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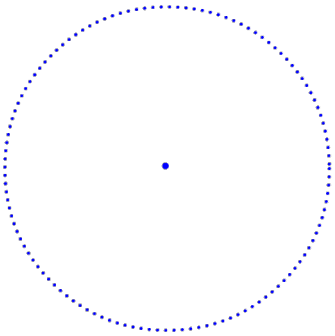
"CLASS 10th"

CIRCLES

FORMULA/CONCEPT LIST

1. Introduction to Circles:

A circle is a geometric shape formed by all the points that are equidistant from a fixed central point.



Key Terms:

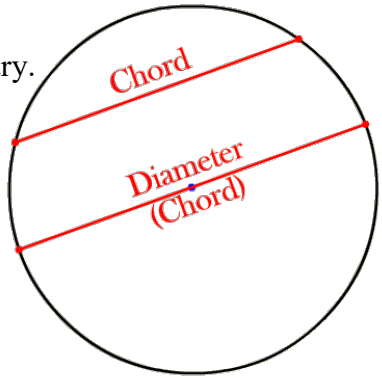
Center:
The fixed central point of the circle is known as its center.

Circumference:
The circumference is the measurement of the circle's boundary.

Radius:
The radius is the distance from the center of the circle to any point on its circumference. It is also the length of any line segment joining the center to a point on the circle.

Chord:
A chord is a line segment connecting any two points on the circle's boundary.

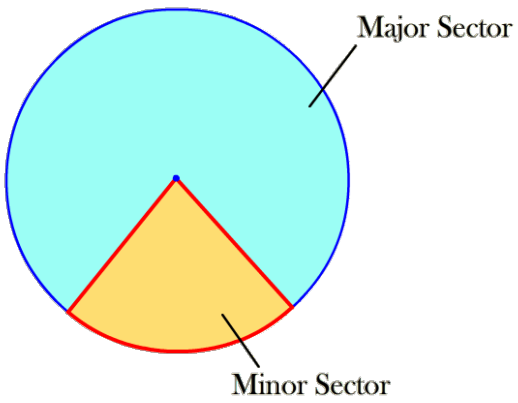
Diameter:
The diameter is twice the length of the radius.
It is the longest chord in a circle and passes through the center.

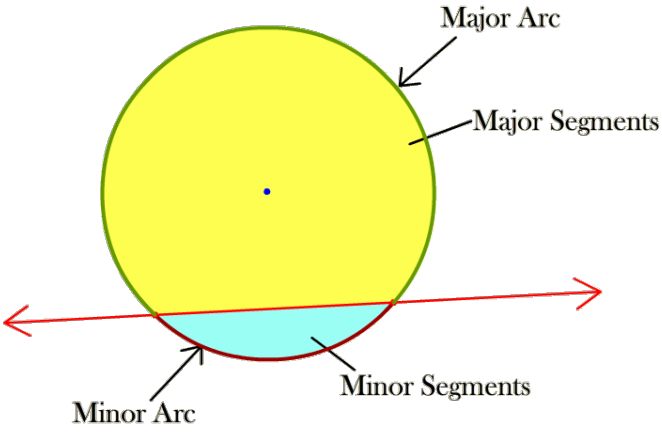


Arc:
An arc is a portion of the circle's boundary that connects two points on the circle's circumference.

Sector:
A sector is a region enclosed by an arc and two radii of the circle, drawn from the center to the arc's endpoints.

Segment:
A segment is an area within a circle, bounded by a chord and an arc.





