CHAPTER 11: AREAS RELATED TO CIRCLES

Introduction

In this chapter, we study how to calculate different areas related to a circle such as sectors, segments, and arcs. A circle is a plane figure in which every point lies at a constant distance from a fixed point called the centre.

In real life, these concepts are used in designing objects like wheels, clocks, gardens, and circular fields. Understanding these helps in solving practical problems involving curved shapes.

Basic Concepts of a Circle

Circle

A **circle** is a collection of all points in a plane that are at a fixed distance (radius) from a fixed point (centre).

Radius (r)

Distance from the centre to any point on the circle.

Diameter

Twice the radius (2r).

Circumference and Area of Circle

Circumference (Perimeter of Circle)

The total boundary length of a circle is called circumference.

Formula:

$$C = 2\pi r$$

Area of Circle

Formula: Area $= \pi r^2$

Where:

- r= radius
- $\pi = \frac{22}{7}$or 3.14

Sector of a Circle

A **sector** is the region enclosed between two radii and the arc between them.

Types of Sector

- **Minor Sector** → smaller part
- **Major Sector** → larger part

Angle of Sector

The angle formed at the centre by the two radii.

Area of a Sector

If a circle is divided based on angle, the area depends on the angle.

Formula:

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

Where:

- θ= central angle
- r= radius

Example

Find area of a sector with radius 4 cm and angle 30°.

$$= \frac{30}{360} \times \pi \times 4^2$$

$$= \frac{1}{12} \times \pi \times 16 = \frac{16\pi}{12}$$

Length of Arc

Arc is a portion of the circumference.

Formula:

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

Segment of a Circle

A **segment** is the region enclosed between a chord and its corresponding arc.

Types

- Minor Segment
- Major Segment

Area of Segment

To find area of segment:

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

Steps to Solve

1. Find area of sector
2. Find area of triangle
3. Subtract

Area of Triangle Inside Circle

Formula:

$$\text{Area} = \frac{1}{2} \times \text{base} \times \text{height}$$

For special cases:

- For 60°, 90°, 120° → use trigonometric values

Important Formula Summary

Sector

$$\frac{\theta}{360°} \times \pi r^2$$

Arc Length

$$\frac{\theta}{360°} \times 2\pi r$$

Segment

Sector – Triangle

Major Sector

πr^2 – Minor Sector

Major Segment

πr^2 – Minor Segment

Solved Example (Conceptual)

Example 1

Radius = 21 cm, angle = 60°

Sector Area:

$$= \frac{60}{360} \times \frac{22}{7} \times 21^2$$

$$= \frac{1}{6} \times \frac{22}{7} \times 441$$

$$= 231 \text{ cm}^2$$

Example 2 (Segment)

Given:

- Radius = 21 cm
- Angle = 120°

Step 1: Sector area

Step 2: Triangle area

Step 3: Subtract

Applications in Real Life

- Designing circular parks
- Making pizza slices
- Clock movement
- Construction of roads and bridges
- Decoration designs

Combination of Figures

Sometimes shapes are combined:

Example:

- Square – Circle
- Rectangle + Semicircle

Steps

1. Break into known shapes
2. Find individual areas
3. Add or subtract

Common Mistakes to Avoid

- Forgetting to convert angle properly
- Using wrong value of π
- Not subtracting triangle in segment
- Confusing arc length with area

Quick Revision Table

Concept	Formula
Circle Area	πr^2

Circumference	$2\pi r$
Sector Area	$(\theta/360) \times \pi r^2$
Arc Length	$(\theta/360) \times 2\pi r$
Segment Area	Sector − Triangle

Summary

In this chapter, we learned:

- Circle basics
- Sector and segment definitions
- Area and arc formulas
- How to calculate segment area
- Real-life applications

These concepts are important for board exams and practical understanding of circular shapes.