**CBSE Class 9 Maths Notes Chapter 10:** Maths has never been easy because many people find it quite difficult to memorize the formulas. However, our class 9 Maths Chapter circle notes help you quickly recall everything. Our notes are made under the most recent CBSE curriculum, which makes it easier and faster for you to learn the topics.

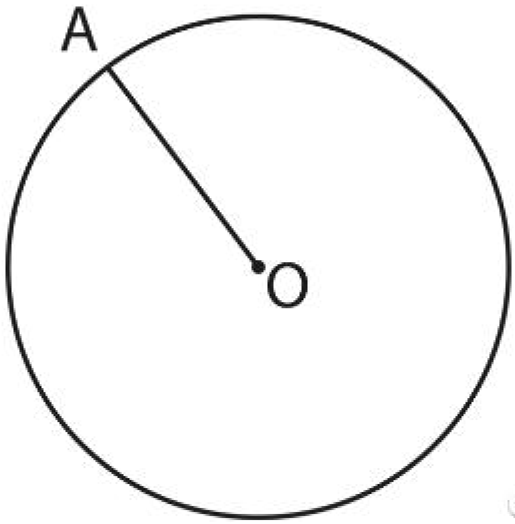
Additionally, the CBSE Class 9 Maths Notes Chapter 10 Circles download option makes studying offline easier. Therefore, we have you covered if you need to learn topics rapidly or if you need practical formulas while learning.

# CBSE Class 9 Maths Notes Chapter 10

- The circle splits a plane into three sections: the circle itself, the inside and outside of the circle.
- A chord is a line that travels around the circumference of a circle, connecting two points.
- A chord that goes through the centre is called a diameter.
- The circumference is the length of a circle's perimeter.
- Equal-length chords subtend equal angles at the middle. Likewise, if the chords' center-subtended angles are equal, then the chords are equal.
- A chord is divided in half by the perpendicular drawn on it from the centre. In the same way, if the line is drawn from the chord's centre to its bisect, it is perpendicular.
- Three non-collinear locations can only be traversed by one circle.
- Equally sized chords are spaced equally apart from the middle. Likewise, if two chords are equally spaced from the centre, they are equal.
- The sum of two angles that are opposite to one another in a cyclic quadrilateral is 180 degrees.
- The angles that the same line segment subtends are equal.
- The matching arcs will be congruent if the circle's chords have the same length. Similarly, matching chords will be equivalent if arcs are congruent.

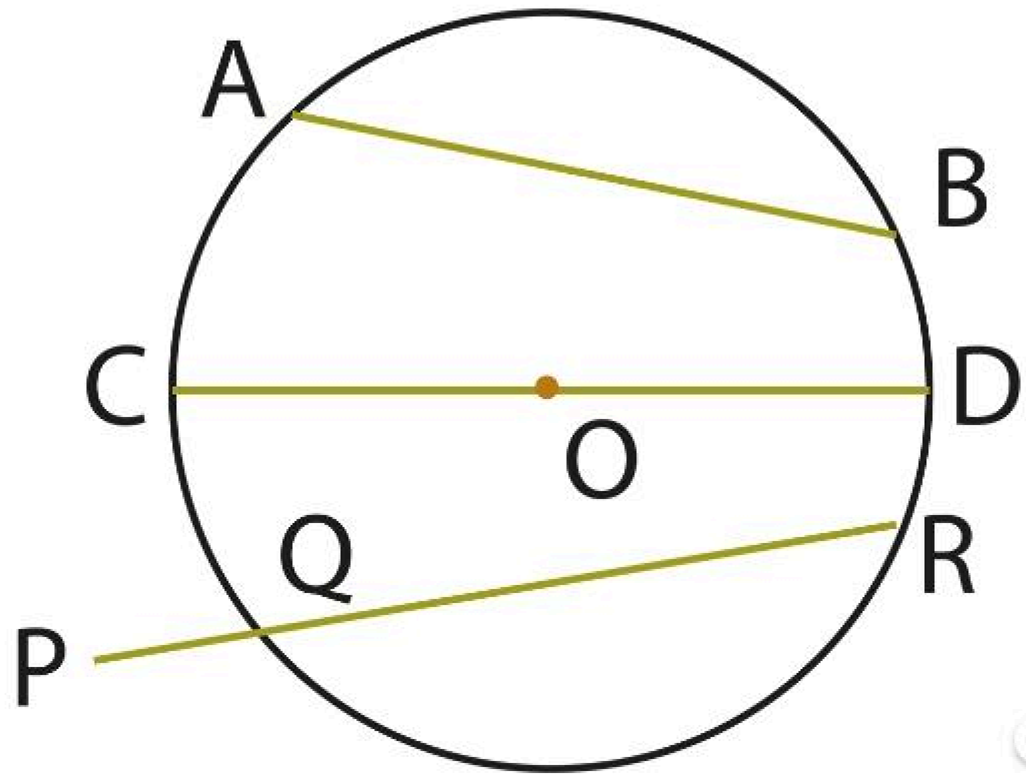
## Circle

The locus of the points at a certain distance from a fixed point is defined as a circle.




## Chord

A chord is a straight line that connects any two points on a circle.




AB stands for the letters that indicate a chord.

The diameter of a circle is its length, which is measured if the chord goes through its centre.

The diameter is half as long as the radius.

A CD is the name given to a diameter.

