



CIRCLES

(TANGENTS TO A CIRCLE)

1 CHAPTER SNAPSHOT

This chapter introduces tangents to a circle and their important properties.

It helps us solve real-life and exam-level problems using theorems.

Key Ideas:

- ✓ Tangent touches the circle at exactly one point.
- ✓ Radius is perpendicular to the tangent at the point of contact.
- ✓ Lengths of tangents drawn from an external point are equal.
- ✓ Tangents and circles form many useful theorems.

2 HIGH-YIELD CONCEPTS

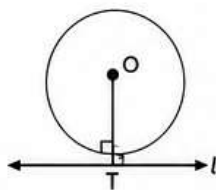
- **Tangent:** A line that touches a circle at exactly one point.
- **Point of Contact:** The point where the tangent touches the circle.
- **Radius-Tangent Property:** The radius through the point of contact is perpendicular to the tangent.
- **Tangent from an External Point:** Tangents drawn from an external point to a circle are equal in length.
- **Converse:** If a line is perpendicular to a radius at the endpoint on the circle, then the line is a tangent.

3 FORMULA BANK

- ★ Length of tangent from an external point P
 $PA = PB$
(If PA and PB are tangents)
- ★ Radius $\perp$ Tangent
 $OP \perp PT$ (Here, PT is tangent at T)
- ★ If $PT \perp OR$ at T
Then PT is a tangent.
- ★ In $\triangle OPT$ (right angled at T)
 $OP^2 = OT^2 + PT^2$
- ★ Length of tangent
 $PT = \sqrt{OP^2 - OT^2}$

4 THEOREM BOX

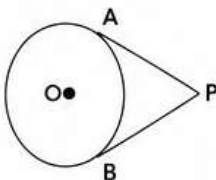
Theorem 1 (Tangent $\perp$ Radius)



If a line is a tangent to a circle, then the radius through the point of contact is perpendicular to the tangent.

$$OT \perp l \text{ at } T$$

Theorem 2 (Equal Tangents from External Point)



The lengths of tangents drawn from an external point to a circle are equal.

$$PA = PB$$

5 BOARD EXAM FOCUS (HOTSPOTS)



Repeated Proofs:

- Prove that the parallelogram circumscribing a circle is a rhombus.
- In two concentric circles, the chord of the larger circle touching the smaller one is bisected at the point of contact.



Key Properties for Problems:

- In a quadrilateral circumscribing a circle, the sum of opposite sides is equal ($AB + CD = AD + BC$).
- The angle between two tangents from an external point is supplementary to the angle subtended by the radii at the centre.



Competency Area:

Using Pythagoras Theorem to find the length of a tangent when the radius and distance from the centre are given.

$$OP^2 = OT^2 + TP^2$$

6 SMART REVISION TIPS

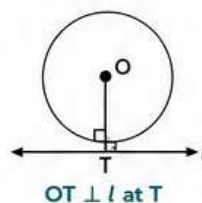
- ✓ Always identify the point of contact first.
- ✓ Draw a neat diagram – it solves half the problem!
- ✓ Use the Radius-Tangent property wherever possible.
- ✓ Remember: Tangents from the same external point are equal.
- ✓ Use Pythagoras theorem in $\triangle OPT$ (right angled at T) for length calculations.

7 COMMON MISTAKES

- ✗ Assuming any line touching the circle at two points is a tangent.
- ✗ Forgetting to prove radius $\perp$ tangent.
- ✗ Using diameter instead of radius in formulas.
- ✗ Not identifying the right-angled triangle in problems.
- ✗ Mixing up external point and point on the circle.

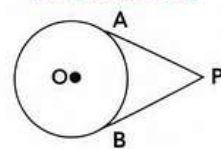
8 VISUAL MEMORY AID

Radius $\perp$ Tangent



$$OT \perp l \text{ at } T$$

Equal Tangents from External Point



$$PA = PB$$

9 30 SECOND RAPID REVISION

- ✓ Tangent touches a circle at exactly one point.
- ✓ Radius through the point of contact is perpendicular to the tangent.
- ✓ Tangents drawn from the same external point are equal.
- ✓ If a line is $\perp$ to radius at the endpoint on the circle, it is a tangent.
- ✓ Use Pythagoras in $\triangle OPT$ for length of tangent.
- ✓ Neat diagram + theorems = Full marks!

10 KEY TAKEAWAY

- A tangent touches a circle at exactly one point, called the point of contact.
- The radius through the point of contact is always perpendicular to the tangent.
- Tangents drawn from the same external point to a circle are always equal in length.
- If a line is perpendicular to the radius at its endpoint on the circle, then the line is a tangent.
- In tangent problems, first identify the right triangle formed by the radius and tangent, then apply Pythagoras theorem.
- Most proof questions are based on Radius $\perp$ Tangent and Equal Tangents from an external point.