

EXERCISE 10.2

Construction of Tangents to a Circle — Class 10th Mathematics

Key Concepts for Tangent Construction

Definition: A tangent is a line that touches the circle at exactly one point (the point of tangency).

Properties:

- The radius at the point of tangency is perpendicular to the tangent.
- From a point outside the circle, two tangents can be drawn.
- Tangents drawn from the same external point are equal in length.

Question 1: Draw Tangent to Arc AB at Point P (P is Midpoint of Arc)

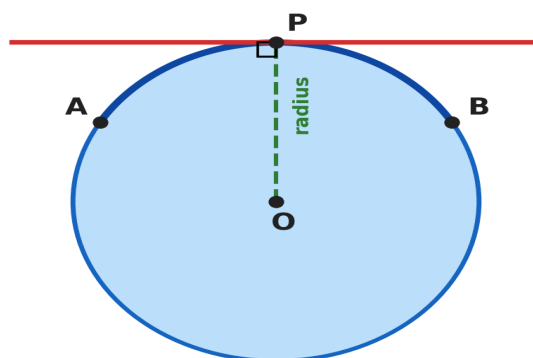
Given: Arc AB with P as the midpoint of the arc

Task: Draw tangent at point P

Construction Steps:

- Step 1: Draw the arc AB with centre O.
- Step 2: Identify point P (midpoint of the arc).
- Step 3: Draw radius OP.
- Step 4: Draw a line perpendicular to OP at point P.
- Step 5: This perpendicular line is the required tangent at P.

Tangent at P (midpoint of arc AB)



Tangent

- OP is the radius to the midpoint P.
- The tangent is perpendicular to OP at P.

Question 2: Draw Tangent to Arc QR at Point P (P is Endpoint of Arc)

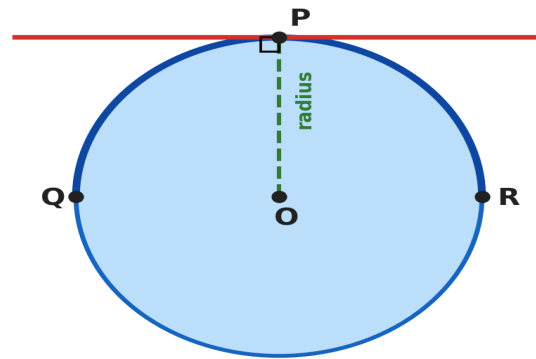
Given: Arc QR with P as the endpoint

Task: Draw tangent at point P

Construction Steps:

- Step 1: Draw the arc QR with centre O.
- Step 2: Locate point P (endpoint of the arc).
- Step 3: Draw radius OP.
- Step 4: Draw a line perpendicular to OP at point P.
- Step 5: This perpendicular line is the tangent at P.

Tangent at P (endpoint of arc QR)



Tangent

- P is the endpoint of the arc.
 - Radius OP is perpendicular to the tangent.
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Question 3: Draw Tangents to a Circle from an External Point P

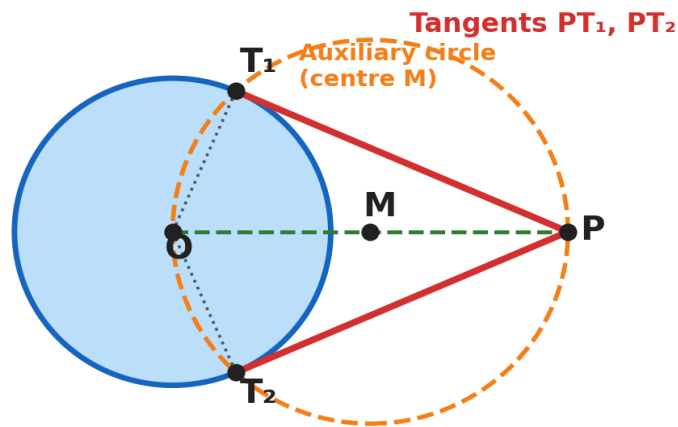
Given: A circle with centre O, point P outside the circle

Task: Draw tangents from P to the circle

Construction Steps:

- Step 1: Draw the circle with centre O.
- Step 2: Mark point P outside the circle.
- Step 3: Join O to P.
- Step 4: Find the midpoint M of OP.
- Step 5: Draw a circle with centre M and radius MP (= MO).
- Step 6: The points where this auxiliary circle intersects the original circle are the points of tangency, T_1 and T_2 .
- Step 7: Join P to T_1 and P to T_2 .
- Step 8: PT_1 and PT_2 are the required tangents.

Tangents from external point P



- PT_1 and PT_2 are tangents from the external point P.
- $\angle OT_1P = \angle OT_2P = 90^\circ$ (angle in semicircle of auxiliary circle).

