AREAS RELATED TO CIRCLES
PPT-5

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

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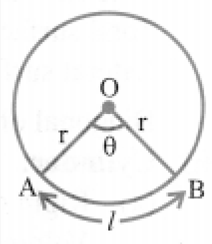
PREVIOUS KNOWLEDGE TEST

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

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

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..

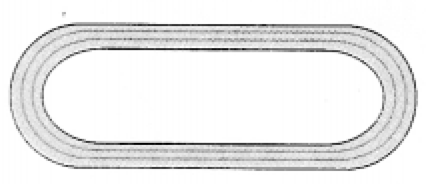
Area of combined plane figures

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

1. The given figure depicts a racing track whose left and right ends are semicircular. The distance between the two inner parallel line segments is 60 m and they are each 106 m long. If the track is 10 m wide, find

(i) the distance around the track along its inner edge.

(ii) the area of the track



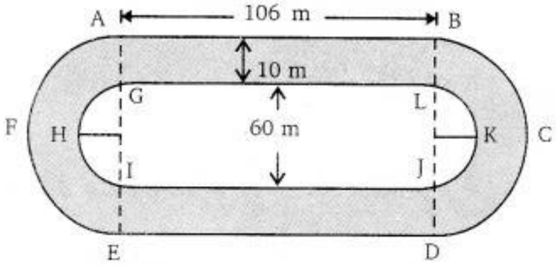
1. The given figure depicts a racing track whose left and right ends are semicircular. The distance between the two inner parallel line segments is 60 m and they are each 106 m long. If the track is 10 m wide, find(i) the distance around the track along its inner edge.
(ii) the area of the track

The distance around the track along the inner edge = Perimeter of GHI + Perimeter JKL + GL + IJ

$$= (\pi \times 30 + \pi \times 30 + 106 + 106) \text{ m}$$

$$= (60\pi + 212) \text{ m}$$

$$= \left(60 \times \frac{22}{7} + 212\right) \text{ m} = \mathbf{\frac{2804}{7}\ m.}$$



(ii) Area of circular path AFEIHGA

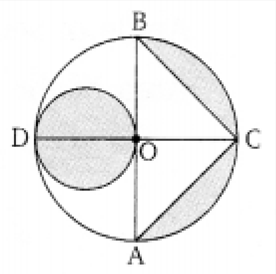
$$= \frac{1}{2} \times \pi \times (40)^2 - \frac{1}{2}\pi \times (30)^2$$

[Outer radius = 30 + 10 = 40 cm]

$$= \frac{\pi}{2}(1600 - 900) = \frac{22}{7 \times 2} \times 700$$

$$= 1100 \text{ m}^2$$

2. In the figure, AB and CD are two diameters of a circle (with centre O) perpendicular to each other and OD is the diameter of the smaller circle. If OA = 7 cm, find the area of the shaded region



2. In the figure, AB and CD are two diameters of a circle (with centre O) perpendicular to each other and OD is the diameter of the smaller circle. If OA = 7 cm, find the area of the shaded region

OA = 7 cm

Radius of the semicircle ABC = OA = 7 cm

Area of the semicircle ABC $= \frac{1}{2}\pi r^2 = \frac{1}{2} \times \frac{22}{7} \times 7 \times 7 = 11 \times 7 = 77\ cm^2$

Diameter AB $= 2(OA) = 2 \times 7 = 14$ and OA = OC = 7 cm (radius)

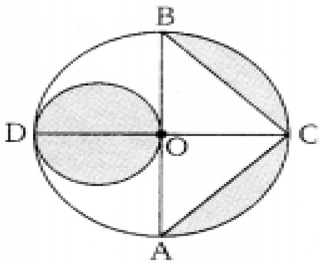
Area of the $\Delta ABC = \frac{1}{2} \times AB \times OC = \frac{1}{2} \times 14 \times 7 = 49\ cm^2$

Area of the circle having diameter (OD = 7 cm) $= \pi\left(\frac{7}{2}\right)^2 = \frac{22}{7} \times \frac{7 \times 7}{2 \times 2} = \frac{11}{2} \times 7 = \frac{77}{2}\ cm^2$

Area of the circle having radius (OA = 7 cm) $= \pi(7)^2 = \frac{22}{7} \times 49 = 22 \times 7 = 154\ cm^2$

Area of the shaded region = {Area of the circle having diameter OD + (Area of the semicircle ABC – Area of the ΔABC)}

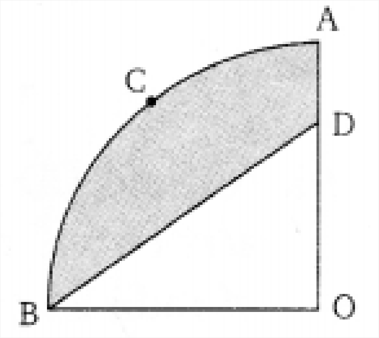
$= \frac{77}{2} + (77 - 49) = \frac{77}{2} + 28 = \frac{77 + 56}{2} = \frac{133}{2} = 66.5\ cm^2$



3. In the figure, OACB is a quadrant of a circle with centre O and radius 3.5 cm. If OD = 2 cm, find the area of the

(i) quadrant OACB,

(ii) shaded region



3. In the figure, OACB is a quadrant of a circle with centre O and radius 3.5 cm. If OD = 2 cm, find the area of the
(i) quadrant OACB,
(ii) shaded region

Radius of the quadrant (r) = 3.5 cm [Given]

(i) Area of quadrant OACB $= \frac{1}{4} \times \pi r^2$

$= \frac{1}{4} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} = \frac{11 \times 7}{8} = \mathbf{\frac{77}{8}}$ **cm²**.

