

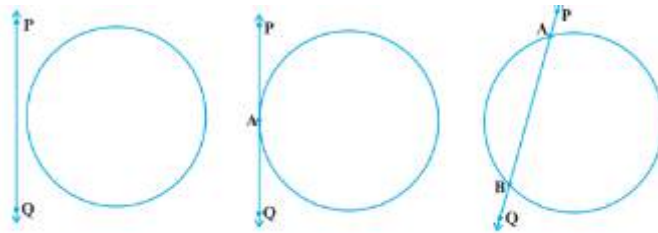
Circles

Introduction to Circles

Circle and line in a plane

For a circle and a line on a plane, there can be **three** possibilities.

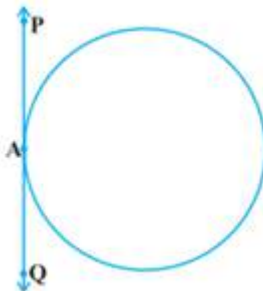
- i) they can be **non-intersecting**
- ii) they can have **a single common point** - in this case, the line touches the circle.
- ii) they can have **two common points** - in this case, the line cuts the circle.



(i) Non intersecting (ii) Touching (iii) Intersecting

Tangent

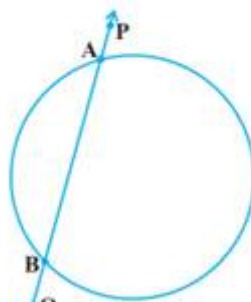
A **tangent to a circle** is a line which touches the circle at exactly one point. For every point on the circle, there is a unique tangent passing through it.



Tangent

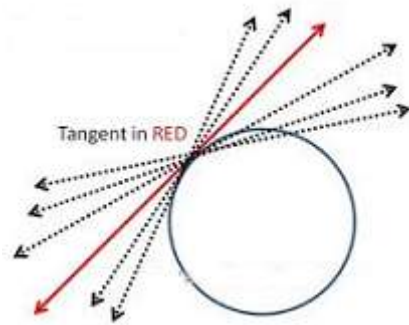
Secant

A **secant to a circle** is a line which has two points in common with the circle. It cuts the circle at two points, forming a chord of the circle.



Secant

Tangent as a special case of Secant

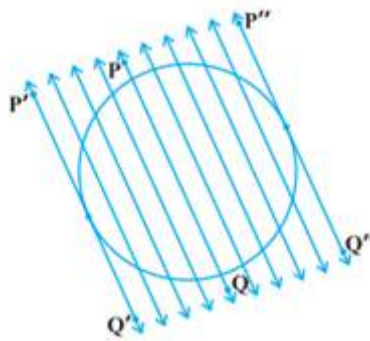


Tangent as a special case of Secant

The tangent to a circle can be seen as a special case of the secant, when the two end points of its corresponding chord coincide.

Two parallel tangents at most for a given secant

For every given **secant** of a circle, there are **exactly two tangents** which are **parallel** to it and touches the circle at two **diametrically opposite points**.

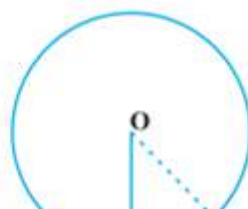


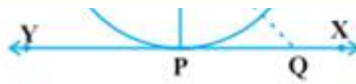
Parallel tangents

Theorems

Tangent perpendicular to radius at point of contact

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



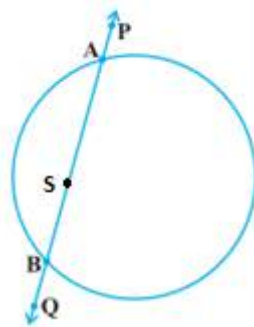


Tangent and radius

Here, O is the centre and $OP \perp XY$.

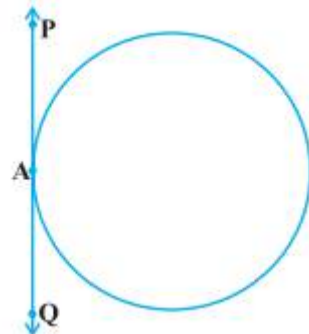
Number of tangents drawn from a given point

i) If the point is in **interior region of the circle**, any line through that point will be a secant. So, **no tangent** can be drawn to a circle passing through a point lying inside it.



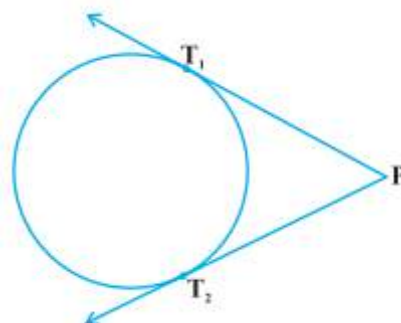
AB is a secant drawn through the point S

ii) There is **one and only one tangent** to a circle passing through a point lying on the circle.



A tangent passing through a point lying on the circle

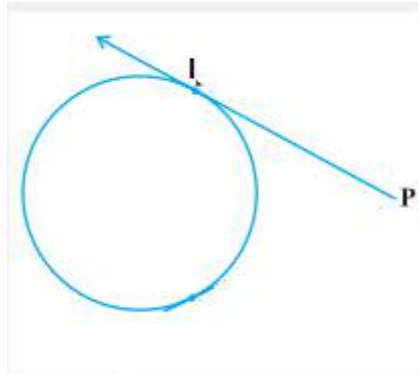
iii) There are **exactly two tangents** to a circle through a point lying outside the circle.



Tangents to a circle from an external point

Length of a tangent

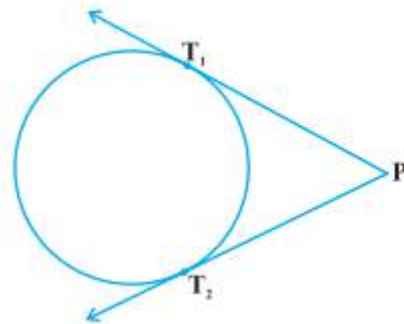
The length of the segment of the tangent from the external point **P** to the point of contact **I** with the circle is called the **length of the tangent** from the point P to the circle.



PI is the length of a tangent

Lengths of tangents drawn from external point

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



Tangents to a circle from an external point

$$PT_1 = PT_2$$