Pre-Calculus Name _____ Period _____
Davidson/Grombacher/Rodell/True

Linear/Angular Velocity Worksheet

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

$\frac{350 \text{ rev}}{\text{min}} \left| \frac{1 \text{ min}}{60 \text{ sec}} \right| \frac{2\pi \text{ rad}}{1 \text{ rev}} = 36.652 \text{ rad/sec}$

1 _____

2. Determine the rpm of a wheel turning 52.8rad/sec.

$\frac{52.8 \text{ rad}}{\text{sec}} \left| \frac{60 \text{ sec}}{1 \text{ min}} \right| \frac{1 \text{ rev}}{2\pi \text{ rad}} = 504.203 \text{ rad/sec}$

2 _____

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

$r = 110 \text{ ft}$

$\frac{1 \text{ rev}}{42 \text{ sec}} \left| \frac{2\pi \text{ rad}}{1 \text{ rev}} \right| = .15 \frac{\text{rad}}{\text{sec}}$

3a _____

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

angular — need radius for linear

$\frac{.15 \text{ rad}}{\text{sec}} \left| \frac{110 \text{ ft}}{1 \text{ rad}} \right| = 16.5 \text{ ft/sec}$

3b _____

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

$\frac{24 \text{ rev}}{1 \text{ sec}} \left| \frac{60 \text{ sec}}{1 \text{ min}} \right| \frac{2\pi \text{ rad}}{1 \text{ rev}} = 9047.787 \text{ rad/min}$

4 _____

60 min in one rev!

5. The minute hand of a watch is 1.3cm long. What is the linear velocity, in cm/sec, of the tip of the hand?

$$\frac{1\ \text{rev}}{60\ \text{min}} \left| \frac{1.3\ \text{cm}}{1\ \text{rad}} \right| \frac{2\pi\ \text{rad}}{1\ \text{rev}} \left| \frac{1\ \text{min}}{60\ \text{sec}} \right| = .002\ \text{cm/sec}$$

5 _____

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

$$\frac{2800\ \text{rev}}{\text{min}} \left| \frac{1\ \text{min}}{60\ \text{sec}} \right| \frac{6\ \text{in}}{1\ \text{rad}} \left| \frac{1\ \text{ft}}{12\ \text{in}} \right| \frac{2\pi\ \text{rad}}{1\ \text{rev}} \left| = 146.608\ \text{ft/sec} \right.$$

6 _____

7. A toy race car is traveling around a circular track that is 3.2m in diameter. It is traveling at 0.31 radians per second.

a. Find its angular velocity in degrees per minute.

$$\frac{.31\ \text{rad}}{\text{sec}} \left| \frac{60\ \text{sec}}{1\ \text{min}} \right| \frac{1\ \text{rev}}{2\pi\ \text{rad}} \left| \frac{360^\circ}{1\ \text{rev}} \right| = 1065.701\ \text{deg/min}$$

7a _____

b. Find its linear velocity in km per hour.

r = 1.6

$$\frac{1065.701\ \text{deg}}{\text{min}} \left| \frac{60\ \text{min}}{1\ \text{hr}} \right| \frac{1.6\ \text{m}}{1\ \text{rad}} \left| \frac{1\ \text{rev}}{360^\circ} \right| \frac{1\ \text{km}}{1000\ \text{m}} \left| \frac{2\pi\ \text{rad}}{1\ \text{rev}} \right| = 1.786\ \text{km/hr}$$

7b _____

8. A merry-go-round rotates at 3600 degrees per minute. The diameter of its platform is 28ft. What is the speed in miles per hour of a point on the edge of the platform? (5280ft = 1 mile)

r = 14 ft

linear velocity

$$\frac{3600^\circ}{\text{min}} \left| \frac{60\ \text{min}}{1\ \text{hr}} \right| \frac{14\ \text{ft}}{1\ \text{rad}} \left| \frac{2\pi\ \text{rad}}{360^\circ} \right| \frac{1\ \text{mi}}{5280\ \text{ft}} \left| = 10\ \text{mph} \right.$$

8 _____

9. Dan and Ella 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 revolutions per minute? Degrees per minute? Radians per minute?

$\left(\frac{1\text{ rev}}{20\text{ sec}}\right)\left|\frac{60\text{ sec}}{1\text{ min}}\right| = 3\text{ rev/min}$ ↓

$\frac{3\text{ rev}}{\text{min}}\left|\frac{360^\circ}{1\text{ rev}}\right| = 1080^\circ/\text{min}$

$\frac{1080^\circ}{1\text{ min}}\left|\frac{2\pi\text{ rad}}{360^\circ}\right| = 18.850\text{ rad/min}$

9a 3 rev/min 1080 deg/min 18.850 rad/min

b. What is their linear velocity in yards per minute?

need radius

$\frac{18.850\text{ rad}}{\text{min}}\left|\frac{25\text{ ft}}{1\text{ rad}}\right|\frac{1\text{ yd}}{3\text{ ft}} = 157.088\text{ yd/min}$

9b _____

10. A train wheel has a diameter of 30in to the rim, which rests on the track. The flange, which keeps the wheel from slipping off the track, projects 1 in beyond the rim. The wheel of the train is rotating at 30 revolutions per second.

a. What is the linear velocity, in mph, of a point on the wheel? $r = 15\text{in}$

need radius

$\frac{30\text{ rev}}{\text{sec}}\left|\frac{15\text{ in}}{1\text{ rad}}\right|\frac{2\pi\text{ rad}}{1\text{ rev}}\left|\frac{60\text{ sec}}{1\text{ min}}\right|\frac{1\text{ ft}}{12\text{ in}}\left|\frac{1\text{ mile}}{5280\text{ ft}}\right|\frac{60\text{ min}}{1\text{ hr}} = 160.650\text{ mph}$

10a _____