UNIT 10 Practical Geometry of Circles

Student's Learning Outcomes

After completing this unit, the students will be able to:

- Locate the centre of a given circle.
- Draw a circle passing through three given non-collinear points.
- Complete the circle:
  - by finding the centre.
  - without finding the centre.

  when a part of its circumference is given.
- Draw a tangent to a given arc, without using the centre, through a given point P when P is
  - the middle point of the arc.
  - at the end of the arc.
  - outside the arc.
- Draw a tangent to a given circle from a point P when P lies
  - on the circumference.
  - outside the circle.
- Draw two tangents to a circle meeting each other at a given angle.
- Apply concepts of practical geometry of a circle to real-life world problems (such as athletic tracks, recreational parks, Ferris wheels and mechanical machines).

10.1 Construction of a Circle

The construction of a circle is a fundamental concept in practical geometry. A circle can be drawn using a compass when its centre and radius are known. However, in more advanced constructions, a circle can also be constructed through three given non-collinear points, as these points uniquely determine a circle. In some cases, a circle may need to be completed when only a part of its circumference is given, either by finding the centre or using geometric techniques without it.

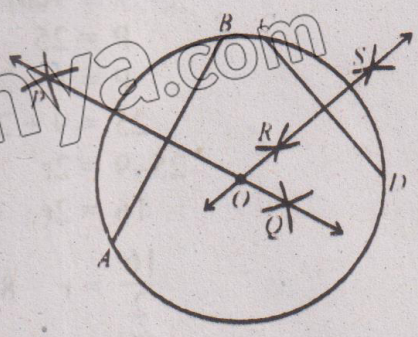
Locate the Centre of a Given Circle

Given: A circle.

Required: To locate the centre of the circle.

Steps of Construction:

1. Take any two chords $\overline{AB}$ and $\overline{CD}$.
2. Draw $\overline{PQ}$ right bisector of $\overline{AB}$.
3. Draw $\overline{RS}$ right bisector of $\overline{CD}$.
4. $\overline{PQ}$ and $\overline{RS}$ intersect each other at point O.
5. Point O is the centre of the circle.



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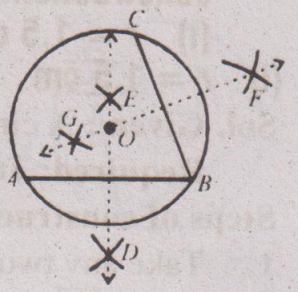
Note

- Points that lie on the same line are collinear.
- Points that do not lie on the same line are non-collinear.

Draw a Circle Passing through Three Given Non-collinear Points

Given: Points A, B and C are non-collinear.

Required: Draw a circle passing through points A, B and C.



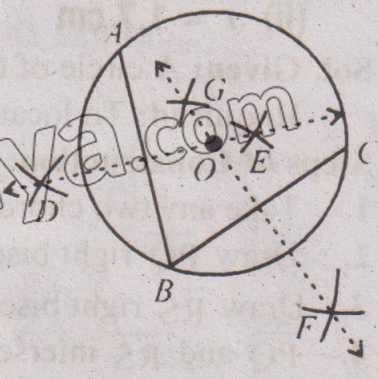
Steps of Construction:

1. Join B to A and C.
2. Draw $\overleftrightarrow{DE}$ right bisector of $\overline{AB}$.
3. Draw $\overleftrightarrow{FG}$ right bisector of $\overline{BC}$.
4. $\overleftrightarrow{DE}$ and $\overleftrightarrow{FG}$ intersect each other at point O. Now O, is centre of the required circle.
5. Take O as centre and draw a circle of radius $m\overline{OA} = m\overline{OB} = m\overline{OC}$, which is the required circle.

Complete a Circle by Finding its Centre, When a Part of its, Circumference is Given

Given: PQR is an arc of a circle.

Required: To complete the circle by finding its centre.



Steps of Construction:

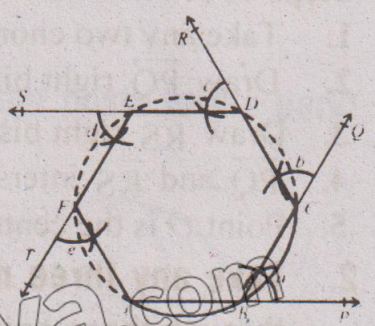
1. Join Q to P and R.
2. Draw $\overleftrightarrow{DE}$ right bisector of $\overline{PQ}$.
3. Draw $\overleftrightarrow{FG}$ right bisector of $\overline{QR}$.
4. $\overleftrightarrow{DE}$ and $\overleftrightarrow{FG}$ intersect each other at point O. So, O is the centre of the circle.
5. Take O as centre and draw a circle of radius $m\overline{OP} = m\overline{OQ} = m\overline{OR}$.

Thus, this circle passes through points P, Q and R on the given part of the circumference.

Complete a Circle without Finding its Centre, When a Part of its Circumference (Arc) is Given

Given: $\overset{\frown}{ABC}$ is a part of circumference of a circle.

Required: Complete a circle of which $\overset{\frown}{ABC}$ is a part without finding the centre of the circle.



Steps of Construction:

1. Take $\overline{AB}$, $\overline{BC}$ two chords of the given arc ABC such that $m\overline{AB} = m\overline{BC}$.
2. Extend $\overline{AB}$ and $\overline{BC}$ to form rays $\overrightarrow{AP}$ and $\overrightarrow{BQ}$ respectively.
3. Construct $m\angle b = m\angle a$
4. Take $m\overline{CD} = m\overline{AB} = m\overline{BC}$ and construct $m\angle c = m\angle a = m\angle b$.
5. Similarly construct $\angle d$ and $\angle e$.
6. Now draw arcs on $\overline{CD}$, $\overline{DE}$, $\overline{EF}$ and $\overline{FA}$ with smooth hand.

Thus, the required circle is completed.

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Solved Exercise 10.1

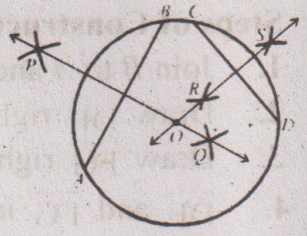
1. Construct a circle with the help of given radius and locate its centre by construction:

(i) $r = 1.5$ cm (ii) $r = 1.7$ cm (iii) $r = 2$ cm

(i) $r = 1.5$ cm

Sol. Given : A circle of the radius of 1.5 cm.

