12
Chapter

Areas Related to Circles

Key Points

1. **Circle:** A circle is the locus of a point which moves in a plane in such a way that its distance from a fixed point always remains the same. The fixed point is called the centre and the given constant distance is known as the radius of the circle.

   If r is radius of a circle, then

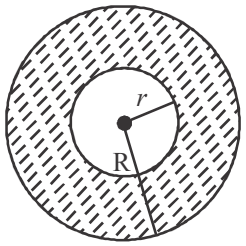
   (i) Circumference = $2\pi r$ or πd where d = 2r is the diameter of the circle

   (ii) Area = πr^2 or $\frac{\pi d^2}{4}$

   (iii) Area of semi circle = $\frac{\pi r^2}{2}$

   (iv) Area of quadrant of a circle = $\frac{\pi r^2}{4}$

   Area enclosed by two concentric circles: If R and r are radii of two concentric circles, then area enclosed by the two circles = $\pi R^2 - \pi r^2$



$= \pi (R^2 - r^2)$

$= \pi (R + r)(R - r)$

   (i) If two circles touch internally, then the distance between their centres is equal to the difference of their radii.

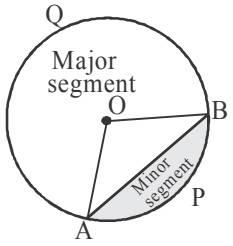
   (ii) If two circles touch externally, then distance between their centres is equal to the sum of their radii.

(iii) Distance moved by rotating wheel in one revolution is equal to the circumference of the wheel.

(iv) The number of revolutions completed by a rotating wheel in

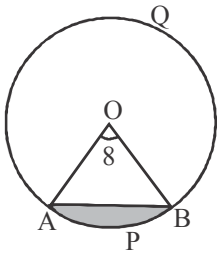
$$\text{one minute} = \frac{\textit{Distance moved in one minute}}{\textit{Circumference of the wheel}}$$

Segment of a Circle: The portion (or part) of a circular region enclosed between a chord and the corresponding arc is called a segment of the circle. In fig. adjacent APB is minor segment and AQB is major segment.



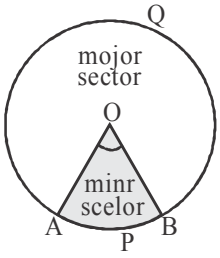
Area of segment APB = Area of the sector OAPB – Area of ΔOAB

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



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

In figure adjacent OAPB is minor sector and OAQB is the major sector.



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

$= \frac{1}{2} \times \textit{length of arc} \times \textit{radius} = \frac{1}{2} lr$

Length of an arc of a sector of angle $\theta = \frac{\theta}{360} \times 2\pi r$

(i) The sum of the arcs of major and minor sectors of a circle is equal to the circumference of the circle.

(ii) The sum of the areas of major and minor sectors of a circle is equal to the area of the circle.

(a) Angle described by minute hand in 60 minutes = 360°

Angle described by minute hand in one minute $= \frac{360°}{60°} = 6°$

Thus minute hand rotates through an angle of 6° in one minute

(b) Angle described by hour hand in 12 hours = 360°

Angle described by hour hand in one hour $= \frac{360°}{12°} = 30°$

Angle described by hour hand in one minute $= \frac{30°}{60°} = \frac{1°}{2}$

Thus, hour hand rotates through an angle of $\frac{1°}{2}$ in one minute.