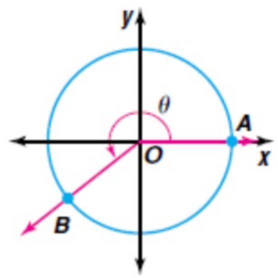
Trig 6.2

Find linear and angular velocity

revolution $1 \text{ rev} = 360° = 2\pi$

central angle



radians θ

angular displacement

angular velocity $\dfrac{\text{rotations}}{\text{time}}$ ← radians $\dfrac{\theta}{t} = \omega$

linear velocity $v = r \cdot \omega$

dimensional analysis lin size↑ speed

activity: bicycle wheel

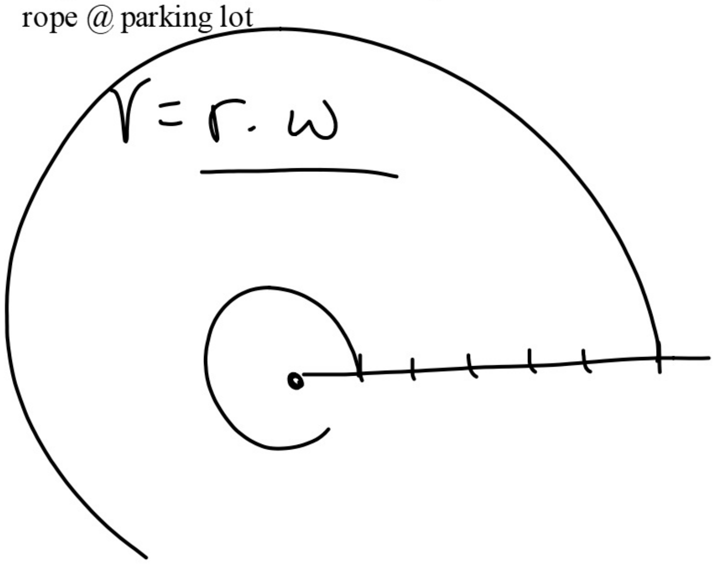
rope and circle @ parking lot

Angular Velocity	If an object moves along a circle during a time of t units, then the angular velocity, ω, is given by $$\omega = \frac{\theta}{t},$$ where θ is the angular displacement in radians.

displacement per time

Must be in radians!
1 revolution =

Angular velocity vs linear velocity
rope @ parking lot



$r \cdot \omega$

Linear Velocity	If an object moves along a circle of radius of r units, then its 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.

how big is the circle?
how fast is it rotating?
radius*angular velocity
Must use RADIANS

Determine the linear velocity of a point rotating at the given angular velocity at a distance r from the center of the rotating object. Round to the nearest tenth.

10. $\omega = 36$ radians per second, $r = 12$ inches

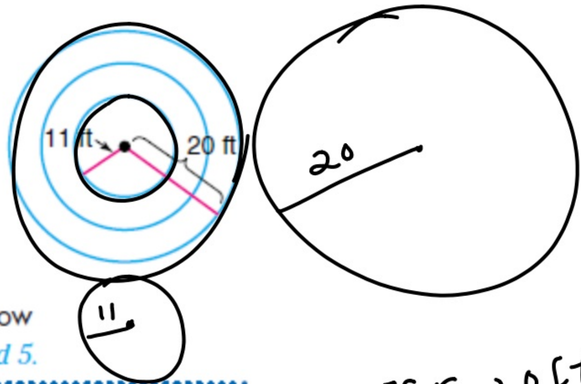
$$v = 12\text{in}\ 36\,\frac{\text{rad}}{\text{s}}$$

$$= 432\,\frac{\text{in}}{\text{s}}$$

how big is the circle?
how fast is it rotating?
radius*angular velocity

Remember the rope?