Required: To locate the centre of the circle



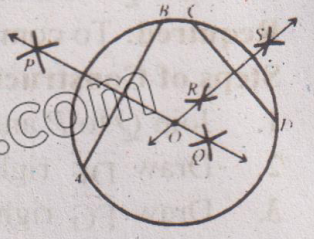
Steps of construction:

1. Take any two chords $\overline{AB}$ and $\overline{CD}$ of the circle.
2. Draw $\overleftrightarrow{PQ}$ right bisector of $\overline{AB}$.
3. Draw $\overleftrightarrow{RS}$ right bisector of $\overline{CD}$.
4. $\overleftrightarrow{PQ}$ and $\overleftrightarrow{RS}$ intersect each other at point O.
5. Point O is the centre of the circle.

(ii) $r = 1.7$ cm

Sol. Given: A circle of the radius of 1.7 cm.

Required: To locate the centre of the circle.



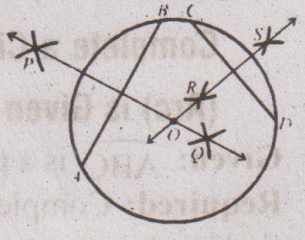
Steps of Construction:

1. Take any two chords $\overline{AB}$ and $\overline{CD}$ of the circle.
2. Draw $\overleftrightarrow{PQ}$ right bisector of $\overline{AB}$.
3. Draw $\overleftrightarrow{RS}$ right bisector of $\overline{CD}$.
4. $\overleftrightarrow{PQ}$ and $\overleftrightarrow{RS}$ intersect each other at point O.
5. Point O is the centre of the circle.

(iii) $r = 2$ cm

Sol. Given: A circle of the radius of 2 cm.

Required: To lacate the centre of the circle.



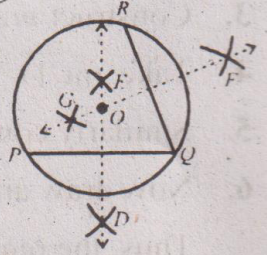
Steps of construction:

1. Take any two chords $\overline{AB}$ and $\overline{CD}$ of the circle.
2. Draw $\overleftrightarrow{PQ}$ right bisector of $\overline{AB}$.
3. Draw $\overleftrightarrow{RS}$ right bisector of $\overline{CD}$.
4. $\overleftrightarrow{PQ}$ and $\overleftrightarrow{RS}$ intersect each other at point O.
5. Point O is the centre of the circle.

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

Sol. Given: Points P, Q and R are non-collinear.

Required: Draw a circle passing through points P, Q and R.



Steps of construction:

1. Join Q to P and R.
2. Draw $\overleftrightarrow{DE}$ the right bisector of $\overline{PQ}$.
3. Draw $\overleftrightarrow{FG}$ the right bisector of $\overline{QR}$

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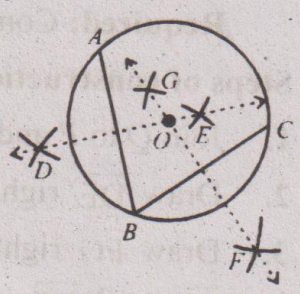
4. $\overline{DE}$ and $\overline{FG}$ intersect each other at point O.

5. Take O as a centre and draw a circle of radius $m\overline{OP} = m\overline{OQ} = m\overline{OR}$, which is required circle.

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

Sol. Given : ABC an arc of a circle.

Required: To complete a circle by finding its centre.



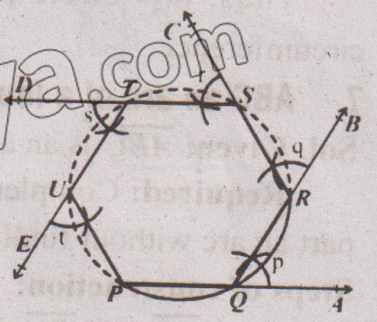
Steps of construction:

1. Join B to C and A.
2. Draw $\overline{DE}$ right bisector of $\overline{AB}$.
3. Draw $\overline{FG}$ right bisector of $\overline{BC}$.
4. $\overline{DE}$ and $\overline{FG}$ intersect each other at point O.
   So, O is the centre of the required circle.
5. Take O as centre and draw a circle of radius $m\overline{OA} = m\overline{OB} = m\overline{OC}$.
   Thus, this circle passes through points A,B and C on the given part of circumference.

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

Sol. Given: $\overset{\frown}{PQR}$ is a part of circumference of a circle.

Required: Complete a circle without finding its centre.



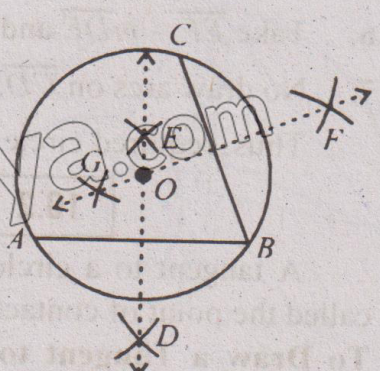
Steps of constructions:

1. Take $\overline{PQ}$ and $\overline{QR}$ two chords of the given arc $\overset{\frown}{PQR}$ such that $m\overline{PQ} = m\overline{QR}$.
2. Extend $\overline{PQ}$ and $\overline{QR}$ to form rays $\overline{PA}$ and $\overline{QB}$ respectively.
3. Construct $m\angle q = m\angle p$.
4. Take $m\overline{RS} = m\overline{PQ} = m\overline{QR}$ and construct $m\angle r = m\angle p = m\angle q$.
5. Take $m\overline{ST} = m\overline{RS}$ and construct $m\angle s = m\angle r$.
6. Take $m\overline{TU} = m\overline{ST}$ and construct $m\angle t = m\angle s$.
7. Take $\overline{UP} = \overline{TU}$
8. Now draw arcs on $\overline{RS}$, $\overline{ST}$, $\overline{TU}$ and $\overline{UP}$ with smooth hand.
   Thus, the required circle is completed.

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

Sol. Given: A, B and C are non-collinear paints.

Required: Draw a circle passing through A, B and C.



