6-2

Study Guide

Linear and Angular Velocity

As a circular object rotates about its center, an object at the edge moves through an angle relative to the object's starting position. That is known as the **angular displacement,** or angle of rotation. **Angular velocity** ω is given by $\omega = \frac{\theta}{t}$, where θ is the angular displacement in radians and t is time. **Linear velocity** v is given by $v = r\frac{\theta}{t}$, where $\frac{\theta}{t}$ represents the angular velocity in radians per unit of time. Since $\omega = \frac{\theta}{t}$, this formula can also be written as $v = r\omega$.

Example 1 **Determine the angular displacement in radians of 3.5 revolutions. Round to the nearest tenth.**

Each revolution equals 2π radians. For 3.5 revolutions, the number of radians is $3.5 \times 2\pi$, or 7π. 7π radians equals about 22.0 radians.

Example 2 **Determine the angular velocity if 8.2 revolutions are completed in 3 seconds. Round to the nearest tenth.**

The angular displacement is $8.2 \times 2\pi$, or 16.4π radians.

$\omega = \frac{\theta}{t}$

$\omega = \frac{16.4\pi}{3}$ $\qquad$ $\theta = 16.4\pi, t = 3$

$\omega \approx 17.17403984$ $\qquad$ *Use a calculator.*

The angular velocity is about 17.2 radians per second.

Example 3 **Determine the linear velocity of a point rotating at an angular velocity of 13π radians per second at a distance of 7 centimeters from the center of the rotating object. Round to the nearest tenth.**

$v = r\omega$

$v = 7(13\pi)$ $\qquad$ $r = 7, \omega = 13\pi$

$v \approx 285.8849315$ $\qquad$ *Use a calculator.*

The linear velocity is about 285.9 centimeters per second.