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2. Interaction Between Circle and Line:

When a circle and a line are considered together, they can have three possible relationships:

1. **Non-Intersecting Line:**

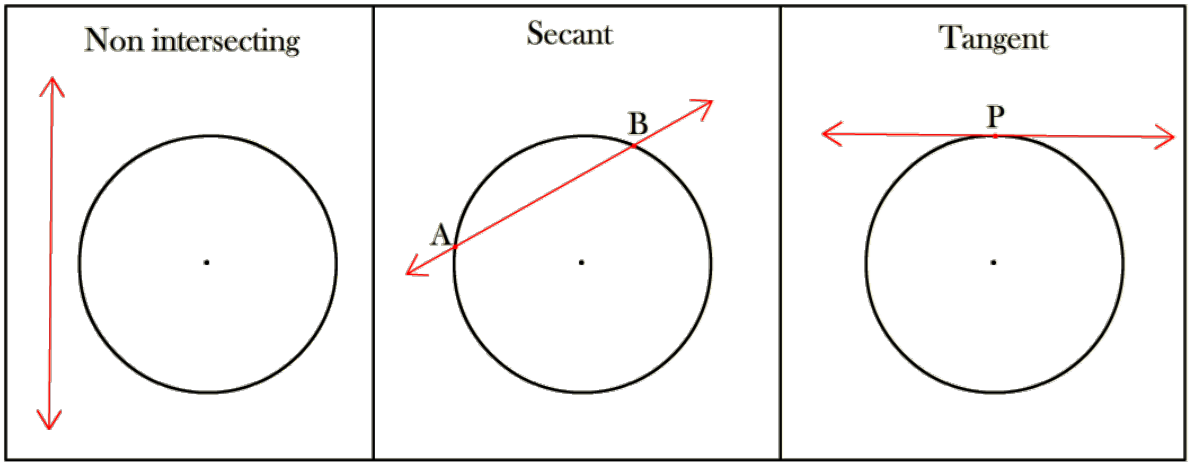
   In this case, the circle and the line do not share any common points.

2. **Secant:**

   A secant is a line that intersects a circle in two distinct points.

3. **Tangent:**

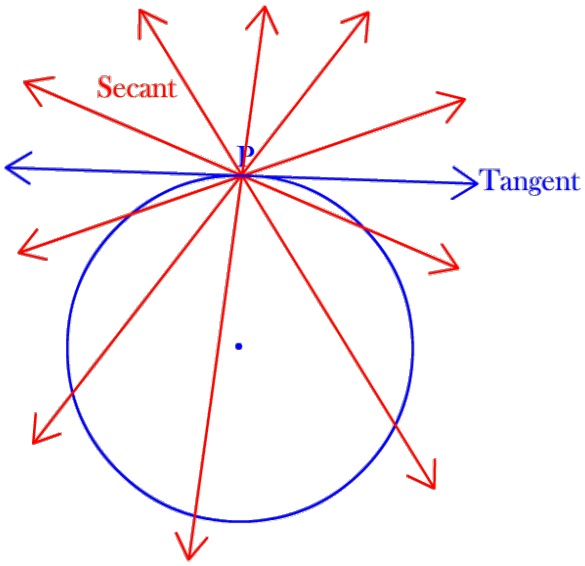
   A tangent is a line that touches the circle at exactly one point, known as the **point of contact**.



3. One tangent one point

A point situated on the circumference of a circle gives rise to just one tangent, while any other lines originating from that same point will function as secants intersecting the circle at two distinct points.

A circle is comprised of an infinite multitude of points, with each individual point having the potential to generate a single tangent. Consequently, when considering all the points on the circle collectively, the circle can indeed possess an infinite number of tangents.



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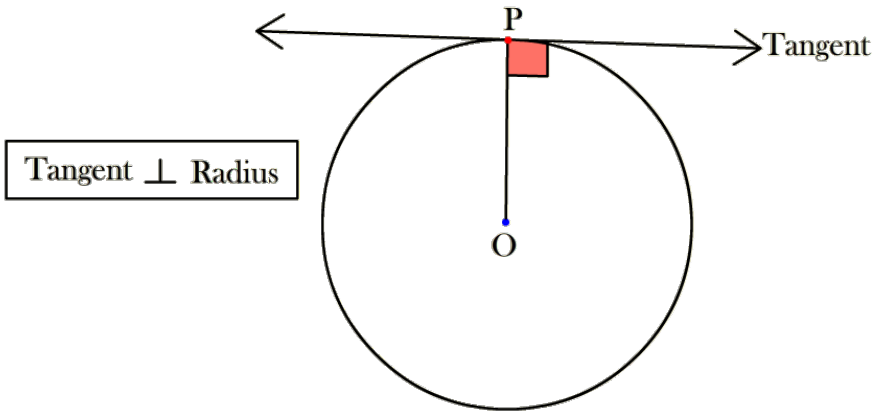
4. Theorem 10.1

Theorem 10.1: The tangent at any point of a circle is perpendicular to the radius through the point of contact.