Steps of construction:

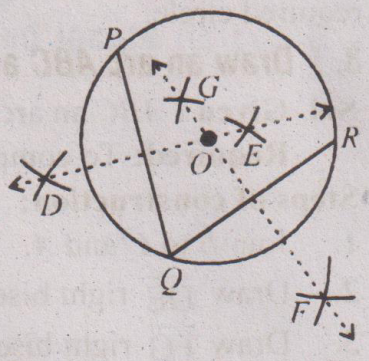
1. Join B to A an C.
2. Draw $\overline{DE}$ right bisector of $\overline{AB}$.
3. Draw $\overline{FG}$ right bisector of $\overline{BC}$.
4. $\overline{DE}$ and $\overline{FG}$ intersect each other at point O.
   Now O, is the centre of the required circle.
5. Take O as centre and draw a circle of radius $m\overline{OA} = m\overline{OB} = m\overline{OC}$, Which is the required circle.

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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.

Sol. Given: Three points P, Q and R on arc

Required: Construct the circle by finding the centre.



Steps of constructions:

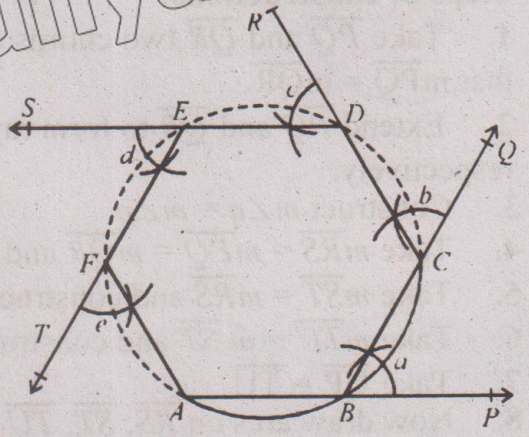
1. Join Q to P and R.
2. Draw $\overline{DE}$ right bisector of $\overline{PQ}$.
3. Draw $\overline{FG}$ right bisector of $\overline{QR}$.
4. $\overline{DE}$ and $\overline{GF}$ intersect each other at point. O Now, O is the centre of the required circle.
5. Take O as centre and draw a circle of radii $m\overline{OP} = m\overline{OQ} = m\overline{OR}$, which is the required cirele.

Thus, this circle passes through points P, Q and R on the given part of the circumference.

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

Sol. Given: $\overline{ABC}$ is an arc.

Required: Complete a circle of which $\overline{ABC}$ is part an arc without finding the centre of circle.



Steps of construction:

1. Take $\overline{AB}$ and $\overline{BC}$ two chords of the given arc ABC such that $m\overline{AB} = m\overline{BC}$.
2. Extend $\overline{AB}$ and $\overline{BC}$ to form $\overline{AP}$ and $\overline{BQ}$ respectively.
3. Construct $m\angle b = m\angle a$
4. Take $m\overline{CD} = m\overline{AB} = m\overline{BC}$ and construct $m\angle c = m\angle a = m\angle b$.
5. Take $\overline{DE} = m\overline{CD}$ and construct $m\angle d = m\angle c$.
6. Take $\overline{EF} = m\overline{DE}$ and construct $m\angle e = m\angle d$.
7. No draw arcs on $\overline{CD}$, $\overline{DE}$, $\overline{EF}$ and $\overline{FA}$ with smooth hand.

Thus, required circle is completed.

10.2 Tangent to a Circle

A tangent to a circle is a straight line that touches the circle at exactly one point, called the point of contact.

To Draw a Tangent to a Given Arc without using the Centre Through a Given point P

Case I When point P is the middle point of the arc

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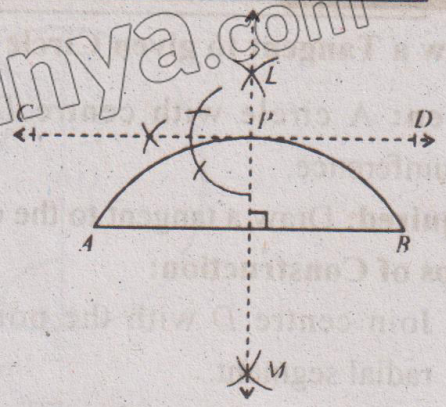
Given: $\overset{\frown}{APB}$ is an arc where P is midpoint of the arc.

Required: Draw tangent to the arc at point P.

Steps of Construction:

1. Join end points A and B of the arc.
2. Draw right bisector $\overline{LM}$ of $\overline{AB}$. it passes through point P.
3. Construct right angle MPC and produce $\overline{CP}$ in the direction of P.

   So, $\overline{CPD}$ is the required tangent.



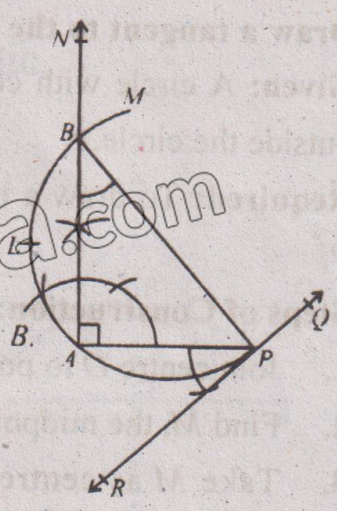
Case II When point P is an endpoint of the arc.

Given: $\overset{\frown}{PLM}$ is an arc, where P is its endpoint.

Required: Draw tangent to the arc PLM at point P.

Steps of Construction:

1. Take any point A on the arc and join P to A.
2. Draw right angle PAN so that $\overline{AN}$ cuts the arc at point B.
3. Join point B to P.
4. Construct $m\angle APR = m\angle ABP$
5. Produce $\overline{RP}$ towards P, so $\overline{RPQ}$ is the required tangent.



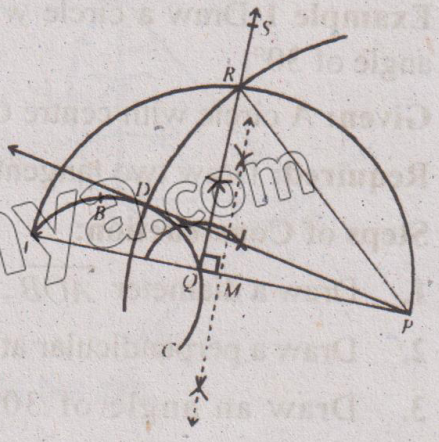
Case III When point P is outside the arc.

