Circles

A tangent touches a circle at one point. Join the centre to that point immediately: the resulting right angle is often the key to the question.

Formulas and methods

The tangent at a point on a circle is perpendicular to the radius through that point.

The two tangent segments from the same external point have equal lengths: PA = PB.

If O is the centre, A a point of tangency and P an external point, $PA^2 = OP^2 - OA^2$.

Why the radius is perpendicular to the tangent: every other point Q on the tangent lies outside the circle, so OQ > r = OA. Thus OA is the shortest distance from O to the tangent line. The shortest distance from a point to a line is perpendicular.

Worked examples

A circle has radius 5 cm. An external point is 13 cm from its centre. Find a tangent length.

Join the centre O to tangent point A. OA ⊥ PA, so $PA = \sqrt{(13^2 - 5^2)} = \sqrt{144} = 12$ cm.

Prove that tangents PA and PB from P have equal lengths.

Join OA, OB and OP. Angles OAP and OBP are right angles, OA = OB (radii), and OP is common. The right triangles OAP and OBP are congruent by RHS. Therefore PA = PB.

Common mistake

Equal tangent lengths must come from the same external point and end at the points of contact. An arbitrary secant segment is not a tangent.

Circles — practice

Try these without looking at the answers. Show substitutions and units. Difficulty labels describe these questions, not official CBSE classifications.

1. [Foundation] What angle does a tangent make with the radius at contact?

2. [Core] PA and PB are tangents from P. PA = 3x + 1 and PB = 5x − 7. Find x and their lengths.

3. [Core] A tangent is 24 cm long and the centre is 25 cm from the external point. Find the radius.

4. [Challenge] Two tangents PA and PB make angle APB = 70°. Find the non-reflex angle AOB.

Circles — answers

1. What angle does a tangent make with the radius at contact?

90°.

2. PA and PB are tangents from P. PA = 3x + 1 and PB = 5x − 7. Find x and their lengths.

3x+1 = 5x−7 gives x = 4. Each tangent is 13 units.

3. A tangent is 24 cm long and the centre is 25 cm from the external point. Find the radius.

$r^2 = 25^2 - 24^2 = 49$, so r = 7 cm.

4. Two tangents PA and PB make angle APB = 70°. Find the non-reflex angle AOB.

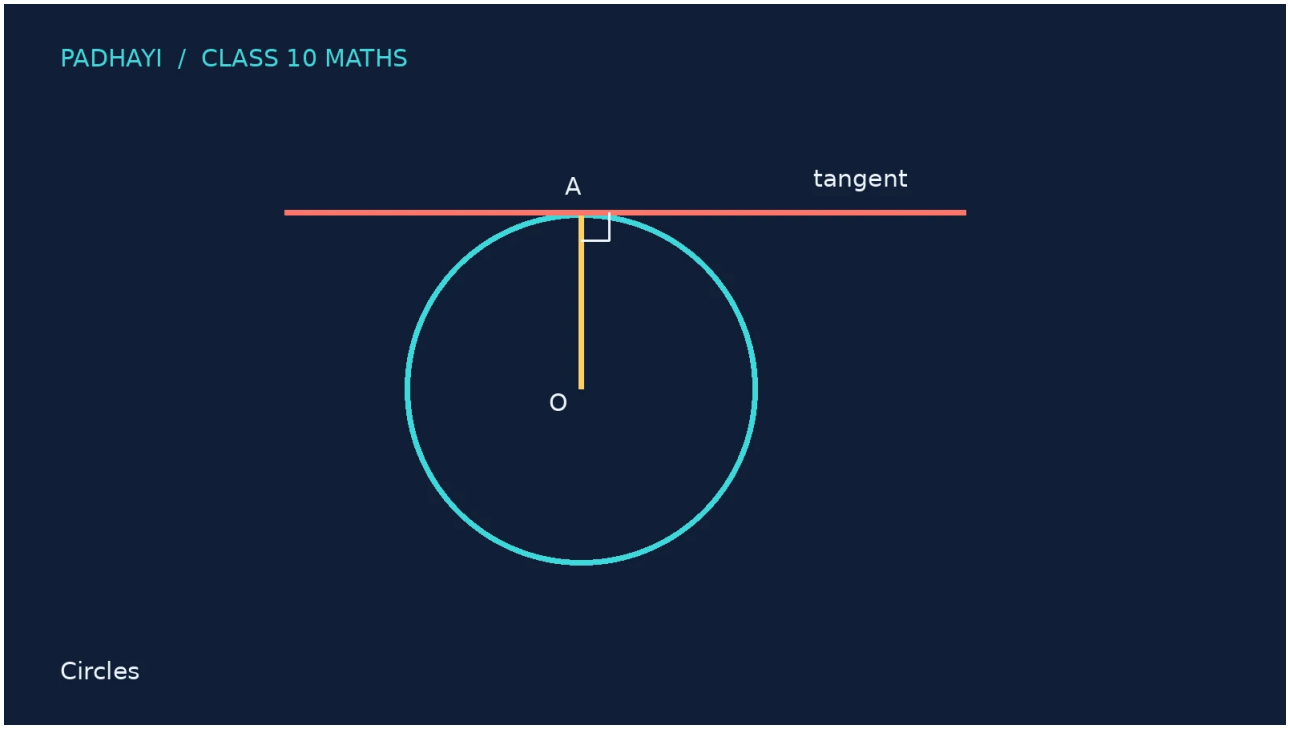
Quadrilateral OAPB has two right angles. Angle AOB = 360° − 90° − 90° − 70° = 110°.

Next step: explain one method aloud, then solve a question from your NCERT textbook without using this sheet.

Original Padhayi revision material. Independent study aid; not an official CBSE or NCERT publication. Syllabus reference: CBSE Mathematics, Class X, 2026–27.

Official CBSE syllabus | NCERT textbooks

Visual reminder



Schematic illustration; diagrams are not necessarily drawn to scale.