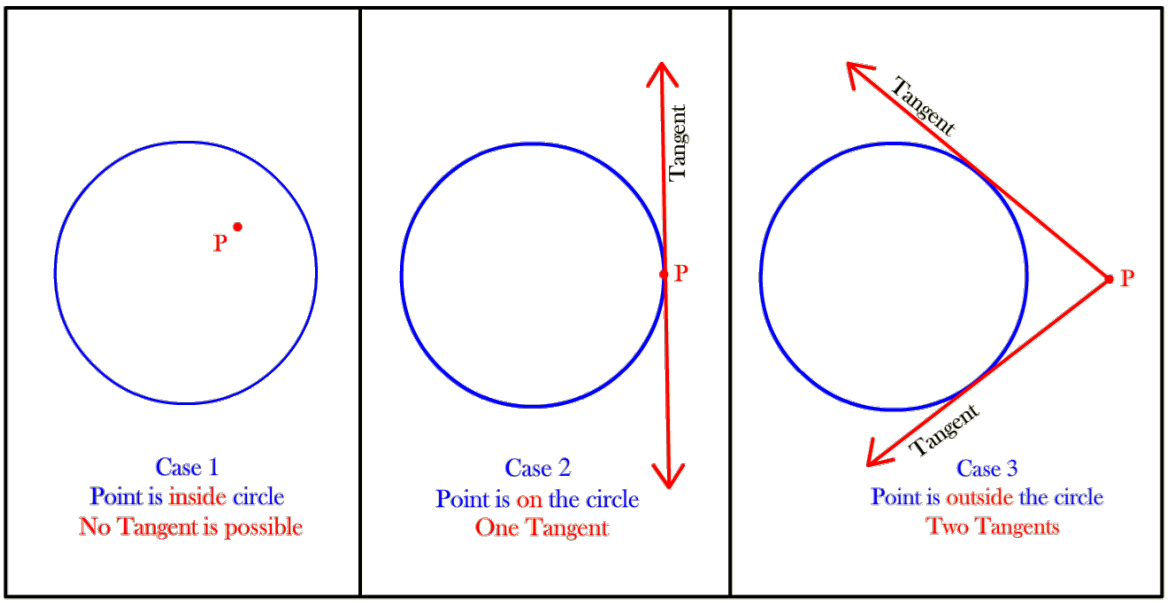


5. Tangent from a point

Case 1: point inside the circle: No tangents.

Case 2: Point on the circumference of circle: 1 Tangent.

Case 3: Point external to circle: 2 Tangents.



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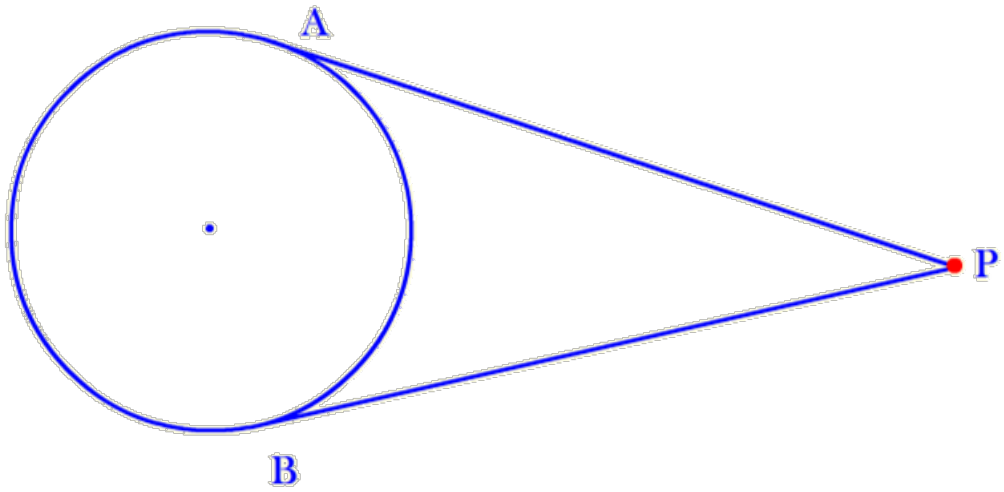
6. Theorem 10.2