Given: $\overset{\frown}{ABC}$ is an arc and a point P is outside it.

Required: To draw a tangent to the arc from point P.

Steps of Construction:

1. Join A to P, $\overline{AP}$ cuts the arc at Q.
2. Find the midpoint M of $\overline{AP}$.
3. Take $\overline{AMP}$ as diameter and draw a semi-circle.
4. Draw perpendicular $\overline{QS}$ on $\overline{AP}$ that cuts the semi-circle at R.
5. Take m $\overline{RP}$ as radius and draw an arc that cuts $\overset{\frown}{ABC}$ at D.
6. Join P to D and produce towards D, so $\overline{PD}$ is the required tangent at D.

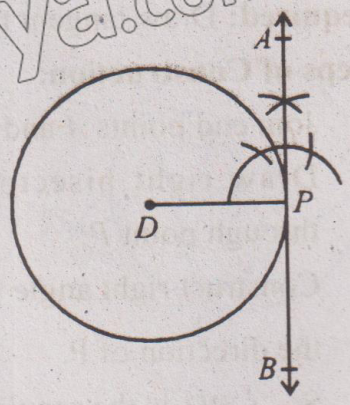


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Draw a Tangent to given Circle from a Point P when P Lies on the Circumference.

Given: A circle with centre D and a point P on its circumference.

Required: Draw a tangent to the circle at point P.



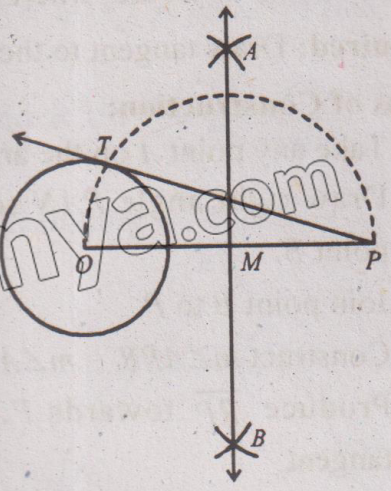
Steps of Construction:

1. Join centre D with the point P. Now, $\overline{DP}$ is the radial segment.
2. Draw a perpendicular $\overline{AB}$ at point P to the radial segment $\overline{DP}$.
   So, $\overline{APB}$ is the required tangent.

Draw a tangent to the circle from a point P when P lies outside the circle

Given: A circle with centre O and a point P that lies outside the circle..

Required: To draw a tangent to the circle from point P.



Steps of Construction:

1. Join centre O to point P.
2. Find M, the midpoint of $\overline{OP}$.
3. Take M as centre and draw a semi-circle with radius as $m\overline{OM} = m\overline{MP}$.
   This semi-circle cuts the circumference at point T.
4. Join P to T and produce towards T.
   $\overline{PT}$ is the required tangent and length of tangent is measured as $m\overline{PT}$.

Draw Two Tangents to a Given Circle Meeting each other at a Given Angle

Example 1 Draw a circle with radius 1.5 cm, Draw tangents to this circle that meet an angle of 30°.

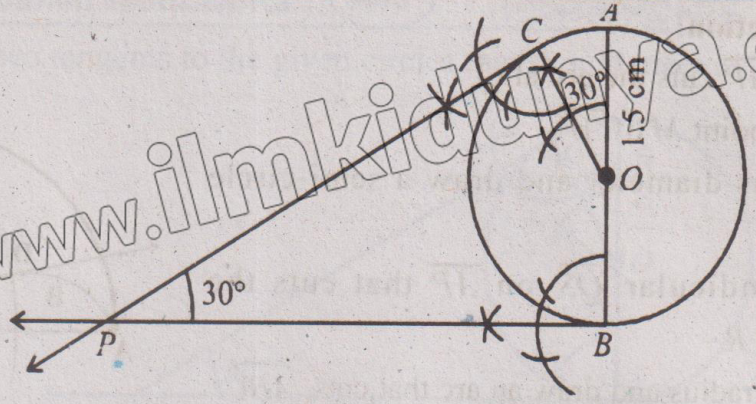
Given: A circle with centre O, of radius 1.5cm.

Required: Draw two tangent to the given circle that should meet at 30°.

Steps of Construction:

1. Draw a diameter $\overline{AOB}$,
2. Draw a perpendicular at B on $\overline{AOB}$, this is one tangent.
3. Draw an angle of 30° at O, as $m\angle AOC = 30°$, where C is a point on the circumference of the given circle.
4. Draw a perpendicular at C on $\overline{OC}$ as $\overline{CP}$ that meets the already drawn tangent at B.

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Hence tangent $\overrightarrow{BP}$ and $\overrightarrow{CP}$ are the required tangents that meet at $m\angle CPB = 30°$

Solved Exercise 10.2

1. Draw tangent to *APB* at point *P*, when *P* is midpoint of the arc.

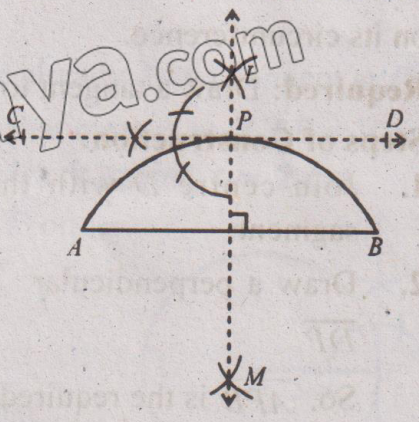
Sol. Given: $\overset{\frown}{APB}$ is an arc where P is the midpoint of the arc.

Required: Draw a tangent to the arc at point P.

Steps of Construction:

1. Join points A and B of the arc.
2. Draw right bisector $\overrightarrow{LM}$ of $\overline{AB}$, it passes through point P.
3. Construct right angle MPC and produce $\overline{CP}$ in the direction of P.

   So, $\overrightarrow{CPD}$ is the required tangent.



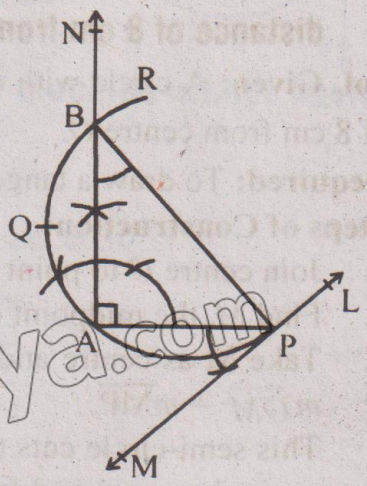
2. Draw tangent to $\overset{\frown}{PQR}$ at point *P*, when *P* is endpoint of the arc.

