



APPLICATIONS OF AREA OF SECTOR

AREAS RELATED TO CIRCLES

1 CHAPTER SNAPSHOT

- ✓ **DEFINITION:**
The area of a sector is used to solve many real-life problems.
- ✓ **KEY FINDING:**
Area of sector formula helps us find areas of regions like grazing fields, umbrella ribs, windmill blades, wiper swept areas, etc.
- ✓ **SUPPORTING FACT:**
 - Many real-life regions are part of a circle.
 - These regions are in the shape of a sector or a segment.
 - We use the area of sector formula (and related formulas) to find their area.

2 HIGH-YIELD CONCEPTS

- **Angle of Grazing (θ):** The central angle covered by the rope.
- **Radius (r):** Length of the rope or radius of the circular path.
- **Area of Grazing / Swept / Covered Region:** It is the area of a sector.
- **Umbrella Rib:** Area covered by one rib is a sector.
- **Windshield Wiper:** Area cleaned by a wiper in one sweep is a sector.
- **General Idea:** Identify the sector, find r and θ , then apply the formula correctly.

KEY FINDING:

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

3 COMPLETE FORMULA BANK

AREA OF SECTOR

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

where, r = radius, θ = central angle (in degrees)

AREA OF SEGMENT

Area of Segment = Area of Sector – Area of Triangle

AREA OF TRIANGLE (Choose as Applicable)

Type of Triangle	Formula
Right Triangle	$A = \frac{1}{2} \times \text{base} \times \text{height}$
Scalene Triangle (all sides are unequal)	$A = \sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{a+b+c}{2}$ [Heron's Formula]
Equilateral Triangle	$A = \frac{\sqrt{3}}{4} \times a^2$
When radius r and central angle θ are known	$A = \frac{1}{2} r^2 \sin \theta$

PROCESS STEP

Identify the figure → Find r and θ → Choose the required formula → Substitute values → Write answer in square units

4 BOARD EXAM FOCUS & QUESTION HOTSPOTS

- HORSE GRAZING FIELD**

FREQUENTLY ASKED QUESTION

 - A horse is tied to a peg with a rope of length r .
 - Find the area grazed by the horse when it can move through an angle θ .
 - Variations: Find angle if area grazed and r are given.
- UMBRELLA RIB**

FREQUENTLY ASKED QUESTION

 - An umbrella has n equal ribs.
 - Find the area of cloth between two consecutive ribs.
 - Variations: Find total area of umbrella cloth if radius and number of ribs are given.
- WINDSHIELD WIPER**

FREQUENTLY ASKED QUESTION

 - A windshield wiper sweeps through an angle θ .
 - Find the area cleaned by the wiper in one sweep.
 - Variations: Find angle or radius if the area swept is given.
- OTHER BOARD APPLICATIONS**
 - Area swept by a windmill blade.
 - Area covered by a fan blade.
 - Area of a sector-shaped park or garden.
 - Area irrigated by a rotating sprinkler.
 - Area enclosed by a circular flower bed.

5 SMART REVISION TIPS & COMMON MISTAKES

SMART REVISION TIPS

- ✓ Draw the figure neatly and label O , r and θ .
- ✓ Identify whether the required region is a sector or a segment.
- ✓ Convert the given angle to degrees if needed (n ribs $\Rightarrow$ angle = $\frac{360^\circ}{n}$).
- ✓ Use the correct formula.
- ✓ Use $\pi = \frac{22}{7}$ unless stated otherwise.
- ✓ Always write the answer in square units (cm^2 , m^2 , etc.).



SUPPORTING FACT

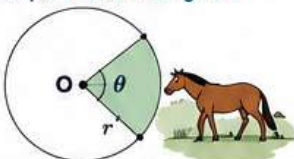
Most real-life problems reduce to finding the area of a sector (or a segment).

COMMON MISTAKES

- ✗ Using diameter instead of radius.
- ✗ Using wrong angle (reflex angle instead of minor angle).
- ✗ Forgetting to convert angle to degrees.
- ✗ Confusing sector with segment.
- ✗ Using wrong formula for area of triangle in segment problems.
- ✗ Wrong units (cm instead of cm^2).

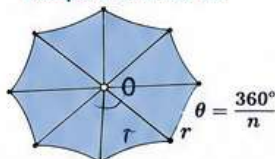
6 VISUAL MEMORY AID (REAL-LIFE APPLICATIONS)

Example 1: Horse Grazing Field



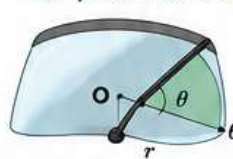
$$\begin{aligned} \text{Area of Grazing Field} \\ &= \frac{\theta}{360} \times \pi r^2 \end{aligned}$$

Example 2: Umbrella Rib



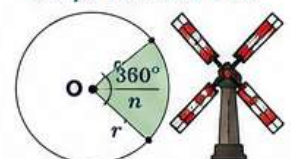
$$\begin{aligned} \text{Area covered by one rib} \\ &= \frac{\pi r^2}{n} \end{aligned}$$

Example 3: Windshield Wiper



$$\begin{aligned} \text{Area cleaned by wiper} \\ &= \frac{\theta}{360} \times \pi r^2 \end{aligned}$$

Example 4: Windmill Blade



$$\begin{aligned} \text{Area swept by one blade} \\ &= \frac{\pi r^2}{n} \end{aligned}$$

QUICK FORMULAS

Quantity	Formula
Area of Sector	$\frac{\theta}{360} \times \pi r^2$
Area of Segment	Area of Sector – Area of Triangle
Area of Triangle (Right)	$\frac{1}{2} \times \text{base} \times \text{height}$
Area of Triangle (Scalene)	$\sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{a+b+c}{2}$
Area of Triangle (Equilateral)	$\frac{\sqrt{3}}{4} a^2$
Area of Triangle (Using r , θ)	$\frac{1}{2} r^2 \sin \theta$

7 30 SECOND RAPID REVISION

- ✓ Identify the real-life situation.
- ✓ Identify r and θ .
- ✓ Decide if the region is a sector or segment.
- ✓ Apply the correct formula.
- ✓ Substitute values carefully.
- ✓ Answer in square units.

KEY TAKEAWAY

The area of sector formula is very useful in solving real-life problems such as horse grazing fields, umbrella ribs, windmill blades, wiper swept areas, fan blades and circular tracks. The key is to identify the sector, know its radius and central angle, and use the correct formula to find the area in square units.

