

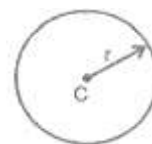
Area Related to Circle

Circle: Circle is a point, which moves so such a manner that its distance from a fixed point id always equal. The fixed point is called center of the circle of the circle and the fixed distance is called radius of the circle.

Area of circle (A) = πr^2

Circumference (C) = $2\pi r$

Diameter (D) = $2r$



Circle

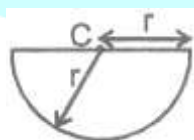
Results:

- (i) If two circles touch internally, then the distance between their centers is equal to the difference of their radii,
- (ii) If two circles touch externally, then the distance between their centers is equal to the sum of their radii.
- (iii) Distance moved by a rotating wheel in one revolution is the circumference of the wheel.
- (iv) $\text{Number of revolutions completed by a rotating wheel in one minute} = \frac{\text{Distance moved in one minute}}{\text{Circumference}}$
- (v) Angle described by minute hand is one minute = 6° .
- (vi) Angle described by hour hand in one hour = 30° .

13.5(a) Semicircle:

Perimeter = $\pi r + 2r = (\pi + 2)r$

Area (A) = $\frac{\pi r^2}{2}$



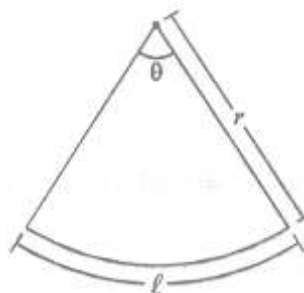
Semi-Circle

13.2(b) Sector:

Area (A) = $\frac{\pi r^2 \theta}{360^\circ}$

Length of arc (ℓ) = $\frac{\pi r \theta}{180^\circ}$

Area(A) = $\frac{1}{2} \times \ell \times r$



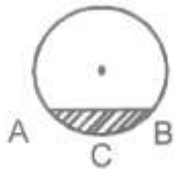
Sector of a Circle

Perimeter = $\ell + 2r$

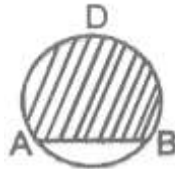
(c) Segment :

Shaded portion in the figure is called segment of a circle.

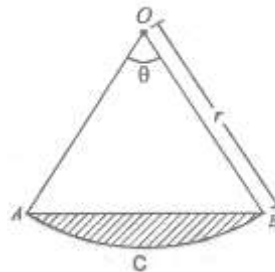
e



Minor segment



Major segment



Minor Segment

Area of minor segment = Area of the sector - Area of triangle OAB

$$A = \frac{\pi r^2 \theta}{360^\circ} - r^2 \sin \frac{\theta}{2} \cos \frac{\theta}{2} \quad \text{OR} \quad A = \frac{\pi r^2 \theta}{360^\circ} - \frac{r^2}{2} \sin \theta$$

Here, segment ACB is called minor segment while ADB is called major segment.

Illustration:

Example: A chord of circle 14 cm makes an angle of 60° at the center of the circle. Find :

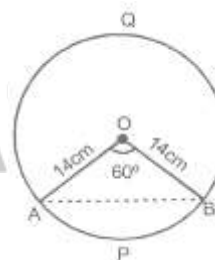
- (i) area of minor sector
- (ii) area of the minor segment
- (iii) area of the major sector
- (iv) area of the major segment

Sol. Given, $r = 14$ cm, $\theta = 60^\circ$

(i) Area of minor sector OAPB = $\frac{\theta}{360^\circ} \pi r^2$

$$= \frac{60^\circ}{360^\circ} \times 3.14 \times 14 \times 14$$

$$= 102.57 \text{ cm}^2$$



(ii) Area of minor segment APB = $\frac{\pi r^2 \theta}{360^\circ} - \frac{r^2}{2} \sin \theta$

$$= 102.57 - \frac{14 \times 14}{2} \sin 60^\circ$$

$$= 102.57 - 98 \times \frac{\sqrt{3}}{2}$$

$$= 17.80 \text{ cm}^2$$

(iii) Area of major sector = Area of circle - Area of minor sector OAPB

$$= \pi (14)^2 - 102.57$$



$$= 615.44 - 102.57 = 512.87 \text{ cm}^2$$

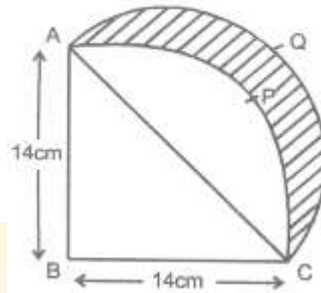
(iv) Area of major segment AQB

$$= \text{Area of circle} - \text{Area of minor segment APB}$$

$$= 615.44 - 17.80$$

$$= 597.64 \text{ cm}^2.$$

Example: ABCP is a quadrant of a circle of radius 14 cm. With AC as diameter, a semicircle is drawn. Find the area of the shaded portion (figure).



Sol. In right angled triangle ABC, we have.

$$AC^2 = AB^2 + BC^2$$

$$AC^2 = 14^2 + 14^2$$

$$AC = \sqrt{2 \times 14^2} = 14\sqrt{2} \text{ cm}$$

$$\begin{aligned} \text{Now required Area} &= \text{Area APCQA} \\ &= \text{Area ACQA} - \text{Area ACPA} \\ &= \text{Area ACQA} - (\text{Area ABCPA} - \text{Area of } \Delta ABC) \end{aligned}$$

$$= \frac{1}{2} \times \pi \times \left(\frac{14\sqrt{2}}{2}\right)^2 - \left[\frac{1}{4} \times \pi(14)^2 + \frac{1}{2} \times 14 \times 14\right]$$

$$= \frac{1}{2} \times \frac{22}{7} \times 7\sqrt{2} \times 7\sqrt{2} - \frac{1}{4} \times \frac{22}{7} \times 14 \times 14 + 7 \times 14$$

$$= 154 - 154 \div 98$$

$$= 98 \text{ cm}^2$$

Example: The diameter of cycle wheel is 28 cm. How many revolution will it make in moving 13.2 km ?

Sol. Distance traveled by the wheel is one revolution $= 2\pi r$

$$= 2 \times \frac{22}{7} \times \frac{28}{2} = 88 \text{ cm}$$

and the total distance covered by the wheel $= 13.2 \times 1000 \times 100 \text{ cm}$

$$= 1320000 \text{ cm}$$

$$\begin{aligned} \therefore \text{Number of revolution made by the wheel} &= \frac{1320000}{88} \\ &= 15000. \end{aligned}$$