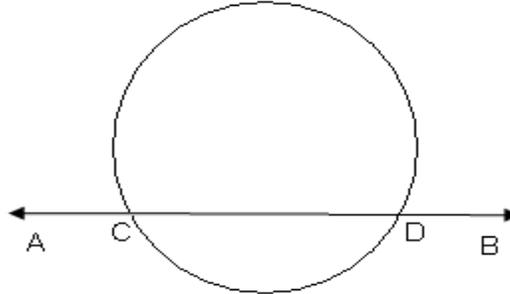


Circles: Tangents and Intersecting Chords

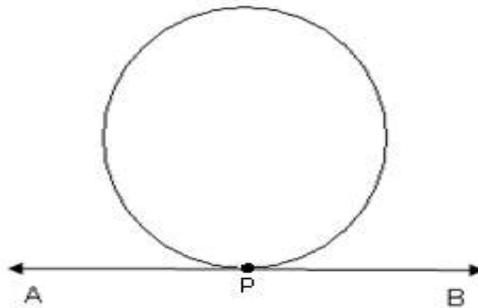
Some terms associated with circle

1. A line which intersects a circle at two distinct points is called a **secant** of the circle.



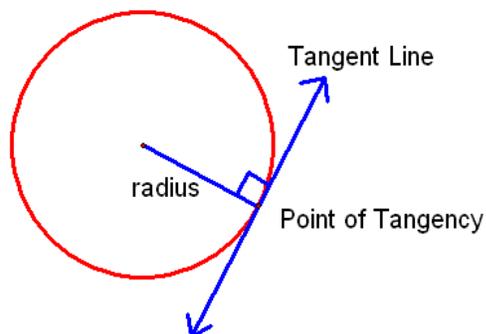
In the figure, AB is a secant to the circle.

2. A **tangent** to a circle is a line that intersects the circle only at one point.
The common point of the circle and the tangent is called **point of contact**.



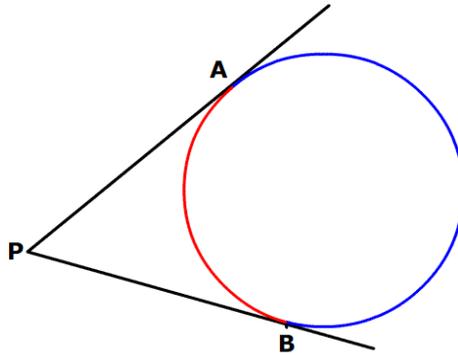
In the figure, AB is a tangent to the circle and P is the point of contact.

3. A tangent to a circle is a special case of the secant when the two end points of the corresponding chord coincide.
4. The tangent at any point of a circle is perpendicular to the radius through the point of contact.



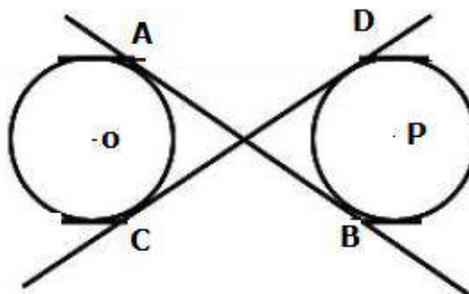
5. A line drawn through the end of a radius (point on circumference) and perpendicular to it is a tangent to the circle.

6. There is no tangent to a circle passing through a point lying inside the circle.
7. There are **exactly two tangents** to a circle **through a point outside the circle**.
8. At any point on the circle there can be one and only one tangent.
9. The length of the segment of the tangent from the external point P and the point of contact with the circle is called the **length of the tangent**.
10. The lengths of tangents drawn from an external point to the circle are equal.



The figure shows two equal tangents ($PA = PB$) from an external point P .

11. The centre of a circle lies on the bisector of the angle between the two tangents.
12. A common tangent is called a direct common tangent if both the circles lie on the same side of it.
13. The two direct common tangents are equal in length.
14. The length of a direct common tangent to two circles is $\sqrt{d^2 - (r_1 - r_2)^2}$, where d is the distance between the centres of the circles and r_1 and r_2 are the radii of the circles.
15. A common tangent is called transverse common tangent if the circles lie on opposite sides of it.



In this figure AB and CD are two transverse common tangents.

The two transverse common tangents are equal in length.

Segment of a chord and its properties

1. If two chords of a circle intersect internally or externally, then the products of the lengths of segments are equal.
2. If two line segments AB and CD intersect at P or lines containing segments AB and CD intersect at P such that $PA \times PB = PC \times PD$, then the four points A, B, C and D are concyclic.
3. If a line touches a circle and from the point of contact a chord is drawn, the angles between the tangent and the chord are respectively equal to the angles in the corresponding alternate segment.
4. If a line is drawn through an end of a chord of a circle so that the angle formed with the chord is equal to the angle subtended by the chord in the alternate segment, then the line is a tangent to the circle.
5. If a chord and a tangent intersect externally then the product of the lengths of the segments of the chord is equal to the square of the length of the tangent from the point of contact to the point of intersection, that is $PA \times PB = PT^2$