

# Circles

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Circles

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Comprehensive study notes for

Circles

by

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(Math King of Katargam). Master every concept with clear explanations, solved examples, and practice problems.

Key Concepts

Basic Terms

A

circle

is the set of all points at a fixed distance (radius) from a fixed point (center).

Chord:

Line segment joining two points on the circle.

Diameter:

Chord passing through center ( $d = 2r$ ).

Arc:

Part of the circumference.

Sector:

Region between two radii and an arc.

Segment:

Region between a chord and an arc.

Chords and Arcs

Equal chords subtend equal angles at the center. Conversely, if angles subtended by chords at the center are equal, the chords are equal. The perpendicular from the center to a chord bisects the chord.

Angle Subtended by an Arc

The angle subtended by an arc at the center is twice the angle subtended by it at any point on the remaining circle.

Theorem:

$\angle AOB = 2 \times \angle ACB$ .

Angles in a Circle

Angles in the same segment of a circle are equal. The angle in a semicircle is a right angle ( $90^\circ$ ). The sum of opposite angles of a cyclic quadrilateral is  $180^\circ$ .

Cyclic Quadrilateral

A quadrilateral whose vertices lie on a circle is called a cyclic quadrilateral

. Opposite angles are supplementary:  $\angle A + \angle C = 180^\circ$  and  $\angle B + \angle D = 180^\circ$ .

## Important Formulas

### Circumference

$$C = 2\pi r$$

### Area

$$A = \pi r^2$$

### Chord Distance

$$d = \sqrt{r^2 - (\text{chord}/2)^2}$$

### Central Angle Theorem

$$\angle AOB = 2 \times \angle ACB$$

### Angle in Semicircle

$$\angle ACB = 90^\circ \text{ (if AB is diameter)}$$

### Cyclic Quadrilateral

$$\angle A + \angle C = 180^\circ, \angle B + \angle D = 180^\circ$$

### Solved Examples

#### Example 1:

In a circle of radius 5 cm, a chord is at a distance of 3 cm from the center. Find the chord length.

Solution:

$$\text{Half-chord} = \sqrt{5^2 - 3^2} = \sqrt{25-9} = \sqrt{16} = 4 \text{ cm. Chord length} = 2 \times 4 = 8 \text{ cm}$$

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#### Example 2:

Find the angle subtended by an arc at the center if it subtends  $30^\circ$  at the circumference.

Solution:

$$\angle \text{ at center} = 2 \times \angle \text{ at circumference} = 2 \times 30^\circ = 60^\circ$$

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#### Example 3:

In a cyclic quadrilateral ABCD,  $\angle A = 80^\circ$ . Find  $\angle C$ .

Solution:

$$\text{Opposite angles sum to } 180^\circ. \angle C = 180 - 80 = 100^\circ$$

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### Practice Questions

Find the radius of a circle if a chord of length 24 cm is at a distance of 5 cm from the center.

Prove that equal chords of a circle subtend equal angles at the center.

In a circle, the angle subtended by a diameter at the circumference is  $90^\circ$ . Prove.

If two circles intersect, prove that the line joining their centers bisects the common chord.

In a cyclic quadrilateral PQRS,  $\angle P = 2\angle R$ . Find  $\angle P$ .

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