ODM EDUCATIONAL GROUP
Changing your Tomorrow

AREAS RELATED TO CIRCLES
PPT-2

SUBJECT : MATHEMATICS
CHAPTER NUMBER: 12
CHAPTER NAME : AREAS RELATED TO CIRCLES

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PREVIOUS KNOWLEDGE TEST

The set of all points in a plane which are at a fixed distance from a fixed point in the plane is called circle. The fixed point is called Centre and the fixed distance is called radius of the circle

Circumference and Area of a Circle

(i) The circumference of a circle is defined as distance covered by travelling once around a circle and is given by C = 2πr = πd

where r = radius of the circle and d = diameter of the circle.

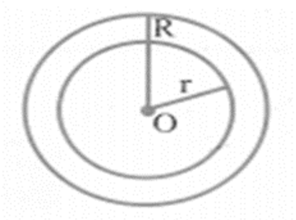
(ii) The Area of a circle of radius r is given by,

A = π r^2.

(iii) Area of a circular ring:

The area of the circular path or ring is given by the difference of the area of outer circle and the area of inner circle.

Area of circular ring = $(R^2 – r^2)$



LEARNING OUTCOME

1 . Students will be able to know the meaning of major segment, minor segment, major sector and minor sector.

2.Students will be able to identify angle subtended by the sector at the Centre.

3. Students will be able to apply the knowledge of Area of sector and segment of a circle in solving real life problems.

Area of sector and segment of a circle:
https://youtu.be/w4OBwKd_cX0 {10.15}

Problem solving:
https://youtu.be/rqZJ40lS2zs {6.20}

Terms Related To Circle

i) Chord: A line segment joining any two points on a circle.

(ii) Arc: A piece of a circle between two points on the circle is called an arc.

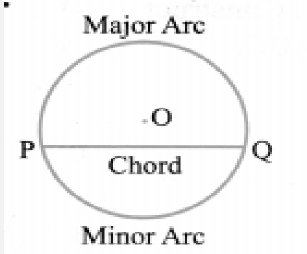
The arc less than the semicircular arc is called minor arc and the one greater than the semi-circular arc is called major arc.

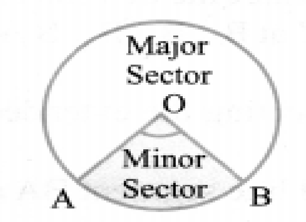
(iii) Sector: The portion of a circular region enclosed by two radii and the corresponding arc is called a sector of the circle.

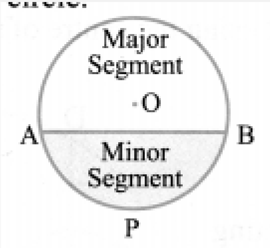
Sector smaller than the semi-circle is called minor sector and the sector larger than the semi-circle is called major sector.

(iv) Segment: The portion of a circular region enclosed between a chord and the corresponding arc is called a segment of the circle.

The segment bounded by the chord and the minor arc intercepted by the chord is called minor segment and the segment bounded by the chord and the major arc intercepted by the chord is called major segment.





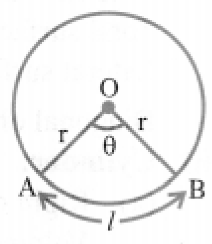


Length of an Arc and Area of Sector

(i) The length of an arc of a sector of an angle θ is given by, $\frac{2\pi R\theta}{360^0}$

The area of the sector AOB of angle θ is given by,

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



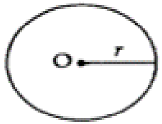
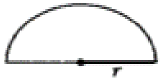
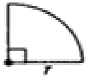
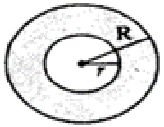
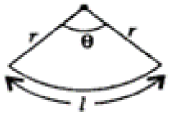
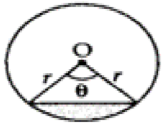
Area of Segment

i) Area of segment APB = Area (sector OAPB) – Area(ΔOAB)
This is the area of minor segment.
∴ area of major segment AQB = πr^2 – Area of minor segment APB

(ii) If θ is the central angle, then the area of segment APB

$$= \frac{\theta}{360} \times \pi r^2 - r^2 \sin\frac{\theta}{2}\cos\frac{\theta}{2}$$

TABLE FOR AREA AND PERIMETER

Figures		Area	Perimeter	
Circle		πr^2 or $\frac{\pi d^2}{4}$	$2\pi r$ or πd	r : radius d : diameter $\pi = \frac{22}{7}$ or 3.14
Semicircle		$\frac{\pi r^2}{2}$	$\pi r + 2r$	
Quadrant		$\frac{\pi r^2}{4}$	$\frac{\pi r}{2} + 2r$	
Ring		$\pi(R + r)(R - r)$	$2\pi R$ (Outer circumference) $2\pi r$ (Inner circumference)	R : Radius of bigger circle r : Radius of smaller circle
Sector		(i) $\frac{\theta}{360} \times \pi r^2$ (ii) $\frac{1}{2} lr$	$\frac{\theta}{360} \times 2\pi r + 2r$	r : Radius of circle l : length of arc
Segment		$\frac{\theta}{360} \pi r^2 - \frac{1}{2} r^2 \sin \theta$	$\frac{\pi r \theta}{180} + 2r \sin \frac{\theta}{2}$	θ : angle subtended by arc at centre