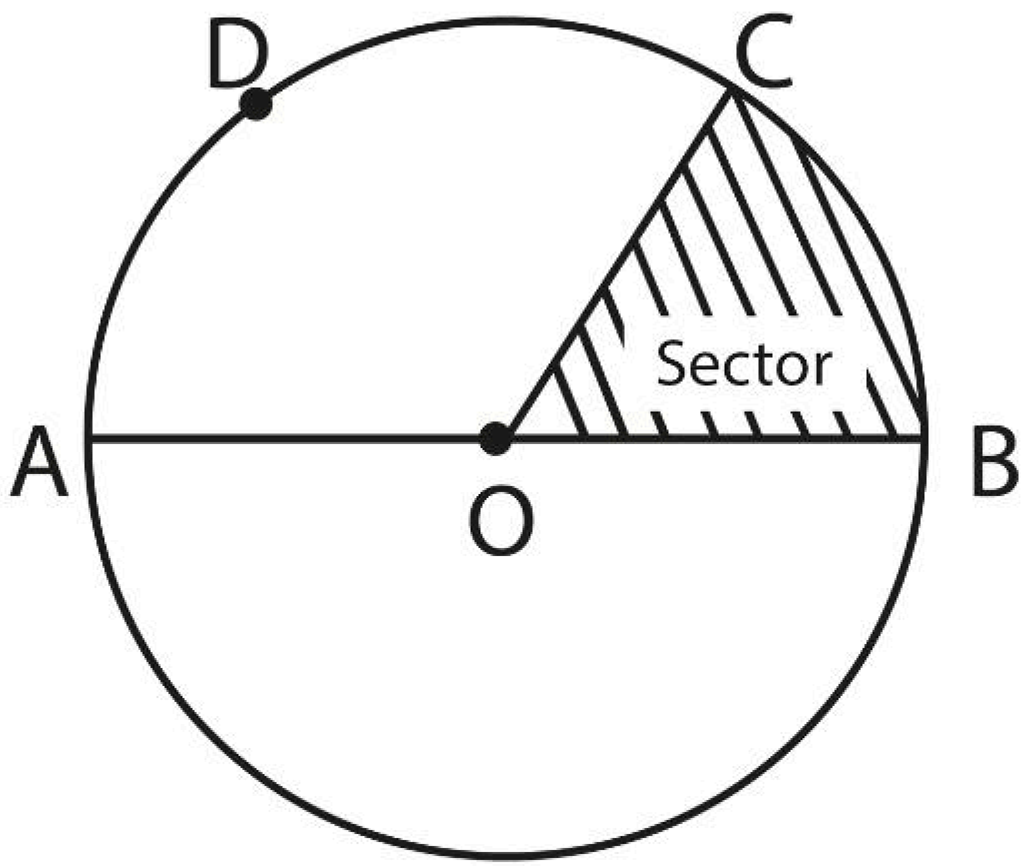
A line that splits a circle in half is called a secant.

PQR is a circle's secant.

## Circumference

A circle's circumference is its entire length.

A circle's perimeter, also known as its border curve, is its circumference.



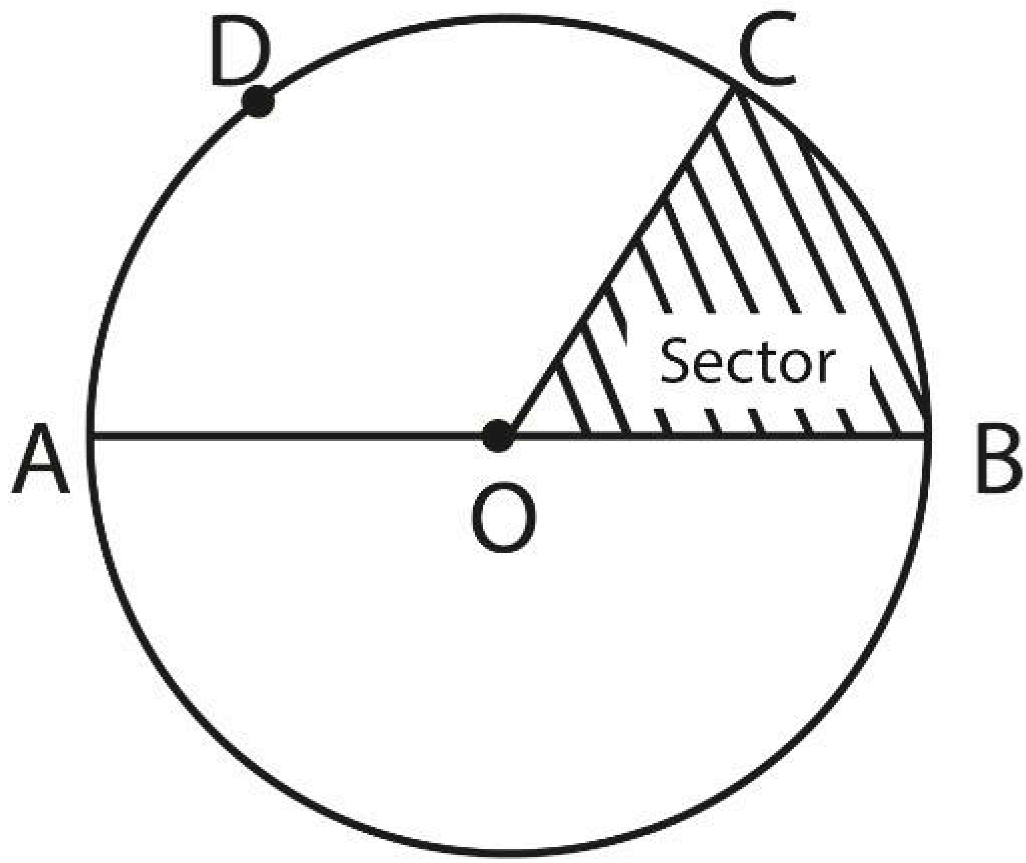

## Arc

Any segment or portion of the circumference is an arc.

A circle is divided into two equal parts by its diameter.

Anything smaller than a semicircle is called a minor arc.

Any arc greater than a semicircle is considered a major arc.