(ii) In ΔBOD, $\angle O = 90°$

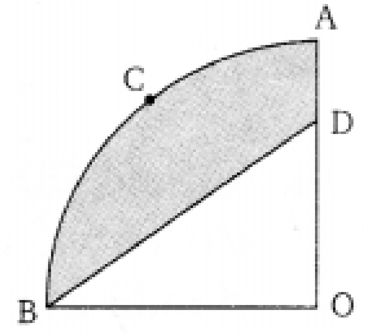
$\therefore$ The area of $\Delta BOD = \frac{1}{2} \times OB \times OD$

$= \frac{1}{2} \times \frac{7}{2} \times 2 = \frac{7}{2}$ cm²

$\therefore$ Area of shaded region

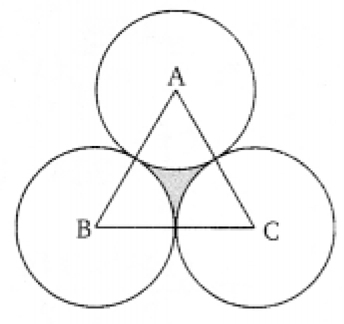
= Area of quadrant OACB – Area of ΔBOD

$= \frac{77}{8} - \frac{7}{2} = \frac{77 - 28}{8} = \mathbf{\frac{49}{8}}$ **cm²**.



4. The area of an equilateral triangle ABC is 17320.5 cm^2. With each vertex of the triangle as centre, a circle is drawn with radius equal to half the length of the side of the triangle (see figure). Find the area of the shaded region.

(Use $\pi = 3.14$ and $\sqrt{3} = 1.73205$



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(Use $\pi = 3.14$ and $\sqrt{3} = 1.73205$

Area of $\Delta ABC = 17320.5\ cm^2$ [Given]

$$\Rightarrow \frac{\sqrt{3}}{4}(\text{Side})^2 = 17320.5$$

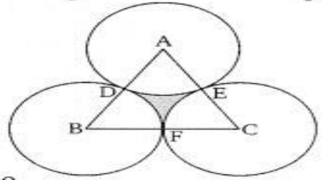
$$\Rightarrow (\text{Side})^2 = \frac{17320.5 \times 4}{1.73205} \quad [\because \sqrt{3} = 1.73205]$$

$$= 40{,}000$$

$$\Rightarrow \text{Side} = 200\ \text{cm}.$$

So, radius of each circle

$$= \frac{200}{2}\ \text{cm} = 100\ \text{cm}$$



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

$$= \frac{60°}{360°} \times \pi \times (100)^2 = \frac{\pi}{6} \times 10000\ cm^2.$$

Similarly, area of sector BDF = area of sector CFE

$$= \frac{\pi}{6} \times 10000\ cm^2.$$

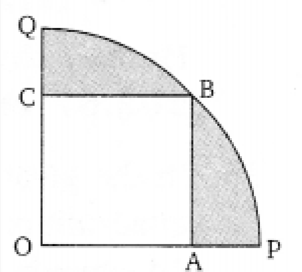
$$\therefore \text{ Total area of three sectors} = 3 \times \frac{\pi}{6} \times 10000$$

$$= 3 \times \frac{3.14}{6} \times 10000 = 15700\ cm^2.$$

The required area of shaded region

$$= (17320.5 - 15700)\ cm^2 = \mathbf{1620.5\ cm^2}.$$

5. In the figure, a square OABC is inscribed in a quadrant OPBQ. If OA = 20 cm, find the area of the shaded region. (Use $\pi = 3.14$).



5. In the figure, a square OABC is inscribed in a quadrant OPBQ. If OA = 20 cm, find the area of the shaded region. (Use $\pi = 3.14$).

Given: side of the square OABC = OA = 20 cm

Area of the square – 20 x 20 = 400 cm^2

$(\text{Diagonal of the square})^2 = (\text{side of the square})^2 + (\text{side of the square})^2$ (By pythagoras theorem)

Diagonal of the square = $\sqrt{2}$ x (side of the square)

$= \sqrt{2} \times (20) = 20\sqrt{2}$ cm^2

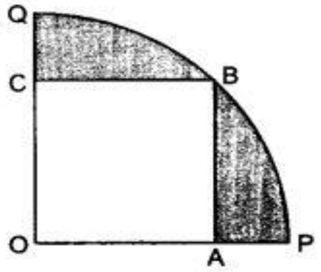
Area of the quadrant OPBQ $= \dfrac{\pi r^2 \theta}{360^\circ}$

$$= \frac{3.14 \times 20\sqrt{2} \times 20\sqrt{2} \times 90^\circ}{360^\circ}$$

$$= 314 \times 2 = 628 \text{ cm}^2$$

Area of the shaded region = Area of the quadrant – Area of the square

$$= 628 - 400 = 228 \text{ cm}^2$$



HOME ASSIGNMENT:Ex-12.3 Q7 to Q16 AHA

1. : Two circular flower beds are there on two sides of a square lawn ABCD of side 55 m. If the Centre of each circular flower bed is the point of intersection O of the diagonals of the square lawn, find the sum of the areas of the lawn and the flower beds..

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