Pre-AP Pre-Calculus
HW 4.1 Angular and Linear Velocity

Name Key

1. The circular blade on a saw has a diameter of 7.5 inches and rotates at 2400 revolutions per minute.
   A) Find the angular speed of the blade in radians per second.

$$\frac{2400 \text{ rev}}{1 \text{ min}} \cdot \frac{1 \text{ min}}{60 \text{ sec}} \cdot \frac{2\pi \text{ rads}}{1 \text{ rev}} = \frac{80\pi \text{ rads}}{\text{sec}}$$

   B) Find the linear speed of the saw teeth (in feet per second) as they contact the wood being cut.

$$\frac{80\pi \text{ rads}}{1 \text{ sec}} \cdot \frac{3.75 \text{ in}}{1 \text{ rad}} \cdot \frac{1 \text{ ft}}{12 \text{ in}} = \frac{25\pi \text{ ft/sec}}{} \approx 78.54 \text{ ft/sec}$$

2. The minute hand of a watch is 1.3 cm long. What is the linear velocity, in cm per second, of the tip of this hand?

$r = 1.3$ cm 1 min =

$$\text{each second} \cdot \frac{2\pi \text{ rad}}{60 \text{ min}} \cdot \frac{1 \text{ min}}{60 \text{ sec}} \cdot \frac{1.3 \text{ cm}}{1 \text{ rad}} = \frac{2.6\pi}{3600} = \frac{1.3\pi}{1800} \text{ cm/sec}$$

3. Determine the angular velocity in radians per second of a wheel turning at 350 rpm.

$$\frac{350 \text{ rev}}{1 \text{ min}} \cdot \frac{1 \text{ min}}{60 \text{ sec}} \cdot \frac{2\pi \text{ rads}}{1 \text{ rev}} = \frac{700\pi}{60} = \frac{70\pi}{6} = \frac{35\pi \text{ rad/sec}}{3}$$

4. A Ferris wheel with a diameter of 220 ft. takes 42 seconds to rotate once.
   A) Determine the angular velocity in radians per second of the Ferris wheel.

$r = 110$ ft

$$\frac{1 \text{ rev}}{42 \text{ sec}} \cdot \frac{2\pi \text{ rad}}{1 \text{ rev}} = \frac{\pi}{21} \text{ rad/sec}$$

   B) Determine the linear velocity in feet per second of the Ferris wheel.

$$\frac{\frac{\pi}{21} \text{ rad}}{1 \text{ sec}} \cdot \frac{110 \text{ ft}}{1 \text{ rad}} = \frac{110\pi}{21} \text{ Ft/sec} \approx \text{Ft/sec}.$$

5. What is the angular velocity in radians per minute of a notch on a wheel that makes 24 rotations per second about its axis?

$$\frac{24 \text{ rev}}{1 \text{ sec}} \cdot \frac{60 \text{ sec}}{1 \text{ min}} \cdot \frac{2\pi \text{ rad}}{1 \text{ rev}} = 2880\pi \text{ rad/min}$$

6. A flywheel mounted on an engine crankshaft has a radius of 6 inches. If the engine is running at 2800 rpm, what is the linear velocity of a point on the outer edge of the flywheel in feet per second?

$$\frac{2800 \text{ rev}}{1 \text{ min}} \cdot \frac{2\pi \text{ rad}}{1 \text{ rev}} \cdot \frac{6 \text{ in}}{1 \text{ rad}} \cdot \frac{1 \text{ ft}}{12 \text{ in}} \cdot \frac{1 \text{ min}}{60 \text{ sec}}$$

$$= \frac{2800 \cdot 12\pi}{12 \cdot 60} = \frac{280\pi}{6} = \frac{140\pi \text{ ft/sec}}{3}$$

7. Dan Druff and Ella Funt are riding on a Ferris wheel. Dan observes that it takes 20 seconds to make a complete revolution. The seat is 25 feet from the axle of the wheel.

A) What is their angular velocity in radians per minute?

$$\frac{1 \text{ rev}}{20 \text{ sec}} \cdot \frac{60 \text{ sec}}{1 \text{ min}} \cdot \frac{2\pi \text{ rads}}{1 \text{ rev}} = \frac{6\pi \text{ rads}}{\text{min}}$$

B) What is their linear velocity in yards per minute?

$$\frac{6\pi \text{ rads}}{1 \text{ min}} \cdot \frac{25 \text{ ft}}{1 \text{ rad}} \cdot \frac{1 \text{ yd}}{3 \text{ ft}} = 50\pi \text{ yds/min}$$