Area of Sector and Segment of a Circle

The two regions — know the difference

Sector — the region enclosed by **two radii and the arc between them** (a pizza slice). It always contains the **centre**. The angle between the radii, measured at the centre, is θ.

Segment — the region enclosed by a **chord and the arc** joining its endpoints. It need not touch the centre.

*In one line: a sector is cut by two radii, a segment by one chord. Unless stated otherwise, both words mean the **minor** piece.*

Core formulas (θ in degrees)

AREA OF A SECTOR

Area = (θ / 360) × πr²

The whole circle sweeps 360° and has area πr². A sector sweeps only θ°, so it is the fraction θ/360 of the circle.

LENGTH OF AN ARC

Arc length = (θ / 360) × 2πr

The same fraction θ/360, applied to the circumference 2πr. This is a length (cm), not an area.

AREA OF A SEGMENT

Segment = Sector − Triangle

Area of segment = (θ/360)πr² − area of the triangle formed by the two radii and the chord. For θ = 90° that triangle is right-angled with area ½r².

Major piece = whole circle − minor piece, for both sectors and segments. Angle of the major sector = 360° − θ.

Key takeaways

- Every formula here is the whole circle scaled by **θ/360** — nothing else to memorise.
- **Area uses πr², arc length uses 2πr.** Check the units: cm² for area, cm for length.
- Use **π = 22/7** when the radius is a multiple of 7, otherwise **π = 3.14** — unless the question specifies.
- Find the smaller piece first, then subtract from πr² for the larger one — it saves exam time.

Common mistakes that cost marks

- Using πr² for a sector and **forgetting the θ/360 factor**.
- Answering with the **sector** when the **segment** was asked — the triangle was never subtracted.
- Taking the major sector's angle as θ instead of **360° − θ**.

Worked Example — Area of a Minor Segment

Question. A chord of a circle of radius **10 cm** subtends a **right angle (90°)** at the centre. Find the area of the corresponding **minor segment**. (Use π = 3.14.)

Solution

1. **Identify what is asked.** A segment is wanted, so the plan is: sector area first, then subtract the triangle. Given r = 10 cm, θ = 90°.
2. **Area of the sector** = (θ/360) × πr² = (90/360) × 3.14 × 10² = ¼ × 3.14 × 100 = **78.5 cm²**
3. **Area of the triangle.** The two radii meet at 90°, so triangle OAB is right-angled with both legs equal to r. Area = ½ × r × r = ½ × 10 × 10 = **50 cm²**
4. **Subtract.** Area of the minor segment = 78.5 − 50

Area of the minor segment = 28.5 cm²

Check the major segment too: πr² − 28.5 = 314 − 28.5 = 285.5 cm². The two segments add back to the full circle, which confirms the answer.

Try these next

- Sector of radius 6 cm, θ = 60°, π = 22/7 → area 132/7 ≈ **18.86 cm²**, arc length 44/7 ≈ **6.29 cm**.
- Same circle: the **major** sector ≈ 113.14 − 18.86 = **94.28 cm²**.
- When θ = 60° or 120°, the triangle needs trigonometry — area = ½r² sin θ, using √3 ≈ 1.73. That is where most segment questions get hard.