AREAS RELATED TO CIRCLES
PPT-3

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

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PREVIOUS KNOWLEDGE TEST

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.

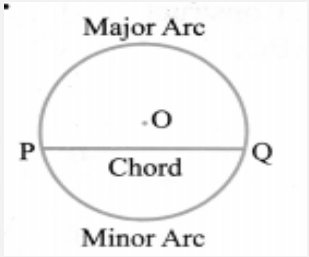
The arc less than the semicircular arc is called minor arc and the one greater than the semi-circular arc is called major arc.

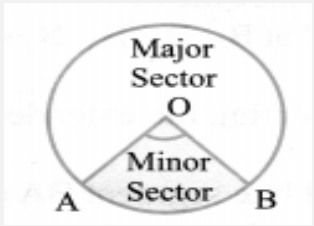
(iii) Sector: The portion of a circular region enclosed by two radii and the corresponding arc is called a sector of the circle.

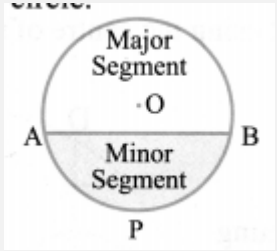
Sector smaller than the semi-circle is called minor sector and the sector larger than the semi-circle is called major sector.

(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.





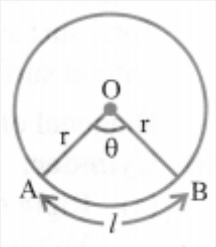


Length of an Arc and Area of Sector

(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,

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



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, the

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

LEARNING OUTCOME

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

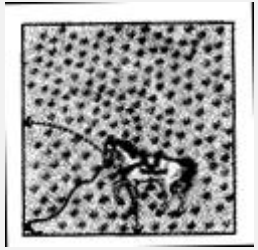
2.Students will be able to identify angle subtended by the sector at the Centre.

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

Problem solving on Area of sector and segment of a circle:
https://youtu.be/wN3sjSVU0rY {10.20}

1.A horse is tied to a peg at one corner of a square shaped grass field of side 15 m by means of a 5 m long rope (see figure). Find

(i) the area of that part of the field in which the horse can graze.
(ii) the increase in the grazing area if the rope were 10 m long instead of 5 m. (Use $\pi = 3.14$)



1.A horse is tied to a peg at one corner of a square shaped grass field of side 15 m by means of a 5 m long rope (see figure). Find

(i) the area of that part of the field in which the horse can graze.
(ii) the increase in the grazing area if the rope were 10 m long instead of 5 m. (Use $\pi = 3.14$)

(i) Length of the rope = Radius of the sector grazed by horse = 5 m

Here, angle of the sector = 90°

$$\text{Area of the field that horse can graze} = \frac{\pi r^2 \theta}{360^\circ} = \frac{3.14 \times 5 \times 5 \times 90^\circ}{360^\circ}$$

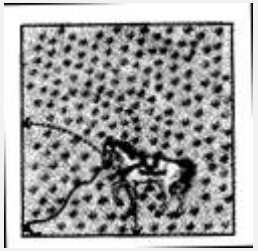
$$= \frac{3.14 \times 5 \times 5}{4} = 19.625 \text{ cm}^2$$

(ii) Length of the rope is increased from 5 m to 10 m

New radius of sector grazed by horse = 10 m

$$\therefore \quad \text{Area grazed by horse} = \frac{\pi r^2 \theta}{360^\circ} = \frac{3.14 \times 10 \times 10 \times 90^\circ}{360^\circ} = 78.5 \text{ cm}^2$$

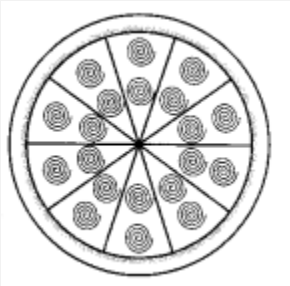
$$\text{Area increased} = 78.5 - 19.625 = 58.875 \text{ cm}^2.$$



2.A brooch is made with silver wire in the form of a circle with diameter 35 mm. The wire is also used in making 5 diameters which divide the circle into 10 equal sectors as shown in figure.

Find:(i) the total length of the silver wire required.

(ii) the area of each sector of the brooch



2.A brooch is made with silver wire in the form of a circle with diameter 35 mm. The wire is also used in making 5 diameters which divide the circle into 10 equal sectors as shown in figure.

Find:(i) the total length of the silver wire required.

(ii) the area of each sector of the brooch

(i) Length of silver wire required to make the perimeter of the circle, i.e.,

$$\text{Circumference} = 2\pi r = \left(2 \times \frac{22}{7} \times \frac{35}{2}\right)\text{mm}$$

$$= 110 \text{ mm.}$$

Length of wire required to make 5 diameters

$$= 5 \times 35 = 175 \text{ mm}$$

$\therefore$ Total length of silver wire required

$$= (110 + 175) \text{ mm} = \mathbf{285\ mm}.$$

(ii) Sector angle of each brooch, $\theta = \frac{360^\circ}{10} = 36^\circ$

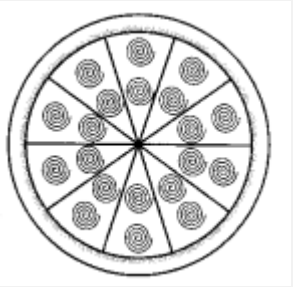
$\therefore$ The area of each sector of the brooch