Question 4: Draw a Circle of Radius 1.3 cm and a Tangent at Point P

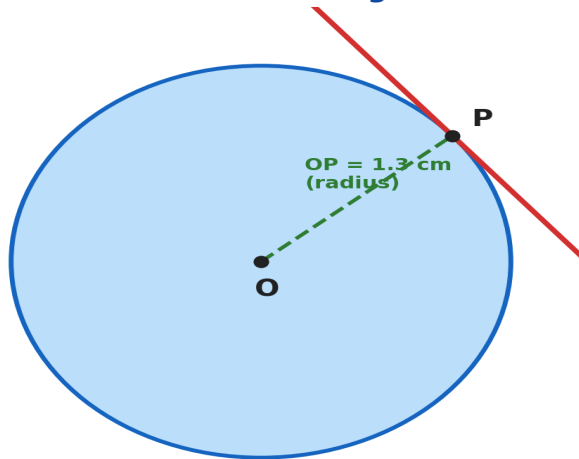
Given: Circle of radius 1.3 cm, point P on the circumference

Task: Draw tangent at point P

Construction Steps:

- Step 1: Mark centre O.
- Step 2: Set the compass to 1.3 cm and draw the circle.
- Step 3: Mark point P on the circumference.
- Step 4: Draw radius OP.
- Step 5: Draw a line perpendicular to OP at P.
- Step 6: This perpendicular line is the required tangent.

Circle $r = 1.3 \text{ cm}$ — Tangent at P



Tangent

- $OP = 1.3 \text{ cm}$ (radius).
 - The tangent is perpendicular to OP .
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Question 5: Draw a Circle of Radius 1.5 cm and Tangents from a Point 8 cm from the Centre

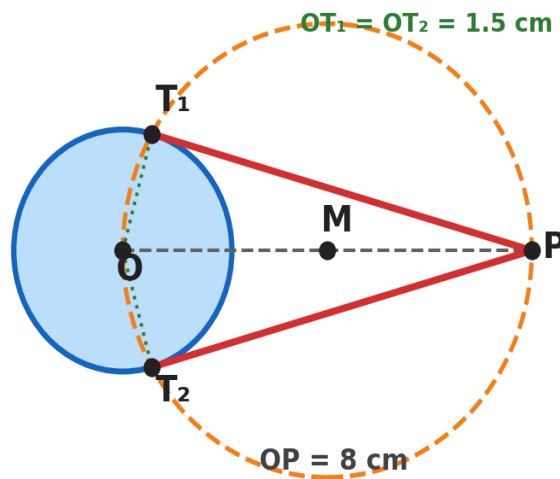
Given: Circle of radius 1.5 cm, external point P at 8 cm from the centre

Task: Draw tangents from P

Construction Steps:

- Step 1: Mark centre O.
- Step 2: Set the compass to 1.5 cm and draw the circle.
- Step 3: Mark point P such that $OP = 8$ cm.
- Step 4: Find the midpoint M of OP.
- Step 5: Draw a circle with centre M and radius MP.
- Step 6: Let this auxiliary circle intersect the original circle at T_1 and T_2 .
- Step 7: Join P to T_1 and P to T_2 .
- Step 8: PT_1 and PT_2 are the required tangents.

Circle $r = 1.5$ cm, external point P ($OP = 8$ cm)



- $OP = 8$ cm.
 - $OT_1 = OT_2 = 1.5$ cm (radius).
 - PT_1 and PT_2 are tangents.
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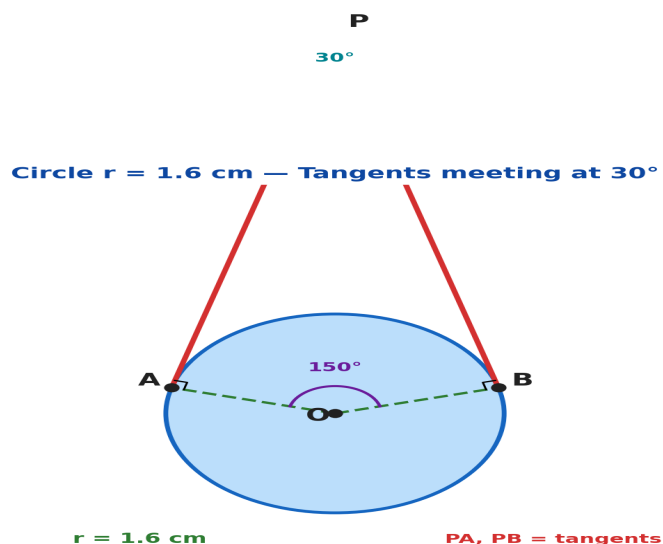
Question 6: Draw a Circle of Radius 1.6 cm and Two Tangents Meeting at 30°

Given: Circle of radius 1.6 cm, angle between tangents = 30°

Task: Draw two tangents meeting at 30°

Construction Steps:

- Step 1: Mark centre O.
- Step 2: Draw the circle with radius 1.6 cm.
- Step 3: Draw radius OA.
- Step 4: At O, construct an angle $\angle AOB = 150^\circ$ ($180^\circ - 30^\circ$).
- Step 5: Draw radii OA and OB.
- Step 6: At A and B, draw perpendiculars to OA and OB respectively.
- Step 7: Let these perpendiculars meet at P.
- Step 8: PA and PB are the tangents meeting at an angle of 30°.