### Sector

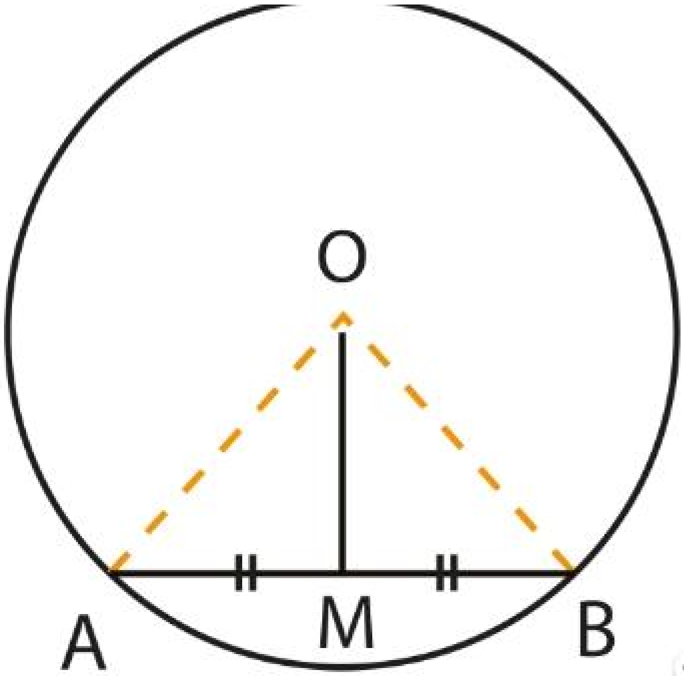
- A sector is the area between an arc and the two radii that connect the arc's centre and endpoints.
- A segment is a section of a circle that has been cut off by a chord.

## Concentric Circles

Concentric circles are circles with the same centre.

## Theorem 1

A straight line drawn from the centre of a circle to bisect a chord which is not a diameter, is at right angles to the chord.




- **Given Data:**
  - Here, $\mathrm{AB}$ is a chord of a circle with the centre $\mathrm{O}$.
  - The midpoint of $\mathrm{AB}$ is $\mathrm{M}$.
  - $\mathrm{OM}$ is joined.
- **To Prove:**

  $\angle \mathrm{AMO} = \angle \mathrm{BMO} = 90^0$
- **Construction:**

  Join $\mathrm{AO}$ and $\mathrm{BO}$.
- **Proof:**

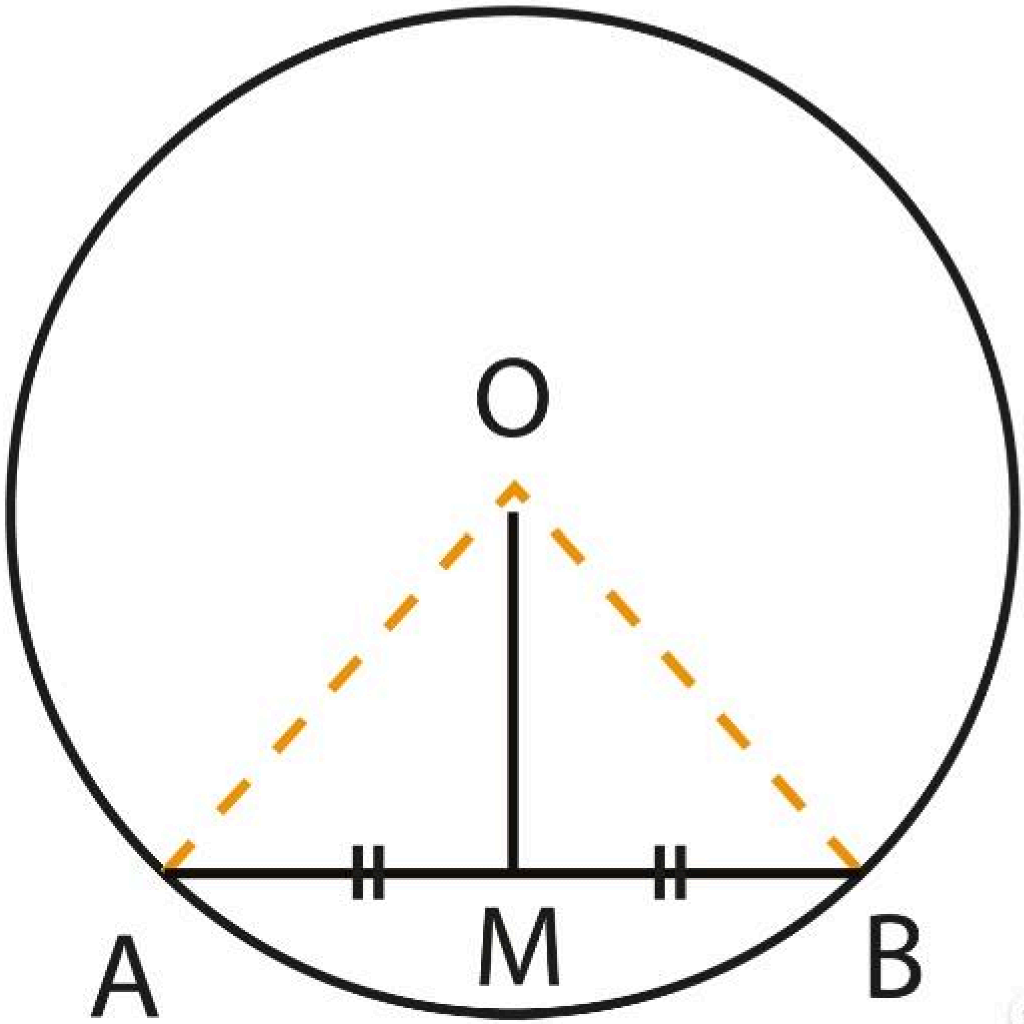
  In $\Delta\mathrm{AOM}$ and $\Delta\mathrm{BOM}$

| Statement | Reason |
|---|---|
| $\mathrm{AO} = \mathrm{BO}$ | radii |
| $\mathrm{AM} = \mathrm{BM}$ | Data |
| $\mathrm{OM} = \mathrm{OM}$ | Common |
| $\Delta\mathrm{AOM} \cong \Delta\mathrm{BOM}$ | $(\mathrm{S.S.S})$ |
| $\therefore \angle \mathrm{AMO} = \angle \mathrm{BMO}$ | Statement $(4)$ |
| But $\angle \mathrm{AMO} + \angle \mathrm{BMO} = 180^0$ | Linear pair |
| $\therefore \angle \mathrm{AMO} = \angle \mathrm{BMO} = 90^0$ | Statements $(5)$ and $(6)$ |

## Theorem 2

**(Converse of theorem 1)**

The perpendicular to a chord from the centre of a circle bisects the chord.



