

ONEPATH ACADEMY



TINKU SIR TRICKS × MASTER MATHEMATICS NOTES

📖 CLASS: 10th CBSE

📖 CHAPTER: CIRCLE

👨‍🏫 TEACHER: Tinku Sir

🎯 TARGET: Board Exam 2026-27

1. CHAPTER OVERVIEW & CONCEPT MAP

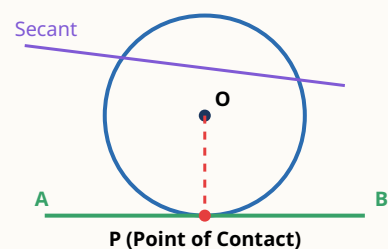
Welcome to the Master Notes for **CBSE Class 10 Circles**. This chapter carries **5 to 8 marks** in the CBSE Board Examination. It is purely theorem-driven, geometry-focused, and highly scoring if your proof-writing structure and visual recognition are sharp!

Concept / Topic	NCERT Weightage	CBSE Question Types	Core Focus
Tangent to a Circle	Theorem 10.1	MCQs, VSA (1-2 Marks)	Perpendicularity ($OP \perp AB$ at Point of Contact)
Number of Tangents	Theorem 10.2	Short & Long Proofs (3-5 Marks)	Equal Tangents ($PA = PB$), Right Triangles
Geometric Applications	NCERT Ex 10.2 + HOTS	Case Studies, Proofs, Competency	Circumscribed Quadrilaterals, Concentric Circles

2. CORE CONCEPTS — WHAT, WHY & HOW

Concept 1: Secant vs. Tangent vs. Point of Contact

- **Secant:** A line that intersects a circle at *two distinct points* (e.g., line PQ).
- **Tangent:** A line that touches the circle at *exactly one point* (e.g., line AB).
- **Point of Contact:** The unique common point P where the tangent touches the circle.
- **Normal:** The line perpendicular to the tangent at the point of contact; it *always passes through the center* O .



🔥 TINKU SIR TRICK: "NO TOUCH, TOUCH, CUT"

- Line completely outside → **0 Common Points** (Non-intersecting line)
- Line touches boundary → **1 Common Point** (Tangent)
- Line cuts inside circle → **2 Common Points** (Secant)

Comparison: Tangent vs. Secant vs. Chord

Feature	Chord	Secant	Tangent
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Intersection Points	2 points (End points lie ON circle)	2 points (Line extends OUTSIDE circle)	1 point (Touches circle externally)
Type of Geometric Entity	Line Segment (finite)	Infinite Line	Infinite Line
Distance from Center (d)	$d < r$	$d < r$	$d = r$ (Radius distance)

3. MANDATORY BOARD THEOREMS & DETAILED PROOFS

★ THEOREM 10.1 (Radius Perpendicular to Tangent)

Statement: The tangent at any point of a circle is perpendicular to the radius through the point of contact.

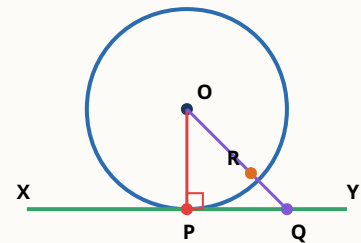
GIVEN: A circle with center O and a tangent XY touching the circle at point P .

TO PROVE: $OP \perp XY$

CONSTRUCTION: Take a point Q on XY other than P . Join OQ . Let OQ intersect the circle at point R .

PROOF:

1. From figure, $OQ = OR + RQ$. Therefore, $OQ > OR$.
2. Since $OP = OR$ (radii of the same circle), we have $OQ > OP$.
3. This condition ($OQ > OP$) holds true for *every point* on the line XY except the point P .
4. Hence, OP is the **shortest distance** from the center O to the line XY .
5. Since the shortest line segment from a point to a line is perpendicular, $OP \perp XY$. (Hence Proved)



🚀 ONEPATH HACK: WHERE TO APPLY THEOREM 10.1

Whenever you see a **Tangent** and a **Radius meeting at the Point of Contact** in any question: Immediately mark 90° ! Then apply **Pythagoras Theorem** in *triangle OPT*:

$$OP^2 + PT^2 = OT^2 \quad \text{implies} \quad \text{ext}\{(\text{Radius})\}^2 + \text{ext}\{(\text{Tangent Length})\}^2 = \text{ext}\{(\text{Distance from Center})\}^2$$

★ THEOREM 10.2 (Lengths of Tangents from External Point)

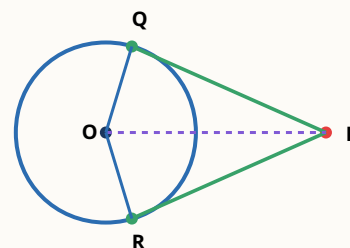
Statement: The lengths of tangents drawn from an external point to a circle are equal.

