

## 1 Fundamentals of Circles

A **circle** is defined as the set of all those points which are at a constant distance from a fixed point.

**Centre:** The fixed point is called the centre. **Radius:** The constant distance from the centre to any point on the circle is called the radius. **Diameter:** The longest chord passing through the centre and touching two points on the circle.

**Concentric Circles:** Circles having the same centre are called concentric circles.

## 2 Circumference of a Circle

The circumference of a circle is the perimeter of the circle. It is given by:

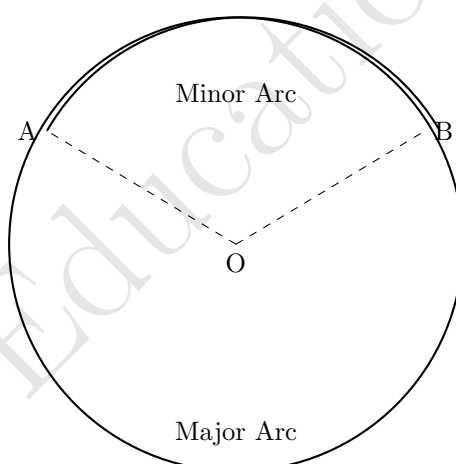
$$\text{Circumference} = \pi \times \text{Diameter} = 2\pi r$$

## 3 Area of a Circle

The area of a circle is given by:

$$\text{Area} = \pi r^2$$

## 4 Arc, Chord, Segment, and Sector of a Circle



### Definitions:

- **Arc:** Any portion of the circumference of the circle.
- **Chord:** A straight line joining any two points on the circle.
- **Segment:** The region enclosed between an arc and a chord.
- **Sector:** The region enclosed by two radii and an arc.

## 5 Formulas for Length of Arc and Area of Sector

Let  $\angle AOB = \theta$  (central angle), where  $O$  is the centre.

**Length of Arc:**

$$\text{Length of Arc} = \frac{\theta}{360^\circ} \times 2\pi r$$

**Area of Sector:**

$$\text{Area of Sector} = \frac{\theta}{360^\circ} \times \pi r^2$$

## 6 Area of a Segment of a Circle

The area of a segment of a circle is calculated as:

$$\text{Area of Segment} = \text{Area of Sector} - \text{Area of Triangle}$$

For  $\theta \leq 90^\circ$ :

$$\text{Area of Segment} = \frac{\theta}{360^\circ} \pi r^2 - \frac{1}{2} r^2 \sin \theta$$

**Example:** Calculate the area of a segment when  $r = 7$  cm and  $\theta = 60^\circ$ .

$$\text{Area} = \frac{60}{360} \times \pi \times 7^2 - \frac{1}{2} \times 7^2 \times \sin 60^\circ$$

## 7 Perimeter of a Segment

The perimeter of a segment consists of the length of the chord and the arc:

$$\text{Perimeter} = \text{Chord Length} + \text{Arc Length}$$

For  $\theta \leq 90^\circ$ :

$$\text{Perimeter} = 2r \sin \left( \frac{\theta}{2} \right) + \frac{\theta}{360^\circ} \times 2\pi r$$

## 8 Conclusion

- The circumference of a circle is  $2\pi r$ .
- The area of a circle is  $\pi r^2$ .
- A sector is a part of a circle enclosed by two radii and an arc.
- A segment is the region enclosed between an arc and a chord.