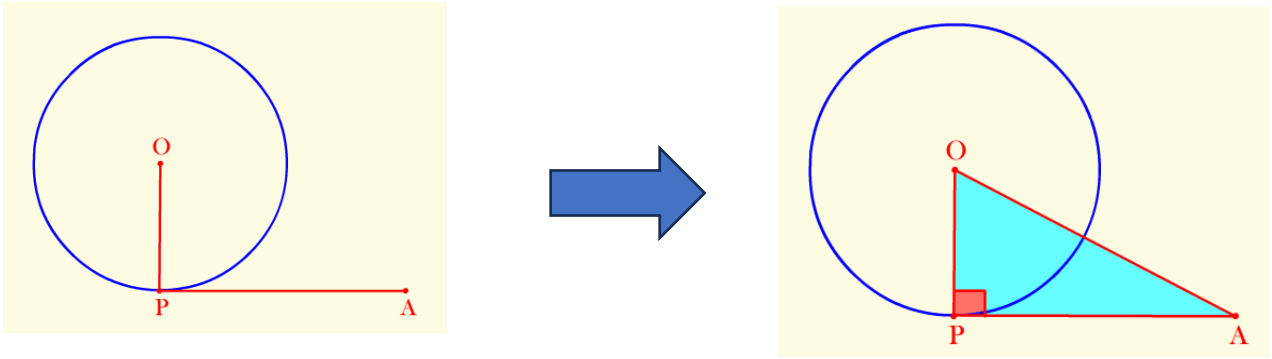
Theorem 10.2: The lengths of tangents drawn from an external point to a circle are equal.



PA = PB

7. Cases related to problems on circles:

Case 1: Radius and Tangent are given in the question.



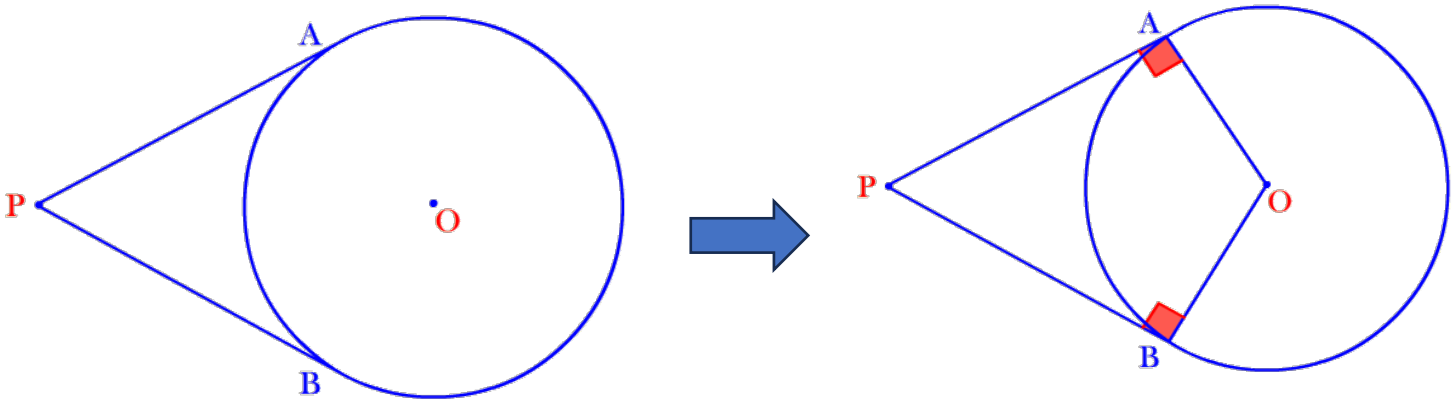
$\angle OPA = 90^o$ (Radius PO $\perp$ Tangent PA)

So, DAOP is a right-angled triangle.

