Angular Velocity Pt 2

Ex. 1.

Determine the linear velocity of a point rotating at an angular velocity of 17π radians per second at a distance of 5 cm from the center of the rotating object. Round to the nearest tenth.

$V = \omega \cdot r$ $\quad \omega = 17\pi$/sec $\quad r = 5$ cm

* $V = \omega r$ *

↑ relationship between linear and angular velocity

$V = \frac{17\pi}{\text{sec}} \cdot \frac{5\text{ cm}}{1} = 267$ cm/sec

Linear Velocity = 267 cm/sec

Ex. 2.

A carousel makes $2\frac{5}{8}$ or 2.625 revolutions per minute. The carousel contains three concentric circles of animals. The inner circle of animals is 11 ft from the center and the outer circle is approximately 20 ft from the center. Determine the linear and angular velocity for a rider on the inner circle and someone on the same row in the outer circle.

$\omega = \frac{2.625\text{ rev}}{1\text{ min}} \cdot \frac{2\pi}{1\text{ rev}} = 5.25\pi$ per minute ≈ 16.49 per min

$\frac{16.49}{60} \cdot \approx .275$ rad/sec $= \omega$

Inside

$V = \omega \cdot r$

$V = \frac{.275}{\text{sec}} \cdot \frac{11\text{ ft}}{1} \approx 3.025$ ft/sec

Outside

$V = \omega \cdot r$

$V = \frac{.275}{\text{sec}} \cdot \frac{20\text{ ft}}{1} \approx 5.5$ ft/sec

There is a relationship between Linear and Angular velocity and using the formulas below we can find this relationship

Arc length

$s = r\theta$

Angular Velocity

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

Linear Velocity

$v = \frac{s}{t}$

$s = r\theta \rightarrow s = r\omega t \qquad v = \frac{r\omega t}{t} = v = \omega r$

A bicycle has wheels 28 inches in diameter. A tachometer determines wheels are rotating at 180 RPM (revolutions per minute) Find the speed (linear velocity)

$\frac{180 \text{ rev}}{\text{min}} \cdot \frac{2\pi}{1 \text{ rev}} = 360\pi \text{ rad/min} = \omega$

$v = \omega r \rightarrow v = \frac{360\pi}{\text{min}} \cdot 14 \text{ in} = \frac{5040\pi \text{ in}}{\text{min}}$

$\frac{5040\pi \text{ in}}{\text{min}} \cdot \frac{60 \text{ min}}{1 \text{ hr}} \cdot \frac{1 \text{ ft}}{12 \text{ in}} \cdot \frac{1 \text{ mile}}{5280 \text{ ft}} = \frac{950017.62}{63360} \approx 14.99 \text{ mph}$

Homework:

If a toy car is on a circular track traveling at 4.5 radians per second. the track has a circumference of 94.247 inches. Find the linear velocity.