- PA and PB are tangents.
- $OA \perp PA$ and $OB \perp PB$.
- $\angle AOB = 150^\circ$, so $\angle APB = 30^\circ$.

Question 7: Draw a Tangent at Any Point on a Circular Track (Radius = 2 cm)

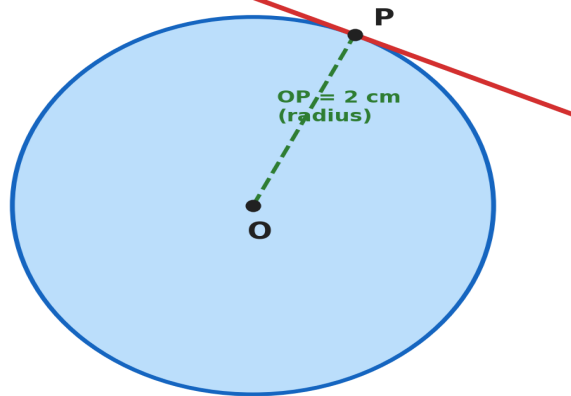
Given: Circle of radius 2 cm, any point P on the track

Task: Draw tangent at that point

Construction Steps:

- Step 1: Mark centre O.
- Step 2: Draw the circle with radius 2 cm.
- Step 3: Choose any point P on the circle.
- Step 4: Draw radius OP.
- Step 5: Draw a line perpendicular to OP at P.
- Step 6: This perpendicular line is the required tangent.

Circular track $r = 2\text{ cm}$ — Tangent at P



Tangent

- $OP = 2\text{ cm}$ (radius).
 - The tangent is perpendicular to OP .
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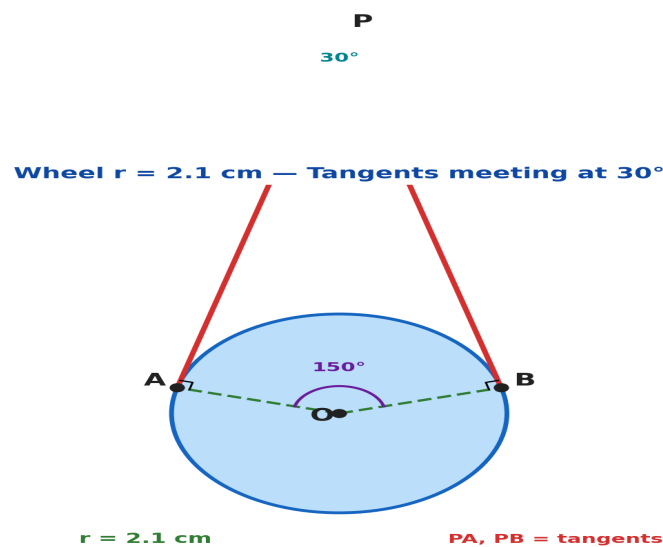
Question 8: Construct Two Tangents to a Wheel ($r = 2.1$ cm) Meeting at 30°

Given: Circle (wheel) of radius 2.1 cm, angle between tangents = 30°

Task: Construct two tangents from an external point

Construction Steps:

- Step 1: Mark centre O.
- Step 2: Draw the circle with radius 2.1 cm.
- Step 3: Draw two radii OA and OB such that $\angle AOB = 150^\circ$.
- Step 4: At A, draw a perpendicular to OA.
- Step 5: At B, draw a perpendicular to OB.
- Step 6: Let these perpendiculars meet at P.
- Step 7: PA and PB are the tangents meeting at 30° .



- PA and PB are tangents.
- $OA \perp PA$ and $OB \perp PB$.

Summary Table

Question	Given	Construction Method
1	Arc with midpoint P	Radius OP $\rightarrow$ Perpendicular at P
2	Arc with endpoint P	Radius OP $\rightarrow$ Perpendicular at P
3	Circle, external point P	Join OP $\rightarrow$ Midpoint M $\rightarrow$ Auxiliary circle $\rightarrow$ Tangents
4	$r = 1.3$ cm, P on circle	Radius OP $\rightarrow$ Perpendicular at P
5	$r = 1.5$ cm, OP = 8 cm	External point method
6	$r = 1.6$ cm, angle = 30°	Radii at $150^\circ \rightarrow$ Perpendiculars
7	$r = 2$ cm, any point P	Radius OP $\rightarrow$ Perpendicular at P
8	$r = 2.1$ cm, angle = 30°	Radii at $150^\circ \rightarrow$ Perpendiculars

Key Theorems Used

Radius-Tangent Theorem: The radius is perpendicular to the tangent at the point of contact.

Tangents from an External Point: Two tangents drawn from an external point are equal in length, and they subtend equal angles at the centre.

Angle Between Tangents: If two tangents meet at P, and the corresponding central angle is $\angle AOB$, then $\angle APB = 180^\circ - \angle AOB$.

Quick Reference: Angle Between Tangents $\leftrightarrow$ Central Angle

Angle between Tangents	Central Angle
30°	150°
45°	135°
60°	120°
90°	90°

Construction Tip: For tangents meeting at angle θ , the central angle is $180^\circ - \theta$.