ENTERTAINMENT The Children's Museum in Indianapolis, Indiana, houses an antique carousel. The carousel contains three concentric circles of animals. The inner circle of animals is approximately 11 feet from the center, and the outer circle of animals is ~~approximately~~ 20 feet from the center. The carousel makes $2\frac{5}{8}$ rotations "rev" per minute. Determine the angular and linear velocities of someone riding an animal in the inner circle and of someone riding an animal in the same row in the outer circle. *This problem will be solved in Examples 3 and 5.*



$V = (0.275 \frac{r}{s})(11 ft) = 3.0 \frac{ft}{s}$

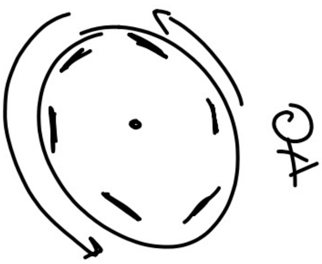
$V = 0.275 \frac{r}{s} \cdot 20 ft$

$5.5 \frac{ft}{s}$

3 ENTERTAINMENT **Refer to the application at the beginning of the lesson. Determine the angular velocity for each rider in radians per second.**

$\omega = 2.625 \frac{rev}{min} \cdot \frac{2\pi \, rad}{1 \, rev} \approx 16.493 \frac{rad}{min} \cdot \frac{1 \, min}{60 \, s}$

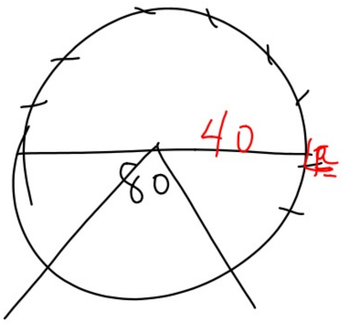
$\omega = 0.275 \frac{rad}{s}$



5 **ENTERTAINMENT** **Refer to the application at the beginning of the lesson. Determine the linear velocity for each rider.**

how big is the circle?
how fast is it rotating?
radius*angular velocity

Determine w given v and r



$1\ rev = 45\ s.$

$\frac{1\ rev}{45\ s.} \cdot \frac{2\pi r}{1\ rev}$

$(40\ ft)\left(\frac{0.14 r}{s}\right) = 5.6\ \frac{ft}{s}$

$V = 8\ \frac{ft}{s}$

$time = 1\ rev$

$\frac{V}{r} = \frac{r \cdot \omega}{r}$

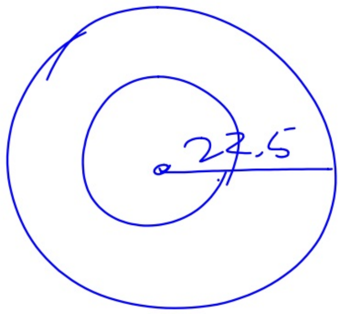
$\omega = \frac{V}{r}$

$\frac{8\ ft}{40\ ft \cdot s}$

$0.2\ \frac{rad}{s}$

$0.2\ \frac{rad}{s} \cdot \frac{1\ rev}{2\pi\ rad} = 0.032\ \frac{rev}{s}$

$\frac{s}{rev}\ 31.25$



$\frac{3\,rev}{min} \cdot \frac{2\pi\,rad}{1\,rev}$ $\quad v ? = \frac{ft}{s}$

$v = 22.5\,ft \cdot \left(6\pi \frac{rad}{min}\right)$

$v = 3.1 \quad r = ?$

$\frac{v}{\omega} = \frac{r \cdot \omega}{\omega} = \frac{3.1 \frac{ft}{s} \frac{60\,s}{1\,min}}{6\pi \frac{rad}{min}}$

$= 424 \frac{ft}{min} \cdot \frac{1\,min}{60\,s}$

$= 7.1 \frac{ft}{s}$

$\frac{186 \frac{ft}{min}}{6\pi \frac{rad}{min}}$ $\quad 9.9 \frac{ft}{rad}$

$\frac{v}{\omega} = \frac{r \cdot \omega}{\omega}$

$\frac{v}{\omega} = r$

WB 6.2 + 39 p.356