GIVEN: A circle with center O , an external point P , and two tangents PQ and PR touching circle at Q and R .

TO PROVE: $PQ = PR$

CONSTRUCTION: Join OP , OQ , and OR .

PROOF:



1. In right-angled triangles $\triangle OQP$ and $\triangle ORP$:
2. $\angle OQP = \angle ORP = 90^\circ$ (Radius $\perp$ Tangent, Theorem 10.1).
3. $OP = OP$ (Common hypotenuse).
4. $OQ = OR$ (Radii of the same circle).
5. By **RHS Congruence Criterion**, $\triangle OQP \cong \triangle ORP$.
6. Therefore, by **CPCT**: $PQ = PR$. (Hence Proved)

TINKU SIR TRICK: "2 ADDITIONAL HIDDEN DEDUCTIONS" FROM THEOREM 10.2

From $\triangle OQP \cong \triangle ORP$, CPCT gives two more powerful results that solve 40% of board questions:

1. $\angle QPO = \angle RPO$ $\implies$ OP bisects the angle between the tangents ($\angle QPR$).
2. $\angle QOP = \angle ROP$ $\implies$ OP bisects the angle subtended at the center ($\angle QOR$).
3. **Supplementary Rule:** $\angle QPR + \angle QOR = 180^\circ$ (Angle between tangents and angle subtended at center are supplementary!).

4. QUESTION IDENTIFICATION SYSTEM

When you see a question in the board exam, use Tinku Sir's "LOOK $\rightarrow$ IDENTIFY $\rightarrow$ SOLVE" framework:

If Question Contains / Asks	Identify Concept	Master Formula / Method to Use
Tangent length, Radius, Distance from center given	Pythagorean Tangent Triangle	$r^2 + L^2 = d^2$ (r = radius, L = tangent, d = dist from center)
Two concentric circles with chord touching inner circle	Concentric Circle Chord Theorem	Radius $\perp$ Chord bisects it: $L_{\text{chord}} = 2\sqrt{R^2 - r^2}$
Quadrilateral circumscribing a circle (touching 4 sides)	Tangential Quadrilateral Property	Opposite sides sum equal: $AB + CD = AD + BC$
Angle between two tangents (θ) given	Supplementary Angle Rule	$\angle_{\text{Center}} + \angle_{\text{Tangents}} = 180^\circ$
Circle inscribed in a Right Triangle	Inradius Formula	$r = \frac{a + b - c}{2}$ where c is hypotenuse

5. STEP-BY-STEP SOLVED EXAMPLES (CBSE PATTERN)

EXAMPLE 1 (Basic / Standard Board Question) 3 Marks

Question: A point P is $13 \text{ ext{ cm}}$ away from the center of a circle. The length of the tangent drawn from P to the circle is $12 \text{ ext{ cm}}$. Find the radius of the circle.

 **CONCEPT:** Theorem 10.1 + Pythagoras Theorem in Right Triangle $\text{riangle } OTP$.

 **GIVEN:** Distance from center $OP = 13 \text{ ext{ cm}}$, Tangent length $PT = 12 \text{ ext{ cm}}$.

 **TO FIND:** Radius $OT = r$.

 **STEP-BY-STEP SOLUTION:**

1. Let O be the center of the circle and T be the point of contact.
2. Since radius is perpendicular to tangent at point of contact (Theorem 10.1):

$$\text{ngle } OTP = 90^\circ$$

3. In right-angled triangle $\text{riangle } OTP$, by Pythagoras Theorem:

$$OT^2 + PT^2 = OP^2$$

4. Substitute given values:

$$r^2 + 12^2 = 13^2 \implies r^2 + 144 = 169$$

$$r^2 = 169 - 144 = 25 \implies r = \sqrt{25} = 5 \text{ ext{ cm}}$$

 **FINAL ANSWER:** The radius of the circle is $5 \text{ ext{ cm}}$.

EXAMPLE 2 (Proving Theorem Application) 4 Marks

Question: Prove that in two concentric circles, the chord of the larger circle, which touches the smaller circle, is bisected at the point of contact.

