

MATHEMATICS • CLASS 10

CHAPTER 11

Areas Related to Circles

CHAPTER NOTES



SECTORS, SEGMENTS AND REGIONS

CIRCLE BASICS (Recall)

Circumference of a circle

$$C = 2\pi r$$

Area of a circle

$$A = \pi r^2$$

DEFINITIONS

Sector: A region bounded by two radii and the corresponding arc.

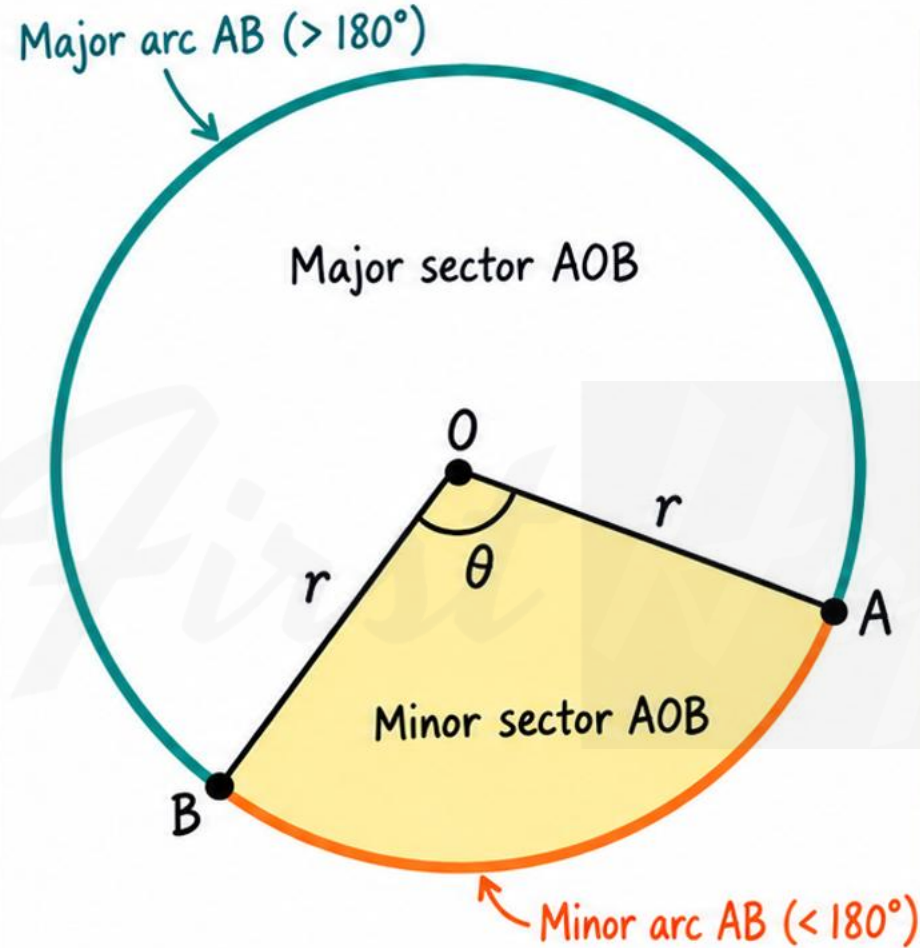
Segment: A region bounded by a chord and the corresponding arc.

MINOR VS MAJOR

Minor: central angle less than 180° .

Major: reflex angle greater than 180° .

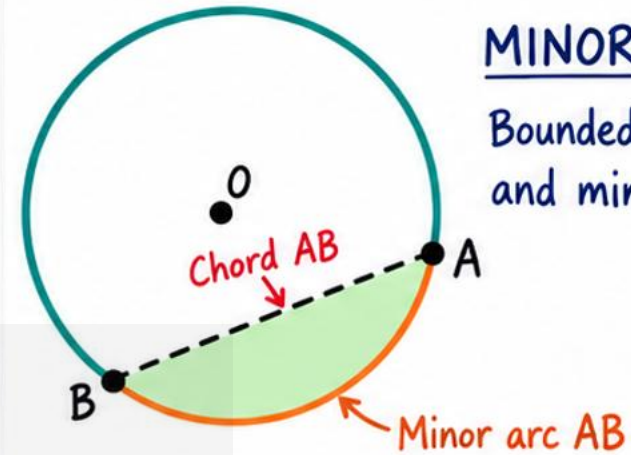
Unless stated otherwise, sector or segment usually means the minor one.