$AO^2 = AP^2 + PO^2$ (Pythagoras theorem)

When you have both a radius and a tangent mentioned in a question, you can turn this situation into a right-angled triangle, like in the figure above. Then, you can use the Pythagorean theorem to solve the problem.

Case 2: Two external tangents are given in the question.



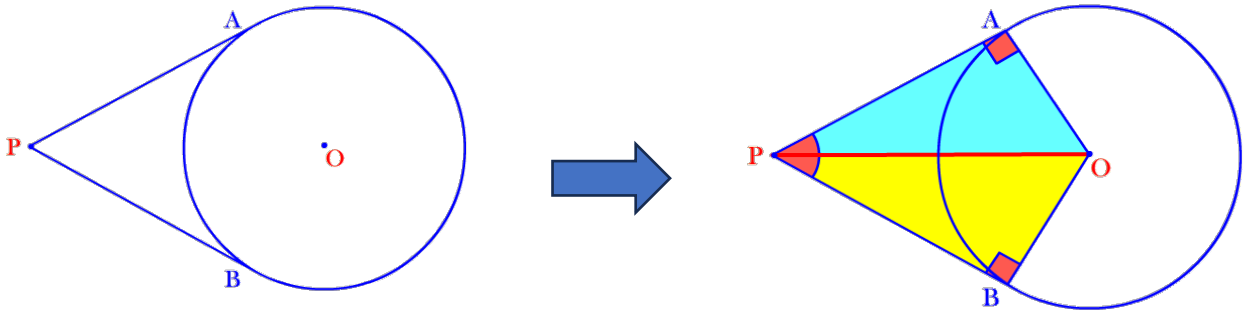
Following data can be used to solve the question:

PA = PB (Tangents drawn from external points are equal, Theorem 10.2)

AO = BO (Radius)

$\angle OAP = \angle OBP = 90^o$ (Radius $\perp$ tangent, Theorem 10.1)

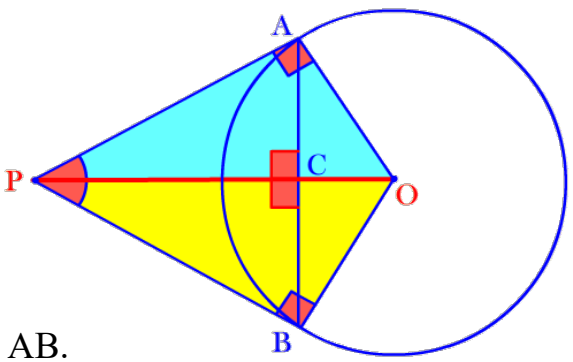
Case 3: Two external tangents and concept of congruency.



DOAP @ DOBP (RHS Criteria, use Case 2)

$\angle APO = \angle BPO$ (CPCT)

So, OP is angle bisector of $\angle P$



Also, DACP @ DBCP

AC = CB (CPCT)

$\angle OCP = \angle BCP = 90^o$ (CPCT)

So, PC is perpendicular bisector of chord AB.