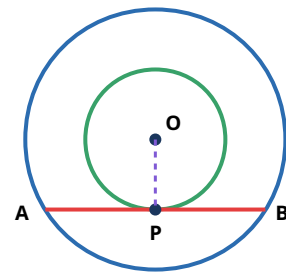
 **CONCEPT:** Concentric circles + Theorem 10.1 + Perpendicular from center bisects chord.

GIVEN: Two concentric circles C_1 (radius R) and C_2 (radius r) with common center O . AB is a chord of C_1 touching C_2 at point P .

TO PROVE: $AP = PB$

STEP-BY-STEP SOLUTION:

- AB is tangent to smaller circle C_2 at point P , and OP is radius of C_2 .
- By Theorem 10.1, $OP \perp AB$.
- Now, AB is a chord of the larger circle C_1 and $OP \perp AB$.
- We know from Class 9 geometry that *the perpendicular drawn from the center of a circle to a chord bisects the chord*.
- Therefore, $AP = PB$. **(Hence Proved)**



EXAMPLE 3 (Circumscribed Quadrilateral) CBSE PYQ 2024 / 5 Marks

Question: A quadrilateral $ABCD$ is drawn to circumscribe a circle. Prove that $AB + CD = AD + BC$.

GIVEN: Quadrilateral $ABCD$ touching circle at P, Q, R, S on sides AB, BC, CD, DA respectively.

TO PROVE: $AB + CD = AD + BC$

PROOF:

By Theorem 10.2, lengths of tangents from an external point are equal:

- From point A : $AP = AS$... (1)
- From point B : $BP = BQ$... (2)
- From point C : $CR = CQ$... (3)
- From point D : $DR = DS$... (4)

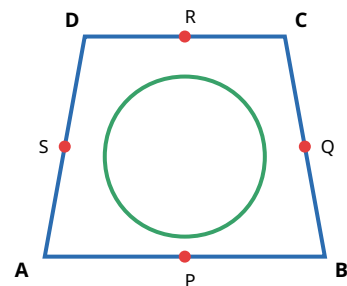
Adding equations (1), (2), (3), and (4):

$$(AP + BP) + (CR + DR) = (AS + DS) + (BQ + CQ)$$

Combining the adjacent segments:

$$AB + CD = AD + BC$$

(Hence Proved)



6. VERIFIED CBSE BOARD PYQS (2023 - 2026 PATTERNS)

VERIFIED **CBSE PYQ 2023** 2 Marks

Question: From an external point P , tangents PA and PB are drawn to a circle with center O . If $\angle APB = 70^\circ$, find $\angle AOB$.

Solution:

1. We know that the angle between two tangents drawn from an external point and the angle subtended by the line segments joining the points of contact to the center are supplementary.
2. $\angle AOB + \angle APB = 180^\circ$
3. $\angle AOB + 70^\circ = 180^\circ \implies \angle AOB = 180^\circ - 70^\circ = 110^\circ$.

VERIFIED CBSE PYQ 2024 3 Marks

Question: Two concentric circles are of radii 5 cm and 3 cm . Find the length of the chord of the larger circle which touches the smaller circle.

Solution:

1. Let O be the center. Radius of larger circle $R = 5 \text{ cm}$, Radius of smaller circle $r = 3 \text{ cm}$.
2. Let AB be the chord touching smaller circle at P . Then $OP \perp AB$.
3. In right $\triangle OPA$: $OA^2 = OP^2 + AP^2 \implies 5^2 = 3^2 + AP^2 \implies 25 - 9 = AP^2 \implies AP = 4 \text{ cm}$.
4. Since P bisects AB : Length of chord $AB = 2 \times AP = 2 \times 4 = 8 \text{ cm}$.

CBSE-STYLE / COMPETENCY PATTERN 2025-2026 Case Study / 4 Marks

Scenario: A circular park of radius 10 m is situated in a colony. Two security guards are standing at points A and B outside the park such that tangents drawn from an observation tower at P touch the park boundary at A and B . Distance of tower P from park center O is 26 m .

Questions:

1. Find length of tangent PA .
2. Find perimeter of $\triangle PAB$ if chord $AB = 19.2 \text{ m}$.

Solution:

1. $PA = \sqrt{OP^2 - OA^2} = \sqrt{26^2 - 10^2} = \sqrt{676 - 100} = \sqrt{576} = 24 \text{ m}$.
2. Since $PB = PA = 24 \text{ m}$, Perimeter of $\triangle PAB = PA + PB + AB = 24 + 24 + 19.2 = 67.2 \text{ m}$.