- **Given Data:**
    1. Here, $AB$ is a chord of a circle with the centre $O$.
    2. $OM \perp AB$
- **To Prove:**

    $AM = BM$
- **Construction:**

    Join $AO$ and $BO$.
- **Proof:**

    In $\Delta AOM$ and $\Delta BOM$

| Statement | Reason |
|---|---|
| $AMO = \angle BMO$ | Each $90^0$ (data) |
| $AO = BO$ | Radii |
| $OM = OM$ | Common |
| $\Delta AOM \cong \Delta BOM$ | $(R.H.S)$ |
| $AM = BM$ | Statement $(4)$ |

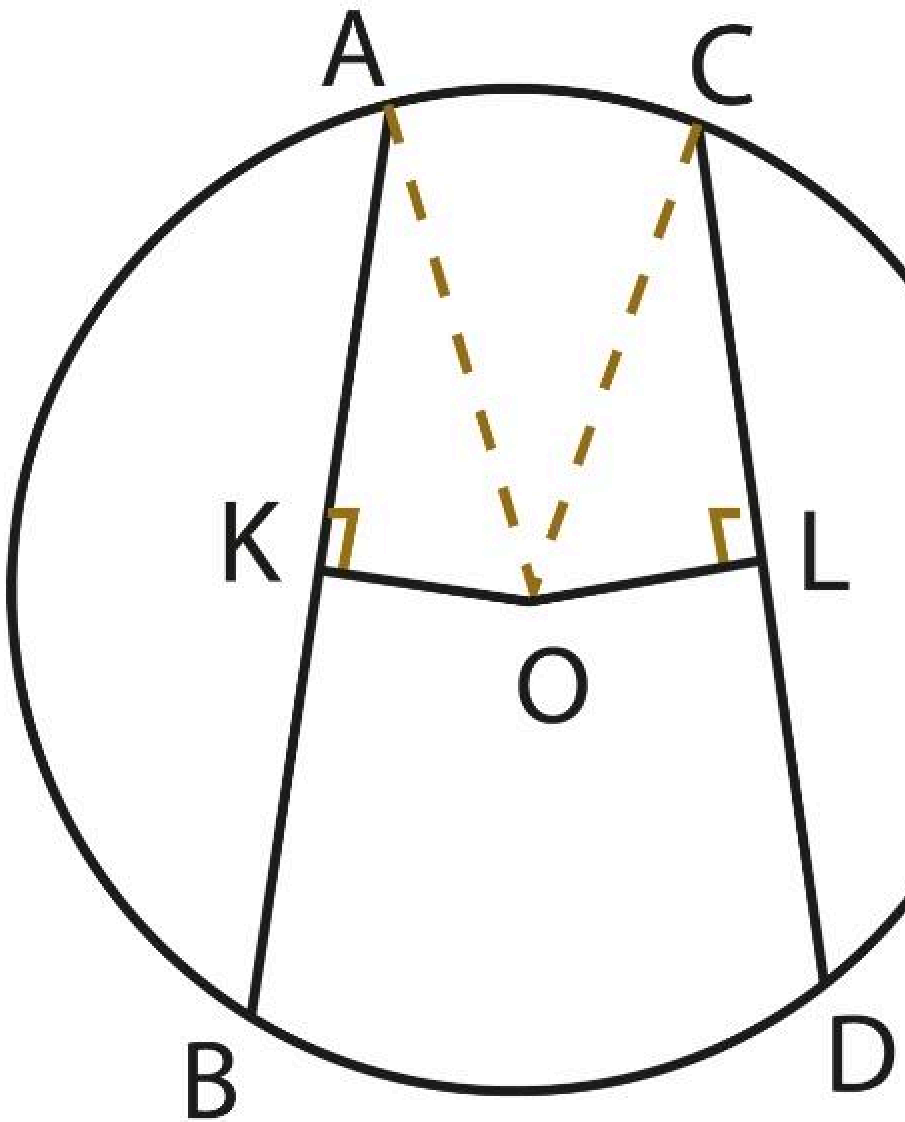
**The transposition of a statement consisting of 'data' and 'to prove' is the converse of a theorem.**

We can see how it works by looking at the previous two theorems:

| Theorem | Converse of Theorem |
|---|---|
| 1 **Data:** $M$ is the midpoint of $AB$ | **To Prove:** $M$ is the midpoint of $AB$ |
| 2 **To Prove:** $OM \perp AB$ | **Data:** $OM \perp AB$ |

## Theorem 3

Equal chords of a circle are equidistant from the centre.


A
C
K
L
O
B
D

- **Given Data:**
    - Here, $AB$and $CD$are equal chords of a circle with centre $O$.
    - $OK \perp AB$ and $OL \perp CD$
- **To Prove:**