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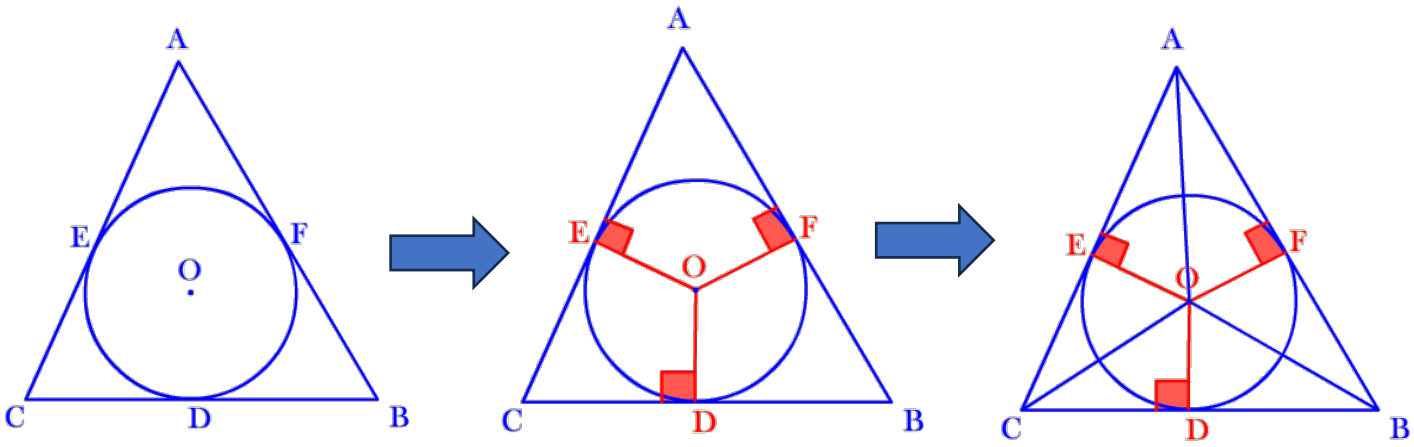
Case 4: Circumscribed Triangle



Tangents from external point are equal, Theorem 10.2

So,

AE = AF (Tangents from external point A)

BD = BF (Tangents from external point B)

CD = CE (Tangents from external point C)

Join OD, OE & OF, to form radius OD, OE & OF.

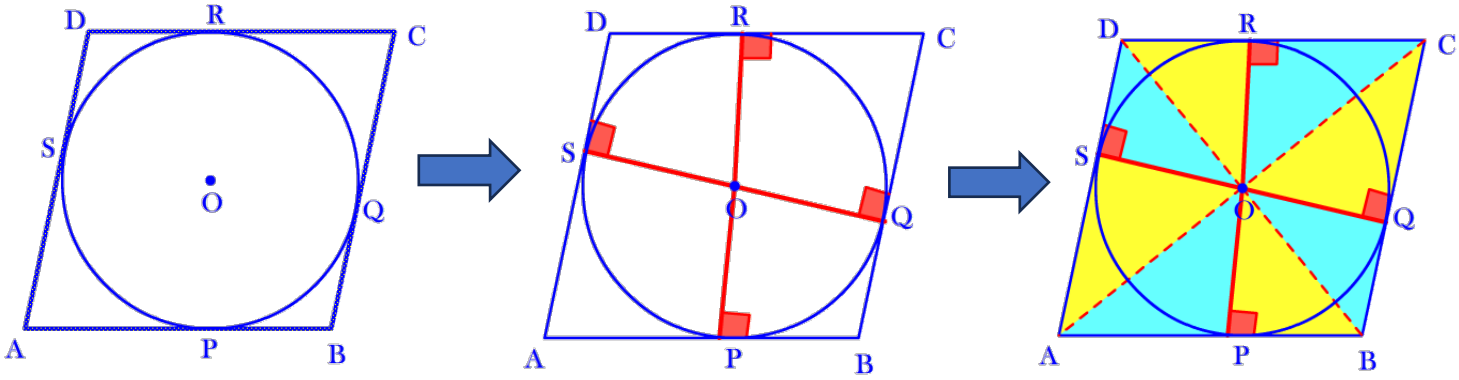
Tangent and radius are perpendicular to each other, Theorem 10.1

$\angle D = \angle E = \angle F = 90^o$

Join AO, BO & CO.

Six Triangles will be formed. Apply Pythagoras to solve for missing sides, and also use concept of congruency to solve the question.