Sol. Given: $\overset{\frown}{PQR}$ is an arc, where P is its end point.

Required: Draw tangent to the arc PQR at point P.

Steps of Construction:

1. Take any point A on the arc join P to A.
2. Draw right angle PAN. So, that $\overrightarrow{AN}$ cuts the arc at point B.
3. Join B to P.
4. Construct $m\angle APM = m\angle APB$
5. Produce $\overline{LM}$ toward P, so, $\overrightarrow{MPL}$ is the required tangent.



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

Sol. Given: $\overset{\frown}{ABC}$ is an arc and a point P is outside it.

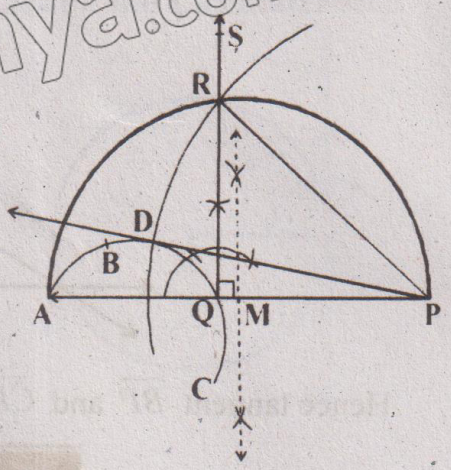
Required: To draw a tangent to the arc from point P.

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Steps of Construction:

1. Join A to P, $\overline{AP}$ cuts the arc at Q.
2. Find the midpoint M of $\overline{AP}$.
3. Take $\overline{AMP}$ as diameter and draw a semi-circle from M.
4. Draw perpendicular $\overline{QS}$ on $\overline{AP}$ that cuts the semi-circle at R.
5. Take m$\overline{PR}$ as radius and draw an arc that cuts $\overline{ABC}$ at D.
6. Join P to D and produce towards D.

   So, $\overline{PD}$ is the required tangent at D.



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

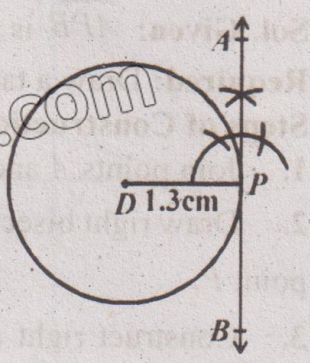
Sol. Given: A circle with centre D of radius 1.3 cm, and a point P on its circumference.

Required: Draw a tangent to the circle at point P.

Steps of Construction:

1. Join centre D with the point P. Now $\overline{DP}$ is the radial sagment.
2. Draw a perpendicular $\overleftrightarrow{AB}$ at point P to the radial segment $\overline{DP}$.

   So, $\overline{APB}$ is the required tangent.



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.

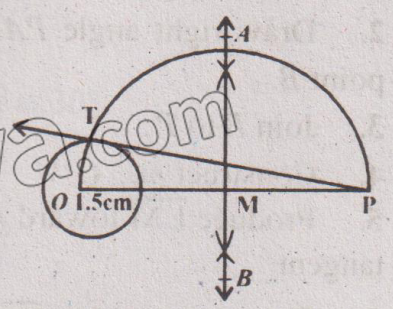
Sol. Given: A circle with centre O, of radius 1.5cm and a point P, which is at a distance of 8 cm from centre O.

Required: To draw a tangent to the circle from point P.

Steps of Construction:

1. Join centre O to point P.
2. Find M, the midpoint of $\overline{OP}$.
3. Take M as centre and draw a semi-circle with radius as $m\overline{OM} = m\overline{MP}$.

   This semi-circle cuts the circumference at point T. $\overline{PT}$ is the required tangent and length of the tangent is measured as $m\overline{PT}$.

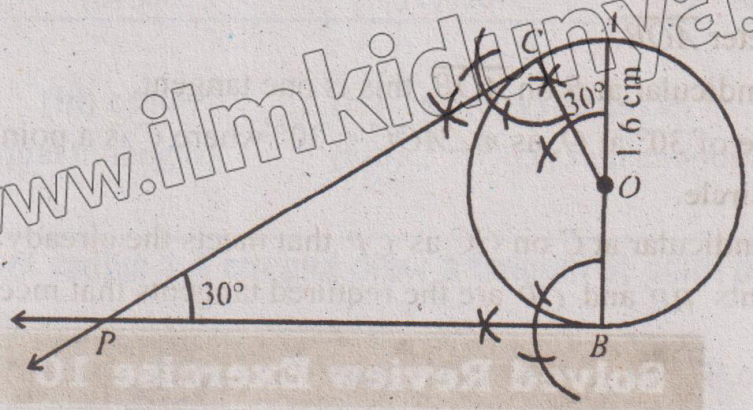


6. Draw a circle of radius 1.6 cm. Draw two tangents that meet an angle of 30°.

Sol. Given: A circle with centre O, of radius 1.6 cm.

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Required: Draw two tangents to the given circles that should meet at 30°.



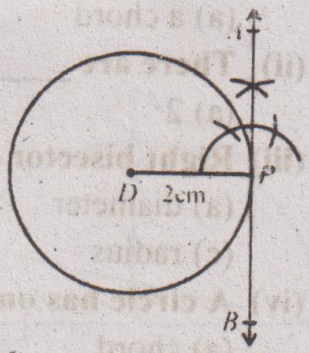
Steps of Construction:

1. Draw a diameter $\overline{AOB}$.
2. Draw a perpendicular at B on $\overline{AOB}$, this is one tangent.
3. Draw an angle of 30° at O, as $m\angle AOC = 30°$, where C is a point on the circumference of the given circle.
4. Draw a perpendicular at C on $\overline{OC}$ as $\overleftrightarrow{CP}$ that meets the already drawn tangent at P. Hence, tangents $\overleftrightarrow{BP}$ and $\overleftrightarrow{CP}$ are the required tangents that meet at $m\angle CPB = 30°$.

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

Sol. Given: A circle with centre D of radius 2 cm. A point P on its circumference.