    $OK = OL$
- **Construction:**

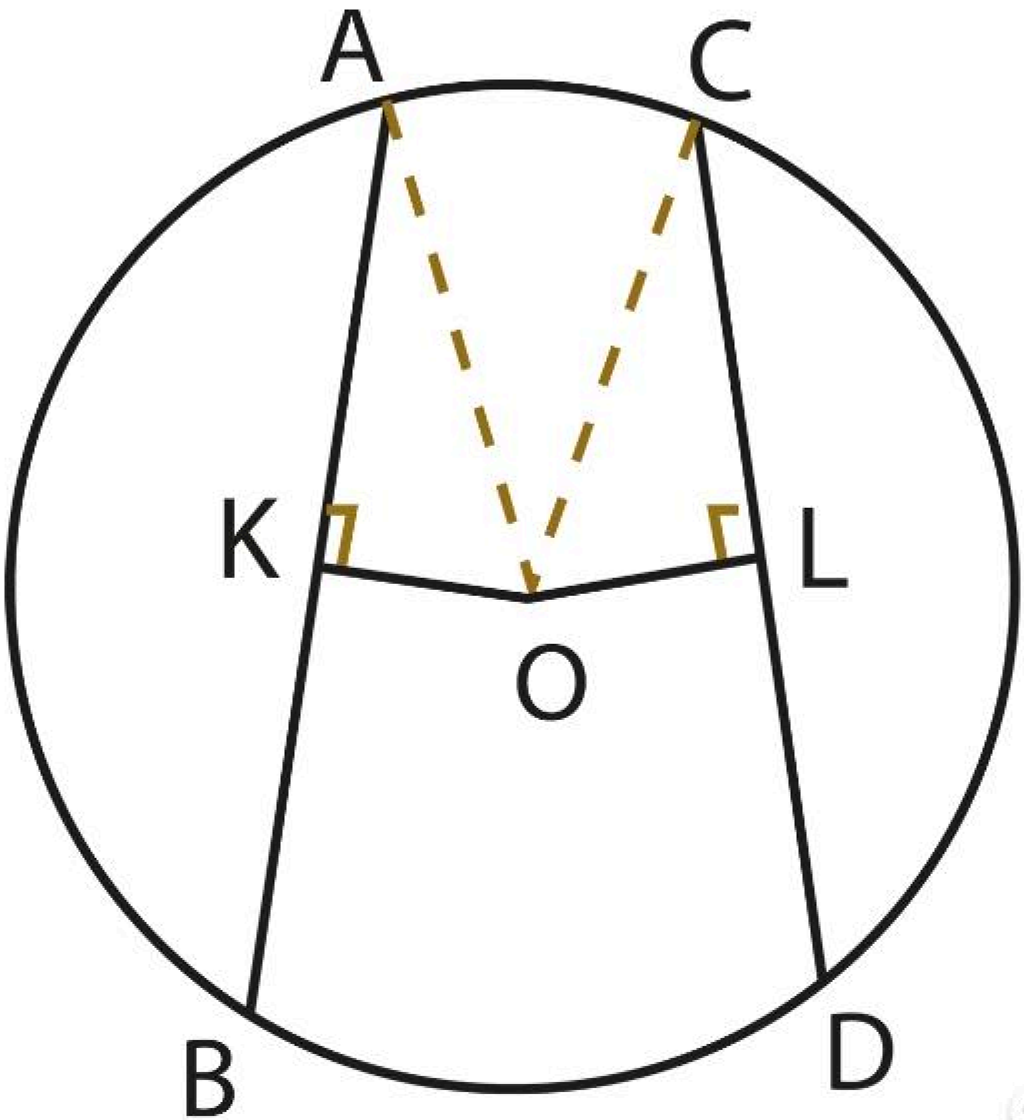
    Join $AO$ and $CO$.
- **Proof:**

| Statement | Reason |
|---|---|
| $AK = \frac{1}{2}AB$ | $\perp$ from the centre bisects the chord. |
| $CL = \frac{1}{2}CD$ | $\perp$ from the centre bisects the chord. |
| But $AB = CD$ | data |
| $\therefore AK = CL$ | Statements $(1), (2)$ and $(3)$ |
| In $\Delta AOK$and $\Delta COL$ | |
| $\angle AKO = \angle CLO$ | Each $90^0$ (data) |
| $AO = CO$ | radii |
| $AK = CL$ | Statements $(4)$ |
| $\therefore \Delta AOK \cong \Delta COL$ | $(R.H.S)$ |
| $\therefore OK = OL$ | Statements $(8)$ |

## Theorem 4

**(Converse of theorem 3)**

Chords which are equidistant from the centre of a circle are equal.


A
C
K
L
O
B
D

- **Given Data:**
  - Here, $\mathrm{AB}$and $\mathrm{CD}$are equal chords of a circle with centre $\mathrm{O}$.
  - $\mathrm{OK} \perp \mathrm{AB}$ and $\mathrm{OL} \perp \mathrm{CD}$
  - $\mathrm{OK} = \mathrm{OL}$
- **To Prove:**

  $\mathrm{AB} = \mathrm{CD}$
- **Construction:**

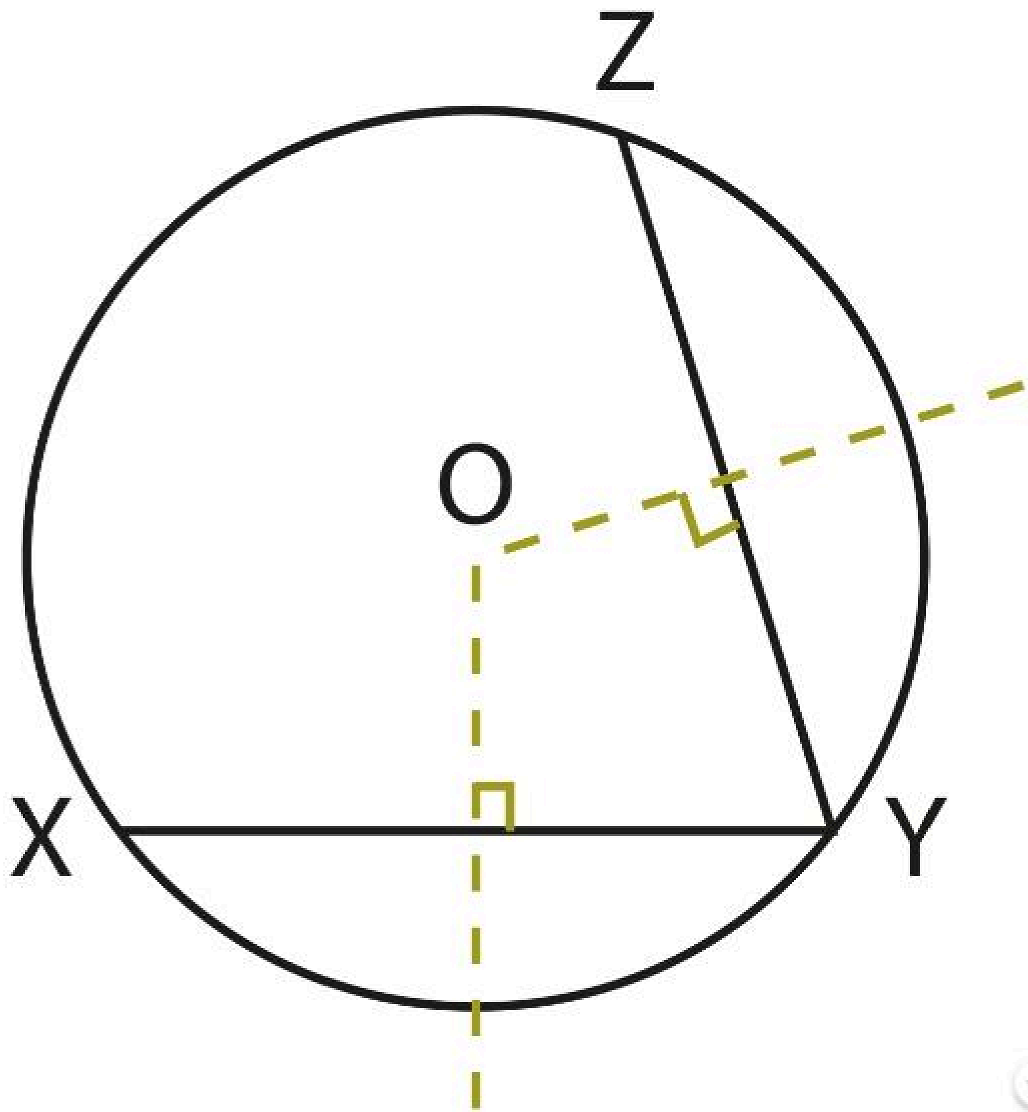
  Join $\mathrm{AO}$ and $\mathrm{CO}$.
- **Proof:**

