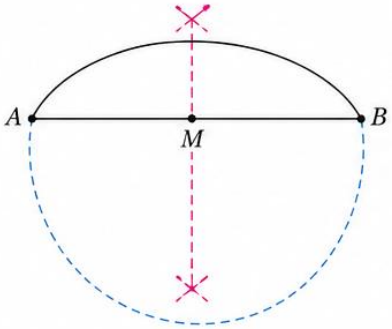
Solution

Given: A part of a circular track.

Required: Complete the circular track.

Steps of Construction:

1. Mark two points A and B on the given part of the track.
2. Join AB (chord).
3. Construct the perpendicular bisector of AB. Let it meet AB at M.
4. Taking M as centre and MA as radius, draw an arc on the side of the given track. This arc completes the circular track.
5. Darken the required circle.



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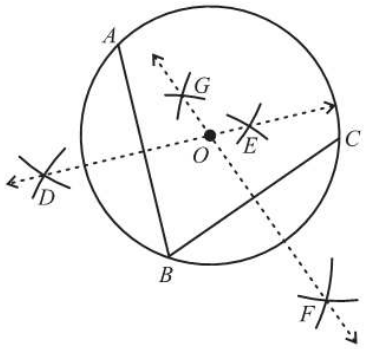


6. Two decorative fences touch the circular flower bed of radius 2.1 cm and meet outside it at an angle of 30° to form an entrance arch. Draw two tangents to the flower bed from the point where the fences meet at an angle of 30°.

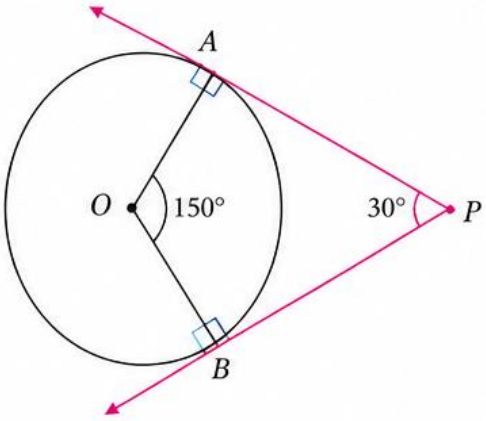
Solution

Given: Radius $r = 2.1$ cm
Angle between the decorative fences = 30°.

Required: Two tangents from the point where fences meet at 30°.

Steps of Construction:

1. Draw a circle with centre O and radius 2.1 cm.
2. At O, construct $\angle AOB = 150°$.
3. Draw OA and OB.
4. Through A, draw a line perpendicular to OA. Through B, draw a line perpendicular to OB. Let the two lines meet at P.
5. Then PA and PB are the required tangents and $\angle APB = 30°$.



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