Required: Draw a tangent to the circle at point P.



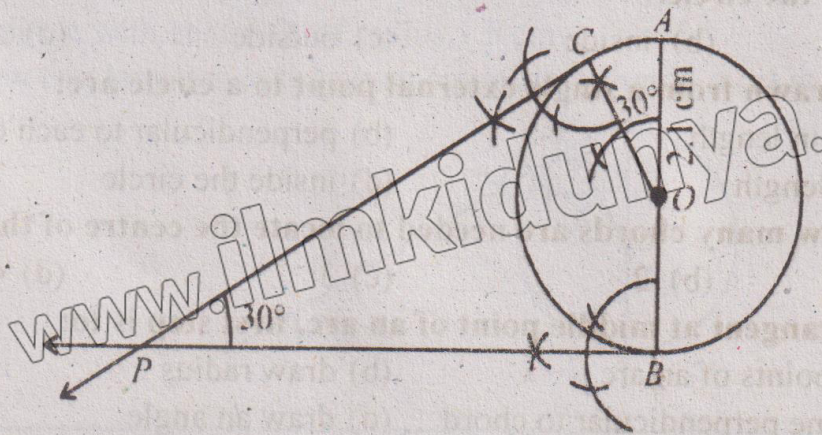
Steps of Construction:

1. Join centre D with point P. Now $\overline{DP}$ is the radial segment.
2. Draw a perpendicular $\overleftrightarrow{AB}$ at point P to the radial segment $\overline{DP}$. So, $\overleftrightarrow{APB}$ is the required tangent.

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

Sol. Given: A circle (pulley) with centre O, of radius 2.1 cm.

Required: Draw two tangents to the given circle that should meet at 30°.



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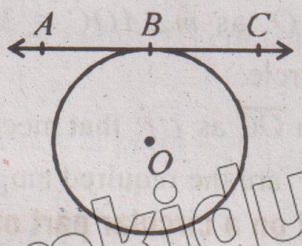
Steps of Construction:

1. Draw a diameter $\overline{AOB}$.
2. Draw a perpendicular at B on $\overline{AOB}$, this is one tangent.
3. Draw an angle of 30° at O, as $m\angle AOC = 30°$ where C is a point on the cirumference of the given circle.
4. Draw a perpendicular at C on OC as $\overleftrightarrow{CP}$ that meets the already drawn tangent at P. Hence, tangents $\overleftrightarrow{BP}$ and $\overleftrightarrow{CP}$ are the required tangents that meet at $m\angle CPB = 30°$.

Solved 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

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

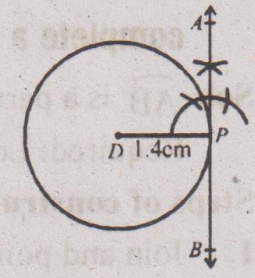
(a) 30° (b) 60° (c) 90° (d) 120°

ANSWERS:

(i) a tangent (ii) 2 (iii) centre (iv) centre (v) an angle
(vi) outside (vii) equal in length (viii) 2 (ix) Join endpoints of an arc
(x) 90°

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

Sol: Given: A circle with cantre D of radius 1.4 cm and a point P on its circumference.



Required: Draw a tangent to the circle at point P.

Steps of construction:

1. Join center D with the point P. Now $\overline{DP}$ is the radial segment.
2. Draw a perpendicular $\overline{AB}$ at point p to the radial DP.
   So, $\overline{APB}$ is the required tangent.

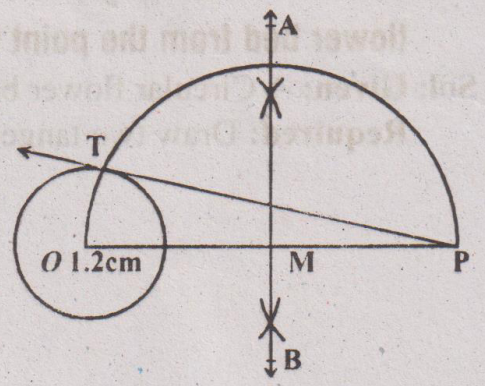
3. Draw a circle of radius 1.2 cm and draw a tangent at point *p*, when *p* is at a distance of 5 cm from the centre.

Sol: Given: A circle with centre O, of radius 1.2 cm and a point P, which is at a distance of 5 cm from centre O.

Required: to draw a tangent to the circle from point P.

Steps of construction

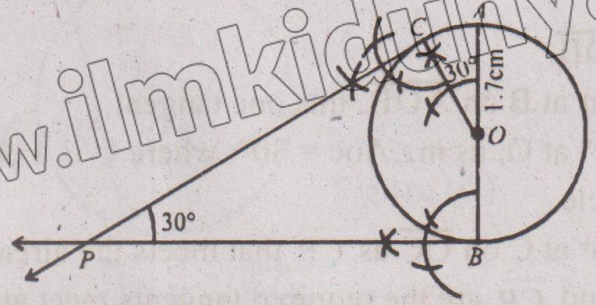
1. Join centre o to point p
2. Find M, the midpoint of $\overline{OP}$
3. Take M as centre and draw a semi-circle with radius as $m\overline{OM} = m\overline{MP}$
   This semi-circle cuts the circumference at point T.
4. Join P to T and produce towards T. $\overline{PT}$ is the required tangent and length of the tangent is measured as m $\overline{PT}$.



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

Sol: Given: A circle with centre O, of radius 1.5 cm.

Required: Draw two tangents to the given circles that should meet at 30°.



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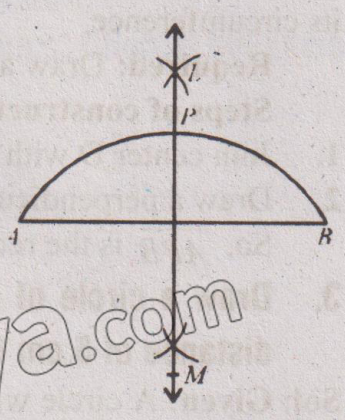
Steps of construction

1. Draw a diameter $\overline{AOB}$.
2. Draw a perpendicular at B on $\overline{AOB}$, this is one tangent.
3. Draw an angle of 30° at O, as $m\angle AOC = 30°$, where C is a point on the circumfernce of the given circle.
4. Draw a perpendicular at C on $\overline{OC}$ as $\overline{CP}$ that meets the already dram tangant at P. Hens tangents $\overline{BP}$ and $\overline{CP}$ are the required tangents meet at $m\angle CPB = 30°$.