  In $\Delta \mathrm{AOK}$and $\Delta \mathrm{COL}$

| Statement | Reason |
|---|---|
| $\angle \mathrm{AKO} = \angle \mathrm{CLO}$ | Each $90^0$ (data) |
| $\mathrm{AO} = \mathrm{CO}$ | radii |
| $\mathrm{OK} = \mathrm{OL}$ | data |
| $\Delta \mathrm{AOK} \cong \Delta \mathrm{COL}$ | $(\mathrm{R.H.S})$ |
| $\therefore \mathrm{AK} = \mathrm{CL}$ | Statements $(4)$ |
| But $\mathrm{AK} = \frac{1}{2}\ \mathrm{AB}$ | $\perp$ from the centre bisects the chord. |
| $\mathrm{CL} = \frac{1}{2}\ \mathrm{CD}$ | $\perp$ from the centre bisects the chord. |
| $\therefore \mathrm{AB} = \mathrm{CD}$ | Statements $(5)$, $(6)$ and $(7)$ |

## Theorem 5

There is one circle, and only one, which passes through three given points not in a straight line.


Z
O
X
Y

- **Given Data:**

  Here, $X, Y$ and $Z$ are three points not in a straight line.

- **To Prove:**

  A unique circle passes through $X, Y$ and $Z$.

- **Construction:**

  - Join $XY$ and $YZ$.
  - Draw perpendicular bisectors of $XY$ and $YZ$ to meet at $O$.

- **Proof:**

| Statement | Reason |
|---|---|
| $OX = OY$ | $O$ lies on the $\perp$ bisector of $XY$ |
| $OY = OZ$ | $O$ lies on the $\perp$ bisector of $YZ$ |
| $OX = OY = OZ$ | Statements $(1)$ and $(2)$ |
| $O$ is the only point equidistant from $X, Y$ and $Z$. | Statements $(3)$ |
| With $O$ as centre and radius $OX$, a circle can be drawn to pass through $X, Y$ and $Z$. | Statements $(4)$ |
| Therefore, the circle with centre $O$ is a unique circle passing through $X, Y$ and $Z$. | Statements $(5)$ |

## Theorem 6

The angle at which an arc of a circle subtends at the centre is double the angle at which it subtends at any point on the remaining part of the circumference.

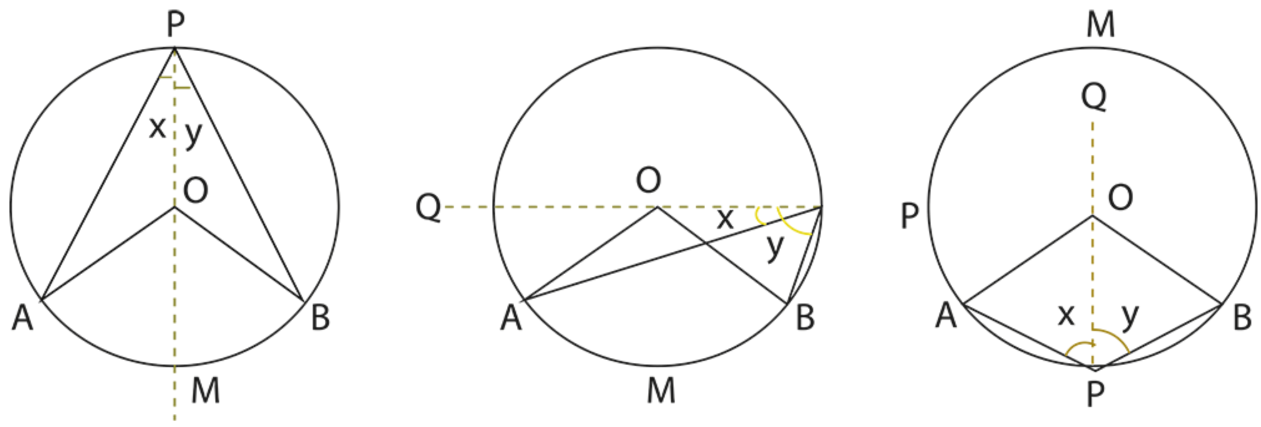


fig (i) fig (ii) fig (iii)

- **Given Data:**

  Arc $\mathrm{AMB}$subtends □$\mathrm{AOB}$ at the center $\mathrm{O}$ of the circle and □$\mathrm{APB}$ on the remaining part of circumference.