7. CONCEPT-WISE GRADED PRACTICE SET

Level	Question	Answer / Key Hint
LEVEL 1 (Basic)	If tangents PA and PB from point P to a circle with center O are inclined to each other at angle of 80° , find $\angle POA$.	$\angle AOB = 100^\circ \implies \angle POA = 50^\circ$
LEVEL 2 (Application)	A circle touches all four sides of quadrilateral $ABCD$ with $AB = 6 \text{ cm}$, $BC = 7 \text{ cm}$, $CD = 4 \text{ cm}$. Find AD .	

		$AB + CD = AD + BC \implies 6 + 4 = AD + 7 \implies AD = 3 \text{ ext{ cm}}$
LEVEL 3 (HOTS)	Prove that the angle between two tangents drawn from an external point to a circle is supplementary to the angle subtended by the line-segment joining the points of contact at the center.	Use quadrilateral $OAPB$ angle sum 360° with two right angles.

8. ⚠ STUDENTS OFTEN MAKE THESE MISTAKES

✗ MISTAKE 1: Assuming Hypotenuse in Tangent Triangle Incorrectly

Wrong Approach: Taking tangent length PT as hypotenuse, writing $PT^2 = OP^2 + OT^2$.

✓ **Correct Approach:** The right angle is ALWAYS at the point of contact T ($\angle OTP = 90^\circ$). Therefore, **distance from center OP is ALWAYS the hypotenuse!**

Formula: $OP^2 = OT^2 + PT^2$

✗ MISTAKE 2: Forgetting Theorems Reasons in Proofs

Wrong Approach: Writing $PA = PB$ without writing the reason.

✓ **Correct Approach:** Always write in brackets: "(Lengths of tangents drawn from an external point to a circle are equal - Theorem 10.2)". CBSE step marking deducts 0.5 to 1 mark for missing geometric reasons!

9. 🗺 VISUAL CHAPTER MIND MAP

CIRCLES (CLASS 10 MATHS)

📌 1. TANGENT PROPERTIES

- Point of contact: Only 1 common point
- Theorem 10.1: Radius $\perp$ Tangent at point of contact ($OP \perp AB$)
- Shortcut: Right triangle $\triangle OPT \rightarrow r^2 + L^2 = d^2$

📌 2. TANGENTS FROM EXTERNAL POINT

- No. of tangents: Exactly 2 from external point
- Theorem 10.2: Tangent lengths are equal ($PA = PB$)
- Equal Center Angles: $\angle AOP = \angle BOP$
- Angle Bisector: Line OP bisects $\angle APB$

📌 3. KEY GEOMETRIC DEDUCTIONS

- Supplementary Angles: $\angle APB + \angle AOB = 180^\circ$
- Tangential Quadrilateral: $AB + CD = AD + BC$
- Concentric Circles Chord: Chord Length $= 2\sqrt{R^2 - r^2}$

🔥 4. BOARD EXAM TRICKS

- Inradius Right $\triangle$: $r = (a + b - c) / 2$
- Cyclic Parallelogram touching circle $\rightarrow$ MUST BE A RHOMBUS!

10. 🚀 ONEPATH ONE-PAGE LAST-MINUTE REVISION

⚡ Top Formulas & Identities

- **Tangent Pythagoras:** $d^2 = r^2 + L^2$
- **Chord in Concentric Circles:** $L = 2\sqrt{R^2 - r^2}$
- **Inradius of Right Triangle:** $r = \frac{\text{Base} + \text{Perpendicular} - \text{Hypotenuse}}{2}$
- **Supplementary Tangent Angle:** $\angle \text{Center} + \angle \text{Tangents} = 180^\circ$

🏆 Top 3 Board Tips

- **Always Draw Clear Diagrams:** Use ruler and compass in proof questions for full marks.
- **State Given & To Prove:** Never jump straight to proof; write structure cleanly.
- **Quote Theorem Numbers / Statements:** Always write theorem statement in brackets for step marks.

11. 🏁 FINAL CHAPTER REVISION CHECKLIST

- ☒ I understand the difference between Secant, Tangent, and Point of Contact.
- ☒ I can state and prove **Theorem 10.1** (Radius $\perp$ Tangent) with diagram and construction.
- ☒ I can state and prove **Theorem 10.2** (Lengths of Tangents from External Point are Equal).
- ☒ I know how to solve right-triangle problems using $r^2 + L^2 = d^2$.
- ☒ I know the circumscribed quadrilateral formula $AB + CD = AD + BC$ and its proof.
- ☒ I can calculate the chord length in concentric circles.
- ☒ I have solved verified CBSE PYQs from 2023 to 2026.
- ☒ I know Tinku Sir's Inradius shortcut trick for right triangles.