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

Sol: $\overset{\frown}{AB}$ is a part of circumference of a circular track.

Required: Locate the centre of the track's are.



Steps of construction

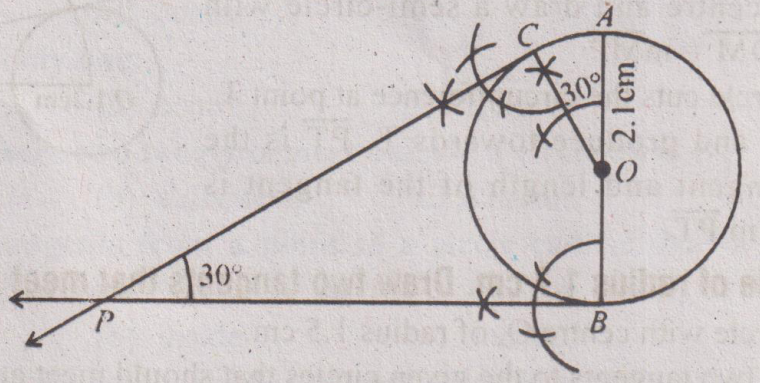
1. Join and points A and B of the arc.
2. Dram a right bisector $\overline{LM}$ of $\overline{AB}$.

   It passes through point P at arc. So, this point P is the canter of the track's arc.

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°.

Sol: Given: A Circular flower bed with centre O, of radius 2.1 cm.

Required: Draw two tangents to the given circle that shoud meet at 30°.



Steps of construction

1. Draw a diameter $\overline{AOB}$.
2. Draw a perpendicular at B on $\overline{AOB}$, this one tangent.
3. Draw an angle of 30° at O, as $m\angle Aoc = 30°$, where C is a point on the circumfernce of the given circle.
4. Draw a perpendicular at C on $\overline{OC}$ as $\overline{CP}$ that meets the already draw tangant at P. Hens tangents $\overline{BP}$ and $\overline{CP}$ are the required tangents meet at $m\angle CPB = 30°$.

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Objective Type Questions

Additional MCQ's

Multiple Choice Questions prepared in the light of new Examination Techniques
(Knowledge, Understanding, Application, Analytical & Conceptual)

10.1 Construction of a circle

1. In figure (A), right bisector of $\overline{CD}$ is:

(a) $\overline{AB}$ (b) $\overline{CD}$ (c) $\overline{RS}$ (d) $\overline{BC}$

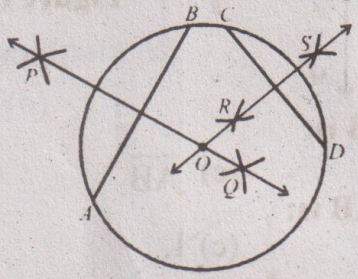


Figure (A)

2. In figure (A), $\overline{PQ}$ is the right bisector of:

(a) $\overline{AB}$ (b) $\overline{CD}$ (c) $\overline{RS}$ (d) $\overline{BC}$

3. In figure (A), intersecting point of both right bisectors is:

(a) O (b) A (c) P (d) Q

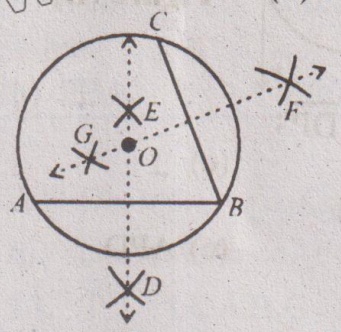


Figure (B)

4. In figure (B), the circle is passing through the points.

(a) A,O,B (b) B,C, F (c) A,B,F (d) A, B, C

5. In figure (B), which is not radius of the circle:

(a) $\overline{AB}$ (b) $\overline{OA}$ (c) $\overline{OB}$ (d) $\overline{OC}$

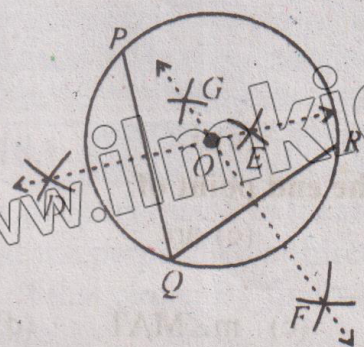


Figure (C)

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6. **In figure (C), which is equal to $\overline{OR}$:**
   (a) $\overline{OD}$ (b) $\overline{OF}$ (c) $\overline{PD}$ (d) $\overline{OQ}$
7. **In figure (C), chords of arc $\overset{\frown}{PQR}$ are:**
   (a) $\overline{PQ}$, $\overline{PR}$ (b) $\overline{PD}$, $\overline{OR}$ (c) $\overline{GF}$ (d) $\overline{DE}$
8. **We can complete a circle without finding centre, when a part of _____ is given.**
   (a) centre (b) chord (c) diameter (d) circumference

10.2 Tangent to a circle

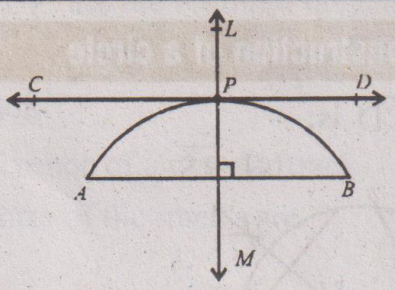


Figure (A)

9. **In fig (A), the tangent of arc AB is:**
   (a) $\overleftrightarrow{CPD}$ (b) $\overleftrightarrow{LPM}$ (c) $\overline{AB}$ (d) $\overrightarrow{LPD}$
10. **In fig (A) the midpoint of arc AB is:**
    (a) c (b) D (c) L (d) P

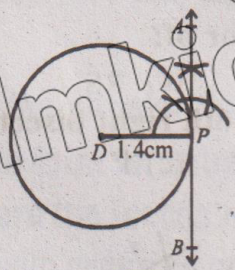


Figure (B)

11. **In fig (B), $\overline{AB}$ is _____ on $\overline{DP}$:**
    (a) = (b) > (c) $\perp$ (d) <
12. **In fig (B), radial segment is:**
    (a) $\overline{AP}$ (b) $\overline{PB}$ (c) APD (d) $\overline{DP}$