- **To Prove:**

  $\angle \mathrm{AOB} = 2\angle \mathrm{APB}$

- **Construction:**

  Join $\mathrm{PO}$ and produce it to $\mathrm{Q}$.

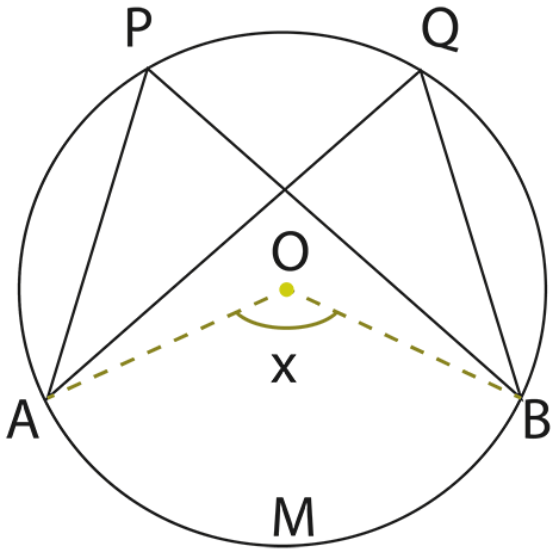
  Let, $\angle \mathrm{APQ} = \mathrm{x}$ and $\angle \mathrm{BPQ} = \mathrm{y}$

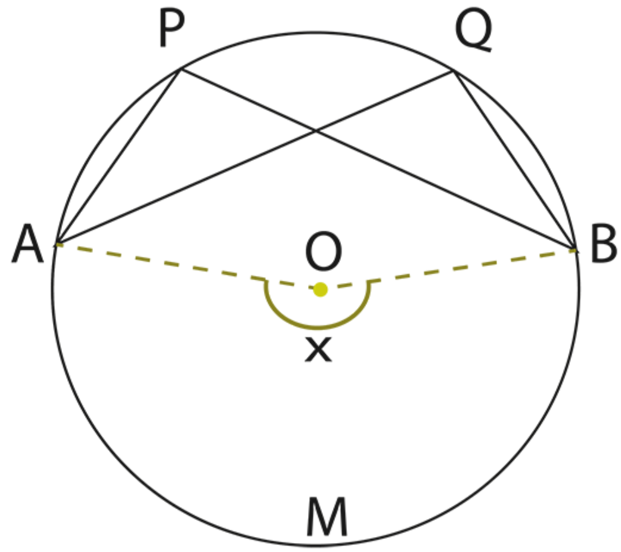
- **Proof:**

| Statement | Reason |
|---|---|
| $\angle \mathrm{AOQ} = \angle \mathrm{x} + \angle \mathrm{A}$ | $\mathrm{Ext.}\ \angle = \mathrm{sum\ of\ the\ int.\ opp.}\ \angle \mathrm{s}$ |
| $\angle \mathrm{x} = \angle \mathrm{A}$ | $\because\ \mathrm{OA} = \mathrm{OP}$ (Radii) |
| $\therefore \angle \mathrm{AOQ} = 2\angle \mathrm{x}$ | Statements $(1)$ and $(2)$ |
| $\therefore \angle \mathrm{BOQ} = 2\angle \mathrm{y}$ | Same way as Statements $(3)$ |
| From figure $(\mathrm{i})$ and $(\mathrm{ii})$ | |
| $\angle \mathrm{AOQ} + \angle \mathrm{BOQ} = 2\angle \mathrm{x} + 2\angle \mathrm{y}$ | Statements $(3)$ and $(4)$ |
| $\Rightarrow\ \angle \mathrm{AOB} = 2(\angle \mathrm{x} + \angle \mathrm{y})$ | Statements $(5)$ |
| From figure $(\mathrm{ii})$ | |
| $\angle \mathrm{BOQ} - \angle \mathrm{AOQ} = 2\angle \mathrm{y} - 2\angle \mathrm{x}$ | Statements $(3)$ and $(4)$ |
| $\angle \mathrm{AOB} = 2(\angle \mathrm{y}$ - $\angle \mathrm{x})$ | Statements $(8)$ |
| $\because \angle \mathrm{AOB} = 2\angle \mathrm{APB}$ | Statements $(9)$ |

## Theorem 7

Angles in the same segment of a circle are equal.




- **Given Data:**

  $\angle APB$ and $\angle AQB$ are in the same segment of a circle with center $O$.

- **To Prove:**

  $\angle APB = \angle AQB$

- **Construction:**

  Join $AO$ and $BO$.

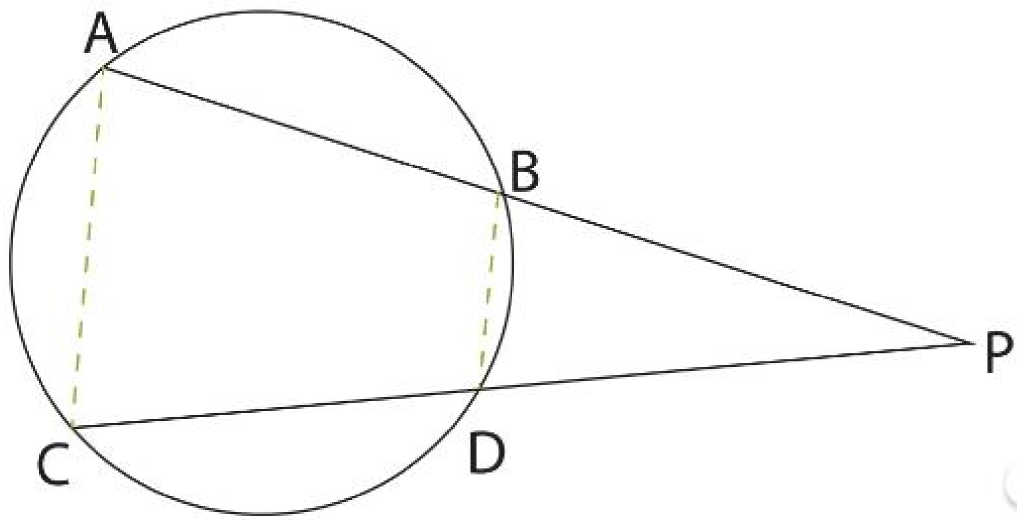
  Let arc $AMB$subtend angle $x$ at the center $O$.