$$= \frac{1}{10} \times \text{Area of the circle}$$

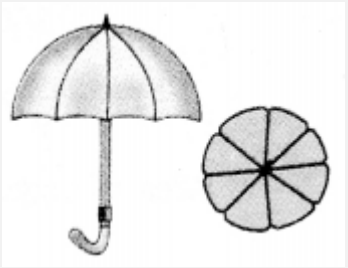
$$= \frac{1}{10} \times \pi r^2 = \frac{1}{10} \times \frac{22}{7} \times \frac{35}{2} \times \frac{35}{2} \text{ mm}^2$$

$$\left[\because \text{Area of circle} = \pi r^2, r = \frac{35}{2}\right]$$

$$= \frac{385}{4} \mathbf{\ mm^2}.$$



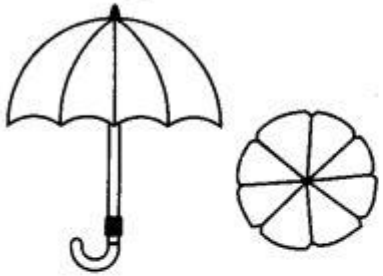
3. An umbrella has 8 ribs which are equally spaced (see figure). Assuming umbrella to be a flat circle of radius 45 cm, find the area between the two consecutive ribs of the umbrella.



3. An umbrella has 8 ribs which are equally spaced (see figure). Assuming umbrella to be a flat circle of radius 45 cm, find the area between the two consecutive ribs of the umbrella.

Radius of the circle = 45 cm Number of ribs = 8

central angle of the circle



$$\text{Angle between two consecutive ribs} = \frac{\text{central angle of the circle}}{\text{number of the sectors (ribs)}} = \frac{360^\circ}{8} = 45^\circ$$

Area between two consecutive ribs = Area of one sector of the circle

$$= \frac{\pi r^2 \theta}{360^\circ} = \frac{22}{7} \times \frac{45 \times 45 \times 45^\circ}{360^\circ}$$

$$= \frac{11 \times 45 \times 9 \times 5}{7 \times 4} = \frac{22275}{28} \text{ cm}^2$$

4. A car has two wipers which do not overlap.
Each wiper has a blade of length 25 cm sweeping through an angle of 115°. Find the total area cleaned at each sweep of the blades.

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Each wiper has a blade of length 25 cm sweeping through an angle of 115°. Find the total area cleaned at each sweep of the blades.

The blade of each wiper sweeps in the form of a sector of radius 25 cm.

The sector angle, $\theta = 115°$ [Given]

$\therefore$ The area covered by one blade

$= \frac{115°}{360°} \times \pi \times (25)^2$

$\therefore$ The area covered by both blades

$$= \left(2 \times \frac{115°}{360°} \times \frac{22}{7} \times 625\right) \text{cm}^2$$

$$= \left(\frac{23}{18} \times \frac{11}{7} \times 625\right) = \mathbf{\frac{158125}{126}}\ \mathbf{cm^2}.$$

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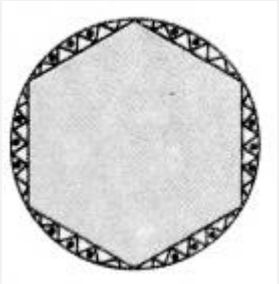
5. A round table cover has six equal designs as shown in the figure. If the radius of the cover is 28 cm, find the cost of making the designs at the rate of ₹0.35 per cm². (Use √3= 1.7)



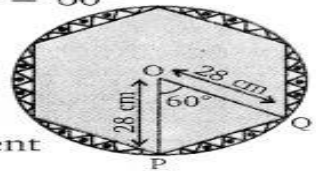
5. A round table cover has six equal designs as shown in the figure. If the radius of the cover is 28 cm, find the cost of making the designs at the rate of ₹0.35 per cm². (Use √3= 1.7)

Here, radius of the cover (r) = 28 cm

and central angle (θ) = $\frac{360^\circ}{6} = 60^\circ$

We join OP and OQ

Then ΔOPQ is an equilateral triangle with side 28 cm.



$\therefore$ Area of one designed segment

= Area of sector OPQ − Area of the ΔOPQ

$$= \frac{60^\circ}{360^\circ} \times \pi \times (28)^2 - \frac{\sqrt{3}}{4} \times (28)^2$$

$$= (28)^2 \times \left(\frac{\pi}{6} - \frac{\sqrt{3}}{4}\right) = (28)^2 \times \left(\frac{22}{7 \times 6} - \frac{1.7}{4}\right)$$

$$= 28^2 \times \left(\frac{11}{21} - \frac{1.7}{4}\right) = 28 \times 28 \times \left(\frac{44 - 35.7}{84}\right)$$

$$= \frac{28 \times 28 \times 8.3}{12} = 77.47 \text{ cm}^2.$$

$\therefore$ Total area of 6 designed segments

$= 6 \times 77.47 = 464.82 \text{ cm}^2.$

$\therefore$ Cost of making the designs

$= ₹\ 464.82 \times 0.35 = ₹\ 162.69.$

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HOME ASSIGNMENT:Ex-12.2 Q8 to Q14 AHA

1. To warn ships for underwater rocks, a lighthouse spreads a red coloured light over a sector of angle 60° to a distance of 12.5km. Find the area of the sea over which the ships are warned

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THANKING YOU

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