AREAS RELATED TO CIRCLES
PPT-6

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

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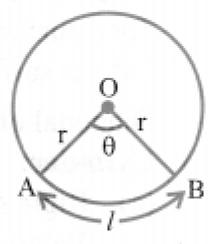
PREVIOUS KNOWLEDGE TEST

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 $A = \frac{\theta}{360^\circ} \times \pi r^2$ e θ is given by,

Area of Segment

i) Area of segment APB = Area (sector OAPB) – Area(ΔOAB)

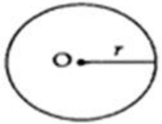
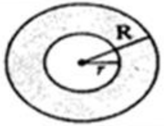
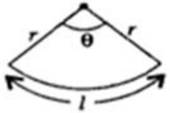
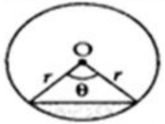
This is the area of minor segment.

∴ 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

LEARNING OUTCOME

1 .Students will be able to find the area of combined plane figures.

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 combined plane figures

https://youtu.be/vrXCfSg_-P0 {10.12}

1. Find the area of a quadrant of a circle, where the circumference of circle is 44 cm. (Use π = 227]

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Circumference of a circle = 44 cm

⇒ 2πr = 44 cm

$$\Rightarrow \quad 2 \times \frac{22}{7} \times r = 44 \text{ cm}$$

$$\Rightarrow \quad r = \frac{44 \times 7}{2 \times 22} = 7 \text{ cm}$$

$$\text{Area of a quadrant} = \frac{1}{4}\pi r^2 = \frac{1}{4} \times \frac{22}{7} \times 7 \times 7$$

$$\therefore \quad \text{Area of quadrant} = \frac{77}{2} = 38.5 \text{ cm}^2$$

2. Area of a sector of a circle of radius 14 cm is 154 cm^2. Find the length of the corresponding arc of the sector.

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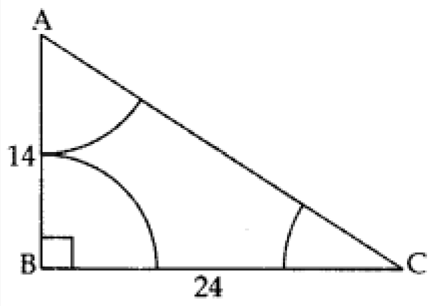
Area of sector = 154 cm^2

$$\frac{1}{2}lr = 154 \quad \Rightarrow \quad \frac{1}{2}(l)(14) = 154$$

$$\Rightarrow \quad 7l = 154 \quad \Rightarrow \quad l = 22 \text{ cm}$$

$\therefore$ **Length of the corresponding arc, $l = 22$ cm**

3. ABC is a triangle right-angled at B, with AB = 14 cm and BC = 24 cm. With the vertices A, B and C as centres, arcs are drawn, each of radius 7 cm. Find the area of the shaded region. (Use $\pi = 22/7$)



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Let ∠BAC = θ_1, ∠ABC = θ_2 and ∠ACB = θ_3

Area of the shaded region

= ar(ΔABC) – [ar(sector A) + ar(sector B) + ar(sector C)]

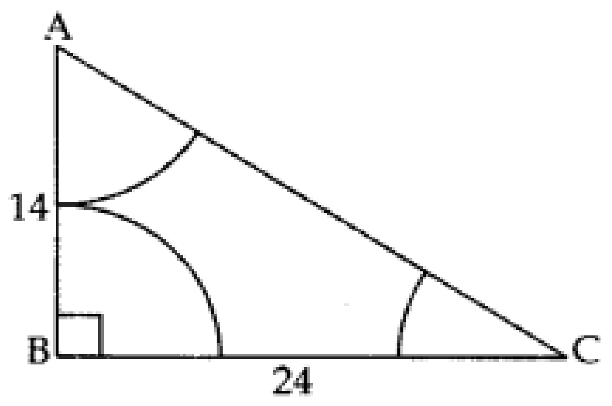
$$= \frac{1}{2} \times AB \times BC - \left[\frac{\theta_1}{360}\pi r^2 + \frac{\theta_2}{360}\pi r^2 + \frac{\theta_3}{360}\pi r^2\right]$$

$$= \frac{1}{2} \times 14 \times 24 - \frac{\pi r^2}{360}(\theta_1 + \theta_2 + \theta_3)$$

$$= 168 - \frac{1}{360} \times \frac{22}{7} \times 7 \times 7 \times 180$$

...[∵ $\theta_1 + \theta_2 + \theta_3 = 180$

$$= 168 - 77 = \mathbf{91\ cm^2}$$



4. All the vertices of a rhombus lie on a circle. Find the area of the rhombus, if the area of the circle is 1256 cm2. [Use π = 3.14]