- **Proof:**

| Statement | Reason |
|---|---|
| $\angle x = 2\angle APB$ | $\angle$at center $= 2 \times \angle$on the circumference |
| $\angle x = 2\angle AQB$ | $\angle$at center $= 2 \times \angle$on the circumference |
| $\therefore \angle APB = \angle AQB$ | Statements $(1)$ and $(2)$ |

## Theorem 16

If two chords of a circle intersect externally, then the product of the lengths of the segments are equal.




- **Given Data:**

  $AB$ and $CD$ are chords of a circle intersecting externally at $P$.

- **To Prove:**

  $AP \times BP = CP \times DP$

- **Construction:**

  Join $AC$ and $BD$.

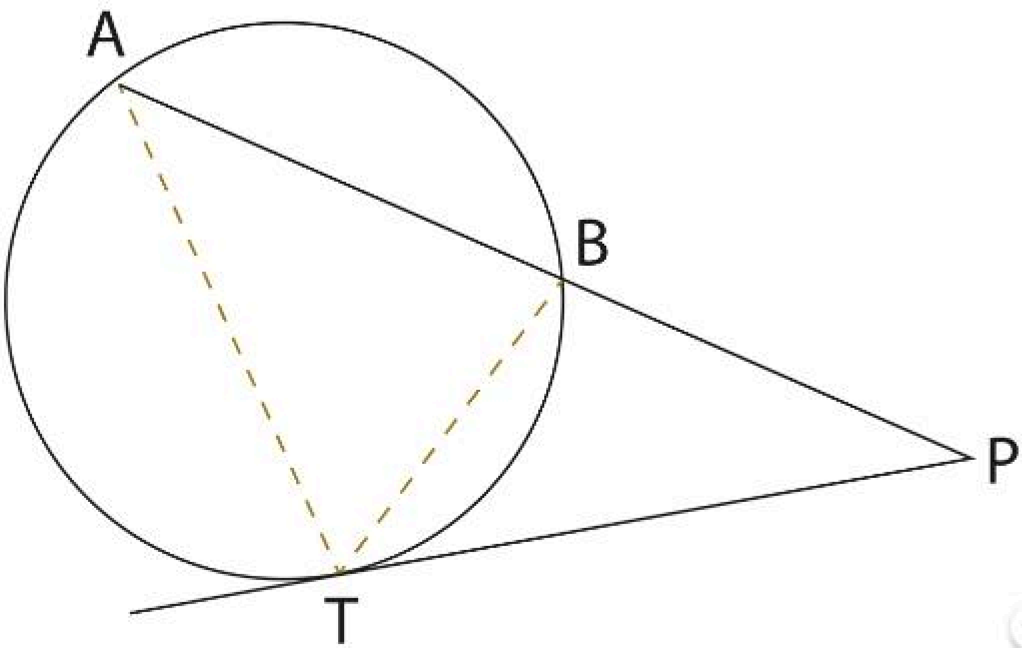
- **Proof:**

  In $\Delta ACP$ and $\Delta DBP$

| Statement | Reason |
|---|---|
| $\angle A = \angle BDP$ | $\text{Ext. } \angle \text{of a cyclic quad.} = \text{Int. opp. } \angle$ |
| $\angle C = \angle DBP$ | $\text{Ext. } \angle \text{of a cyclic quad.} = \text{Int. opp. } \angle$ |
| $\therefore\ \Delta ACP \sim \Delta DBP$ | $AA$ similarity |
| $\therefore \dfrac{AP}{DP} = \dfrac{CP}{BP}$ | Statements $(3)$ |
| $AP \times BP = CP \times DP$ | Statements $(4)$ |

## Theorem 17

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 on the length of the tangent from the point of contact to the point of intersection.




- **Given Data:**

  A chord $\mathrm{AB}$ and a tangent $\mathrm{TP}$ at a point $\mathrm{T}$ on the circle intersect at $\mathrm{P}$.

- **To Prove:**

  $\mathrm{AP} \times \mathrm{BP} = \mathrm{PT}^2$

- **Construction:**

  Join $\mathrm{AT}$ and $\mathrm{BT}$.

- **Proof:**

| Statement | Reason |
|---|---|
| In $\Delta\mathrm{APT}$ and $\Delta\mathrm{TPB}$ | Angles in alternate segment |
| $\angle\mathrm{A} = \angle\mathrm{BTP}$ | |
| $\angle\mathrm{P} = \angle\mathrm{P}$ | Common |
| $\therefore\ \Delta\mathrm{APT} \sim \Delta\mathrm{TPB}$ | $\mathrm{AA}$ similarity |
| $\frac{\mathrm{AP}}{\mathrm{PT}} = \frac{\mathrm{PT}}{\mathrm{BP}}$ | Statements $(3)$ |
| $\mathrm{AP} \times \mathrm{BP} = \mathrm{PT}^2$ | Statements $(4)$ |

## Benefits of CBSE Class 9 Maths Notes Chapter 10

You begin developing your skills in Class 9, which is similar to this. Those chapters serve as the foundation for strong skills that you will use in Class 10.

It may be tempting to skip maths in class 9 and go right to maths in class 10, but it's important to regard mathematics as an exciting adventure. Students use class 9 maths as a compass to navigate the turns and turns of mathematical research. The journey becomes more pleasurable and the path more manageable with support systems like this. So, grab a seat, welcome Class 9's difficulties, and let the mathematical journey begin. These maths notes for class 9 will help you build better concepts. You can use these notes to clear your concepts in a better way.