Case 5: Circumscribed Quadrilateral



Tangents from external point are equal, Theorem 10.2

So,

AP = AS (Tangents from external point A)

BD = BF (Tangents from external point B)

CR = CQ (Tangents from external point C)

DR = DS (Tangents from external point D)

Join OP, OQ, OR & OS, to form radius OP, OQ, OR & OS.

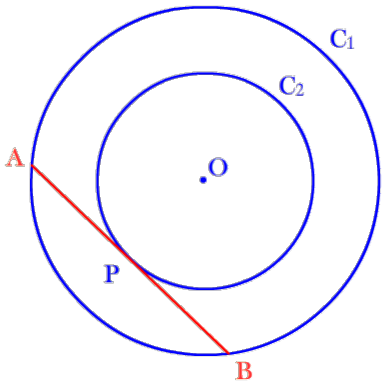
Tangent and radius are perpendicular to each other, Theorem 10.1

$\angle P = \angle Q = \angle R = \angle S = 90^{o}$

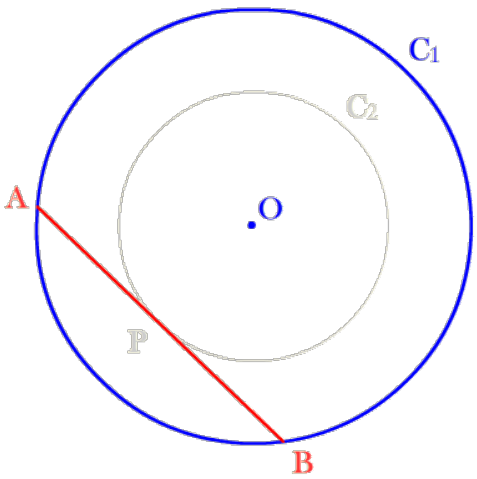
Join AO, BO, CO & DO.

Eight Triangles will be formed. Apply Pythagoras to solve for missing sides, and also use concept of congruency to solve the question.

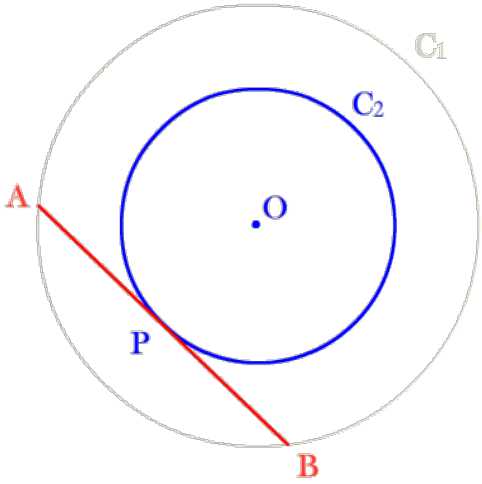
Case 6: Concentric circle with chord and tangent concept.



Chord AB to circle C_1 is touching circle C_2 at one point only.



AB is chord to circle C_1



AB is tangent to circle C_2

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8. Check out complete chapter Circles class 10th lecture series on YouTube.

All the lectures are created using animation and visual tools, for better learning experience.

The complete series includes following lectures:

1. Chapter circles - All Concepts covered: https://youtu.be/o7lVKGuHgrE
2. Theorem 10.1 Proof: https://youtu.be/eX-7tm6lW18
3. Theorem 10.2 Proof: https://youtu.be/kFEGpK0J10o
4. Exercise 10.1: https://youtu.be/tOY2SPd-q68
5. NCERT example questions: https://youtu.be/1M19tfdX3x0
6. Exercise 10.2 Q1 to Q5: https://youtu.be/bSHUmWw_N2I
7. Exercise 10.2 Q6 to Q10: https://youtu.be/6t3wbIb38aM
8. Exercise 10.2 Q11 to Q13: https://youtu.be/y2v5PFaNZMA
9. **Revision: https://youtu.be/G5VNx4Z08Ok**

NOTES: