Trig Class 11 NCERT

Problem Solutions

Problem 8

The perimeter of a certain sector of a circle is equal to the length of the arc of a semi-circle having the same radius. Express the angle of the sector in degrees, minutes, and seconds.
Solution:
Let the radius of the circle be r.
The perimeter of the sector $= 2r + r\theta$
The length of the arc of a semi-circle with the same radius $= \pi r$
Given that the perimeter of the sector is equal to the length of the arc of the semi-circle:
$2r + r\theta = \pi r$
$\theta = \pi - 2$
Since θ is in radians, convert it to degrees:
$\theta = (\pi - 2) \times \frac{180}{\pi}$
$\theta = 180 - \frac{360}{\pi}$
$\theta \approx 180 - 114.6$
$\theta \approx 65.4 \text{ degrees}$
To express this in degrees, minutes, and seconds:
$0.4 \text{ degrees} = 0.4 \times 60 = 24 \text{ minutes}$
Thus, the angle is approximately $65 \text{ degrees}, 24 \text{ minutes}, \text{and } 0 \text{ seconds}$.

Problem 9

An airplane propeller rotates 1000 times per minute. Find the number of degrees that a point on the edge of the propeller will rotate in 1 second.
Solution:
The propeller rotates 1000 times per minute.
Each rotation is 360°.
In one minute, the total rotation in degrees is:
$1000 \times 360^\circ = 360000^\circ$
In one second (since there are 60 seconds in a minute), the rotation in degrees is:
$\frac{360000^\circ}{60} = 6000^\circ$
Thus, the point on the edge of the propeller will rotate 6000° in 1 second.

Problem 10

A train is moving on a circular track of 1500 m radius at the rate of 66 km/hr. What angle will it turn in 20 seconds?
Solution:

Convert the speed to meters per second:
$66 \text{ km/hr} = 66 \times \frac{1000}{3600} \text{ m/s} = 18.33 \text{ m/s}$
Distance covered in 20 seconds:
$d = 18.33 \text{ m/s} \times 20 \text{ s} = 366.67 \text{ m}$
The circumference of the circle:
$C = 2\pi \times 1500 = 3000\pi \text{ m}$
The fraction of the circumference covered in 20 seconds:
$\frac{366.67}{3000\pi}$
The angle (in radians):
$\theta = 2\pi \times \frac{366.67}{3000\pi} = \frac{366.67}{1500} = 0.244 \text{ radians}$
Convert to degrees:
$0.244 \times \frac{180}{\pi} \approx 14^\circ$
Thus, the train will turn approximately 14° in 20 seconds.

Problem 11

A circular metallic plate of radius 8 cm and thickness 6 mm is melted and molded into a pie (a sector of the circle with thickness) of radius 16 cm and thickness 4 mm. Find the angle of the sector.
Solution:
Volume of the metallic plate:
$V_{\text{plate}} = \pi \times (8 \text{ cm})^2 \times 0.6 \text{ cm} = 38.4\pi \text{ cm}^3$
Volume of the sector:
$V_{\text{sector}} = \frac{1}{2} \times r^2\theta \times \text{thickness}$
$= \frac{1}{2} \times (16 \text{ cm})^2 \times \theta \times 0.4 \text{ cm}$
$= 128\theta \times 0.4 = 51.2\theta \text{ cm}^3$
Since the volumes are equal:
$38.4\pi = 51.2\theta$
$\theta = \frac{38.4\pi}{51.2} \approx 2.36 \text{ radians}$
Convert to degrees:
$\theta \times \frac{180}{\pi} \approx 2.36 \times \frac{180}{\pi} \approx 135^\circ$
Thus, the angle of the sector is approximately 135°.