OA and OB are radii; $\angle AOB = \theta$.

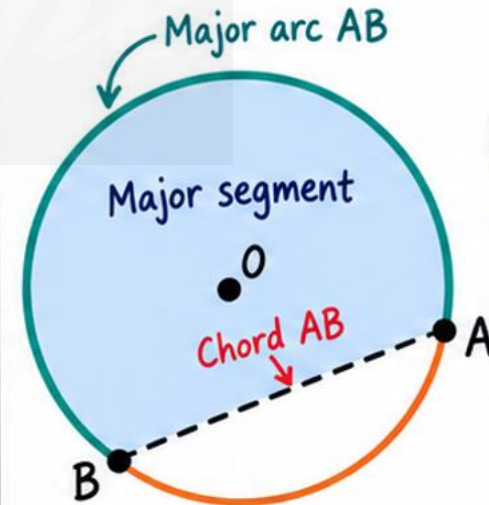
$$0^\circ < \theta < 180^\circ$$

A sector uses two radii; a segment uses a chord.



MINOR SEGMENT

Bounded by chord AB and minor arc AB.



MAJOR SEGMENT

Bounded by chord AB and major arc AB.

ARC LENGTH AND SECTOR AREA

IDEA: FRACTION OF A FULL CIRCLE

- A full circle has 360° at its centre. The circumference of the full circle is $2\pi r$ and the area is πr^2 .
- A sector with central angle θ° is part of the full circle.
- All the measures in the sector are the same fraction of the full circle.

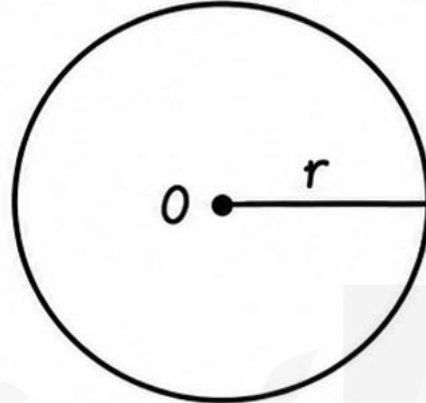
SECTOR DIAGRAM

- O is the centre of the circle.
- OA and OB are radii of length r .
- $\angle AOB = \theta^\circ$ is the central angle.
- The arc AB has length l .

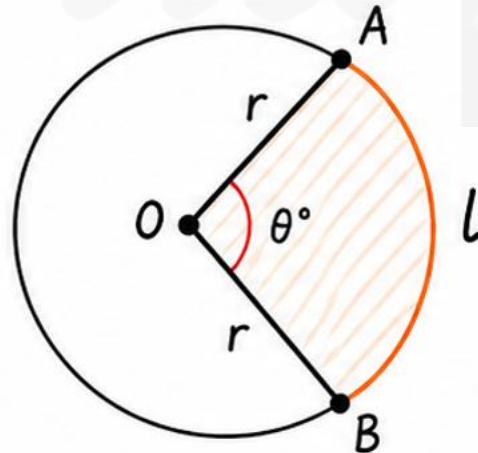
UNITS

- Arc length (l, L) has units of length: cm or m.
- Area (sector or major sector) has units of area: cm^2 or m^2 .

Full circle (360°)



Circumference = $2\pi r$
Area = πr^2



MINOR SECTOR (central angle θ°)

$$\text{Fraction} = \frac{\theta}{360^\circ}$$

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

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

$$\text{Perimeter of minor sector} = 2r + l$$

MAJOR SECTOR (central angle $360^\circ - \theta^\circ$)

$$\text{Fraction} = \frac{360^\circ - \theta}{360^\circ}$$

$$\text{Arc length (major) } L = \frac{360^\circ - \theta}{360^\circ} \times 2\pi r$$

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



Remember: Minor sector uses θ .

Major sector uses $360^\circ - \theta$.