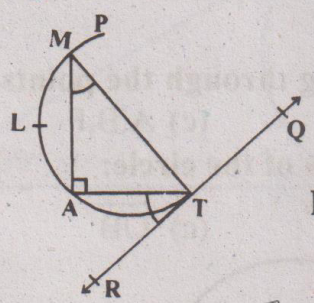


Figure C

13. **In fig (C) the end point of arc is:**
    (a) T (b) A (c) L (d) M
14. **In fig (C) $\overline{RTQ}$ is a tangent at the end point of:**
    (a) circle (b) diameter (c) arc (d) $\overline{AL}$
15. **In fig (C) $m\angle ATR$ = _____.**
    (a) $m\angle AMO$ (b) $m\angle MTO$ (c) $m\angle MAT$ (d) $m\angle AMT$

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16. If $\overline{PM}$ and $\overline{PQ}$ are two tangents of a circle from a point outside the circle then $m\overline{PM} - m\overline{PQ}$.

(a) ≠ (b) < (c) = (d) >

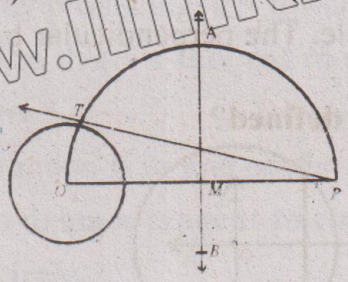


Figure (D)

17. In fig (D), which is true.

(a) $\overline{OT} \perp \overline{OT}$ (b) $\overline{oT} = PT$ (c) $\overline{PT} \perp \overline{OT}$ (d) $\overline{OM} > MP$

18. In fig (D) M is the midpain of:

(a) $\overline{OP}$ (b) $\overline{AB}$ (c) $\overline{OT}$ (d) $\overline{PT}$

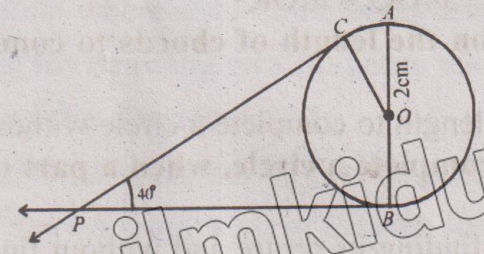


Figure (E)

19. In fig (E), Length of diameter is:

(a) 2 cm (b) 4 cm (c) 6 cm (d) 8 cm

20. In fig (E), $m\angle AOC = m\angle$

(a) OAC (b) PBA (c) BOC (d) CPB

ANSWERS:

1.	$\overleftrightarrow{RS}$	2.	$\overline{CD}$	3.	O	4.	A, B, C	5.	$\overline{AB}$	6.	$\overline{OQ}$
7.	$\overline{PQ}$, $\overline{PR}$			8.	circumference			9.	$\overline{CPD}$	10.	P
11.	$\perp$	12.	$\overline{DP}$	13.	T	14.	A,B,C	15.	$m\angle AMT$	16.	=
17.	$\overline{PT} \perp \overline{OT}$			18.	$\overline{OP}$	19.	4 cm	20.	CPB		

Additional Short Question

Short Answer Questions prepared in the light of new Examination Techniques (Knowledge, Understanding, Application, Analytical & Conceptual)

10.1 Construction of a circle

1. **What is geometric property used to locate the centre of a circle.**

Ans. The property is that the perpendicular bisector of any chord of circle always passes through the centre of that circle. By finding, where two such bisectors intersect, you locate the exact centre.

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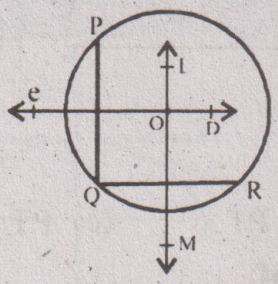
2. How many points on the circumference are required to find the center, and why?

Ans. You need at least three distinct points. These points allow you to draw two chords.

3. What is the significance of the point where the two right bisectors of the chords of a circle meet?

Ans. That point is the centre of the circle. The perpendicular bisector of any chord passes through the centre.

4. In fig how is radius of the circle defined?



Ans. The radius is defined that it is a distance from the centre of the circle to any point on arc Mathematically $r = m\overline{OP} = m\overline{OQ} = m\overline{OR}$

5. What constraint is placed on the length of chords to complete a circle without finding its centre?

Ans. The chords must be equal in length to complete a circle without finding its centre.

6. What are the two ways to complete a circle, when a part of its circumference is given.

Ans. We can complete a circle by finding its centre and without finding its centre, when a part of its circumference is given.

10.2 Tangent to a Circle

7. What is the first step of construction a tangent of a arc when P is the middle point of arc.

Ans. First step of construction is join endpoints of the arc.

8. What is the geometrical relationship between the chord of an arc and a line passing through the mid point of the arc.

Ans. The line is right bisector of the cord of arc. The perpendicular bisector of the cord must pass through mid point of arc and centre of the circle.

9. In the figure (A) which two angles must be constructed to be equal to find the direction of the tengent line?



Figure (A)

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Ans. To find the direction of the tangent line $m\angle APR = m\angle ABP$ must construct equal.

10. In the figure (A), once the angles are equalized, what line segment defines the required tangent?

Ans. The line RPQ formed by producing $\overline{RP}$ towards the required tangent.

11. What is the first step to draw a tangent to a given circle from a point P when P is on the circumference?

Ans. The first step of construction is to join center with the point p on circumference.

12. Describes the steps to dram a tangent to circle with centre "O", from a point P, which is outside the circle.

Ans. 1. Join center O to point P.
2. Find the midpoint (M) of $\overline{OP}$.
3. From the midpoint of draw a sami-circle equal to radius $\overline{OM}$.
4. Join P to the point where semi-circle inters sets the circle.

13. According to steps for drawing two tangents meeting at a 30° angle, what is the purpore of drawing the diameter first.

Ans. To provide a base line for constructing first tangent.

14. Can a tangent be drawn from a point located inside the circle?

Ans. No, a tangent cannot be drawn from a point located inside the circle because a line passing through a point inside the circle will always intersect the circle at two points.

15. What is a point of tangency?

Ans. It is a specific, single point where the tangent line touches the circumference of the circle.



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