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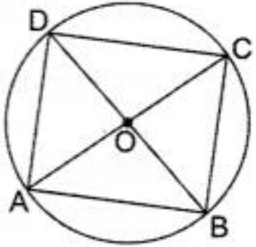
Let r be the radius of circle

In rhombus, AB = BC = CD = AD

⇒ AC = BD = 2r

∴ Area of circle $= \pi r^2$

$1256 = 3.14 r^2$ ...[Given



$r^2 = \frac{1256}{3.14} = 400$

⇒ $r = 20$ cm

∴ Area of rhombus $= \frac{1}{2}(AC \times BD)$

$= \frac{1}{2} \times 40 \times 40 = 800 \text{ cm}^2$

5. A chord of a circle of the 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 $\sqrt{3} = 1.73$)..

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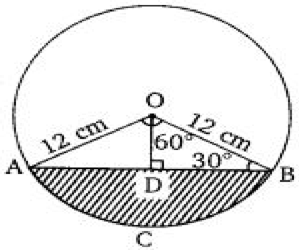


Let AB be a chord which subtends an angle 120° at the centre O of the circle.

Area of segment ACB

$= \text{Area of sector OACB} - \text{Area of } \Delta OAB \quad ...(i)$

$$\text{Area of sector OACB} = \frac{120°}{360°} \times 3.14 \times (12)^2$$

$$= \frac{1}{3} \times 3.14 \times 12 \times 12 = 150.72 \text{ cm}^2. \quad ...(ii)$$

We draw $OD \perp AB$.

$\therefore \angle OBD = 180° - (90° + 60°) = 30°$

Now from ΔODB, $\sin 30° = \frac{OD}{OB}$

$$\Rightarrow \quad \frac{1}{2} = \frac{OD}{12} \quad \left[\because \sin 30° = \frac{1}{2}\right]$$

$$\Rightarrow \quad OD = 6 \text{ cm}$$

Also, $\cos 30° = \frac{BD}{OB} \Rightarrow \frac{\sqrt{3}}{2} = \frac{BD}{12} = \frac{12\sqrt{3}}{2}$ cm

$$\Rightarrow \quad BD = 6\sqrt{3} \text{ cm}$$

$$\therefore \quad AB = 2BD = 2 \times 6\sqrt{3} \text{ cm} = 12\sqrt{3} \text{ cm.}$$

$$\therefore \text{ Area of } \Delta OAB = \frac{1}{2} \times AB \times OD$$

$$= \frac{1}{2} \times 12\sqrt{3} \times 6 = 36\sqrt{3} \text{ cm}^2. \quad ...(iii)$$

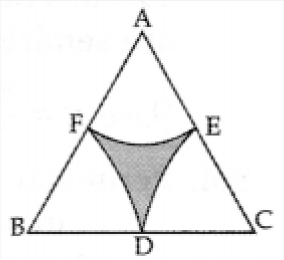
From equations (i), (ii) and (iii), we get:

$$\text{Area of segment ACB} = \left(150.72 - 36\sqrt{3}\right) \text{ cm}^2$$

$$= 88.37 \text{ cm}^2$$

Hence, the area of the segment of the circle is **88.37** cm².

6. Arcs are drawn by taking vertices A, B and C of an equilateral triangle ABC of side 14 cm as centres to intersect the sides BC, CA and AB at BZ their respective mid-points D, E and F. Find the area of the shaded region. [Use π = 22/7 and √ 3= 1.73]



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∠ABC = ∠BAC = ∠ACB = 60° … [equilateral Δ

Let $\theta = 60°$, $r = \frac{14}{2} = 7$ cm

Area of shaded region

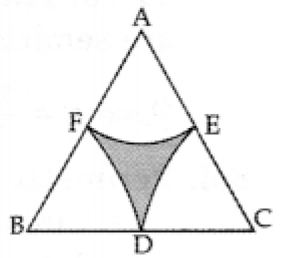
= ar(ΔABC) – 3 (ar of sector)

$= \frac{\sqrt{3}}{4}(\text{side})^2 - 3 \cdot \frac{\theta}{360}\pi r^2$

...[Area of equilateral $\Delta = \frac{\sqrt{3}}{4}\text{side}^2$

$= \frac{1.73}{4} \times 14 \times 14 - 3 \times \frac{60}{360} \times \frac{22}{7} \times 7 \times 7$

$= 84.77 - 77 = 7.77 \text{ cm}^2$



HOME ASSIGNMENT:CH-12

EXERCISE-12.1 ,12.2 AND 12.3

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THANKING YOU

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