1. Find the area of a sector of a circle with radius 6 cm if angle of the sector is 60°.

1. Find the area of a sector of a circle with radius 6 cm if angle of the sector is 60°.

Given: Radius of sector, r = 6 cm and angle of sector, $\theta = 60°$

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

$$= \frac{22}{7} \times 6 \times 6 \times \frac{60°}{360°} = \frac{22 \times 6 \times 6}{7 \times 6}$$

$$= \mathbf{18.86\ cm^2}.$$

2. Find the area of a quadrant of a circle whose circumference is 22 cm

2. Find the area of a quadrant of a circle whose circumference is 22 cm

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Let radius of the circle = r

∴ Circumference of the circle = $2\pi r$

According to question,

$$2\pi r = 22 \text{ cm}$$

$$\Rightarrow \quad 2 \times \frac{22}{7} \times r = 22 \Rightarrow r = \frac{22 \times 7}{2 \times 22} = \frac{7}{2} \text{cm}$$

$$\text{Area of quadrant of the circle} = \frac{\pi r^2 \theta}{360^\circ} = \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times \frac{90^\circ}{360^\circ} = \frac{22 \times 7}{2 \times 2 \times 4} = \frac{77}{8} \text{ cm}^2$$

3. The length of the minute hand of a clock is 14 cm. Find the area swept by the minute hand in 5 minutes

3. The length of the minute hand of a clock is 14 cm. Find the area swept by the minute hand in 5 minutes.

Angle described by the minute hand in 60 minutes = 360°

Angle described by the minute hand in 5 minutes

$$= \frac{360° \times 5}{60°} = 30°$$

Now, we have $\theta = 30°$ and $r = 14$ cm.

$\therefore$ Required area swept by the minute hand in 5 minutes = Area of the sector with $r = 14$ cm and $\theta = 30°$

$$= \left(\frac{\pi r^2 \theta}{360°}\right) \text{cm}^2 = \left(\frac{22}{7} \times 14 \times 14 \times \frac{30°}{360°}\right) \text{cm}^2$$

$= \mathbf{51.33\ cm^2}$.

4. A chord of a circle of radius 10 cm subtends a right angle at the centre. Find the area of the corresponding:

(i) minor segment

(ii) major segment (Use $\pi = 3.14$

4. A chord of a circle of radius 10 cm subtends a right angle at the centre. Find the area of the corresponding:

(i) minor segment

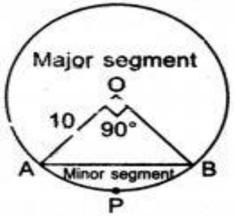
(ii) major segment (Use π = 3.14)

Given: radius of the circle = 10 cm

Angle subtended by chord at centre = 90°

(i) Area of the minor segment

= Area of the sector OAPB – Area of ΔAOB formed with radius and chord



$$= \frac{\pi r^2 \theta}{360°} - \frac{1}{2} r^2 \sin\theta$$

$$= 3.14 \times \frac{10 \times 10 \times 90°}{360°} - \frac{1}{2} \times 10 \times 10 \times \sin 90°$$

$$= 3.14 \times \frac{10 \times 10}{4} - \frac{1}{2} \times 10 \times 10$$

$$= 3.14 \times 25 - 50 = 78.5 - 50 = 28.5 \text{ cm}^2$$

(*ii*) Area of the major segment = Area of the circle – Area of the minor segment

$$= \pi r^2 - 28.5 = 3.14 \times 10 \times 10 - 28.5$$

$$= 314 - 28.5 = 285.5 \text{ cm}^2$$

5. In a circle of radius 21 cm, an arc subtends an angle of 60° at the centre. Find:
(i) length of the arc.
(ii) area of the sector formed by the arc.
(iii) area of the segment formed by the corresponding chord

5. In a circle of radius 21 cm, an arc subtends an angle of 60° at the centre. Find:
(i) length of the arc.
(ii) area of the sector formed by the arc.
(iii) area of the segment formed by the corresponding chord

Given: Radius of circles, $r = 21$ cm
Angle of sector, $\theta = 60°$

(i) Length of the arc $= \frac{\theta}{360°} \times 2\pi r$
$= \frac{60°}{360°} \times 2 \times \frac{22}{7} \times 21 = \frac{1}{6} \times 2 \times 22 \times 3$
$=$ **22 cm.**

(ii) Area of the sector formed by the arc
$= \pi r^2 \times \frac{\theta}{360°} = \frac{22}{7} \times 21 \times 21 \times \frac{60°}{360°}$
$= 11 \times 21 =$ **231 cm².**

(iii) From the figure, OA = OB [Radii of same circle]
$\angle A = \angle B = \frac{1}{2}(180° - 60°) = 60°$
i.e., $\angle OAB$ is an equilateral triangle.

$\therefore$ Area of equilateral $\Delta OAB = \frac{\sqrt{3}}{4}(\text{Side})^2$
$= \frac{\sqrt{3}}{4}(21)^2 = \frac{441\sqrt{3}}{4}$ cm²
$\therefore$ Area of segment formed by the chord
= Area of sector − Area of equilateral triangle
$= \left(231 - \frac{441\sqrt{3}}{4}\right)$ **cm².**

HOME ASSIGNMENT:Ex-12.2 Q1 to Q7 AHA

1. A chord of a circle of radius 12 cm subtends an angle of 120° at the centre. Find the area of the corresponding segment of the circle. (Use $\pi = 3.14$ and $\sqrt{3} = 1.73$

2. Find the area of the sector of a circle with radius 4 cm and of angle 30°. Also, find the area of the corresponding major sector (Use $\pi = 3.14$).

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