MINOR AND MAJOR SECTOR AREAS

EXAMPLE – Sector of Radius 4 cm and Angle 30°

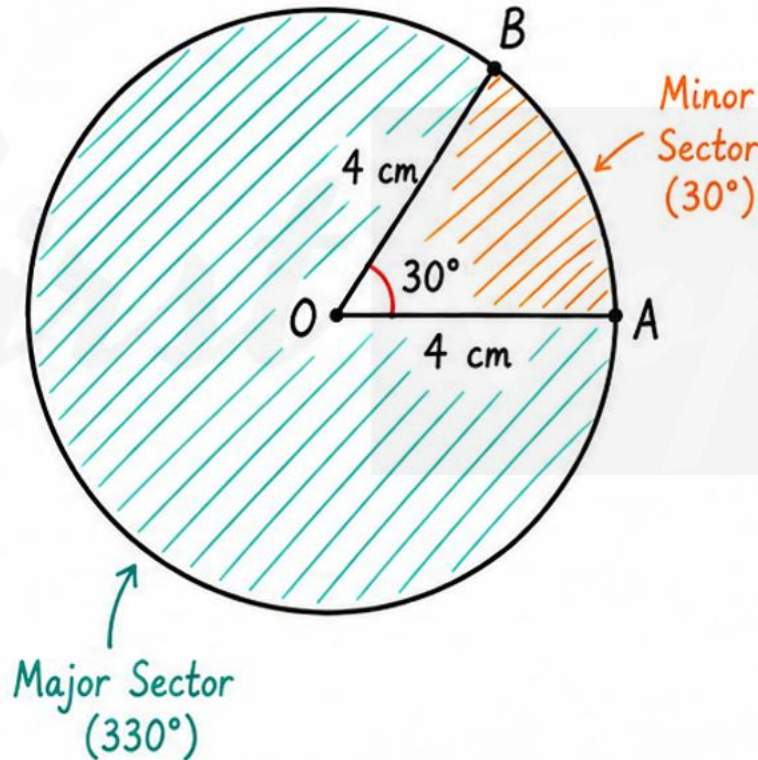
Find the minor-sector area and corresponding major-sector area for $r = 4$ cm, $\theta = 30^\circ$, using $\pi = 3.14$.

- A sector of a circle is the region enclosed by two radii and an arc.
- The minor sector is formed by the smaller angle (θ), and the major sector is formed by the remaining angle ($360^\circ - \theta$).

- Formula for area of a sector:

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

- Here, $r = 4$ cm, $\theta = 30^\circ$, $\pi = 3.14$.
- First, find the minor-sector area.
- Then, find the area of the full circle.
- Finally, major-sector area = full circle area – minor-sector area.
- As a direct check, compute the major-sector area using $\theta = 330^\circ$.



1) Minor-sector area ($\theta = 30^\circ$)

$$\begin{aligned}\text{Area} &= \frac{30^\circ}{360^\circ} \times 3.14 \times 4^2 \\ &= \frac{30}{360} \times 3.14 \times 16 \\ &= \frac{30 \times 3.14 \times 16}{360} \\ &= \frac{12.56}{3} \text{ cm}^2 \\ &\approx 4.19 \text{ cm}^2\end{aligned}$$

Minor-sector area = 4.19 cm^2

2) Area of full circle

$$\text{Area} = 3.14 \times 4^2 = 3.14 \times 16 = 50.24 \text{ cm}^2$$

3) Major-sector area (by subtraction)

$$\begin{aligned}\text{Major area} &= 50.24 - 4.19 = 46.05 \text{ cm}^2 \\ &\approx 46.1 \text{ cm}^2\end{aligned}$$

Major-sector area = 46.1 cm^2

4) Direct check using $\theta = 330^\circ$

$$\begin{aligned}\text{Area} &= \frac{330^\circ}{360^\circ} \times 3.14 \times 4^2 \\ &= \frac{330}{360} \times 3.14 \times 16 \\ &= 46.05 \text{ cm}^2 \quad \checkmark\end{aligned}$$



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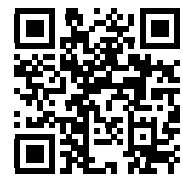


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