

Name: _____

Skill Sheet 8.1

Circular Motion

You used degrees when you first learned how to measure angles. However, the degree is not the most convenient unit for using angles to calculate angular speed. For the purpose of angular speed, the radian is a better unit of angle. One radian equals 57.3 degrees (approximately). Radians are better for angular speed because a radian is a ratio of two lengths, and it does not have any units in the sense that meters or seconds are units. This skill sheet provides you with practice in using degrees, radians, and in calculating angular speed.

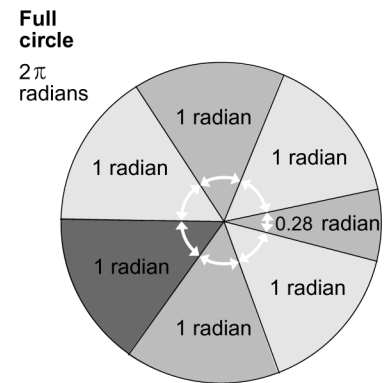
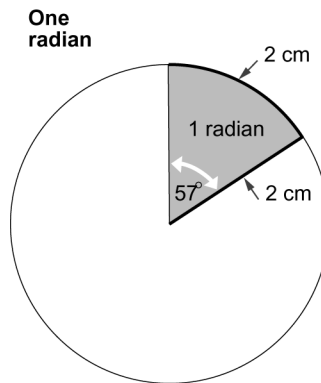
1. Working with degrees, radians, and angular speed

A full circle has 360 degrees, or 2π radians ($\pi = 3.14$).

Convert degrees to radians by multiplying by $\pi/180^\circ$.

Example: How many radians is 45° ?

$$45^\circ \times \frac{\pi}{180^\circ} = 0.79 \text{ radians}$$



Convert radians to degrees by multiplying by $180^\circ/\pi$.

Example: How many degrees are represented by 3.5 radians?

$$3.5 \text{ radians} \times \frac{180^\circ}{\pi} = 200^\circ$$

Angular speed (ω) is given in radians/second. The formula for angular speed is shown in the graphic at right.

Linear speed is found by multiplying angular speed by the radius of the object being considered. The formula for linear speed is: $v = \omega r$.

Angular speed

Angular speed
(rad/sec)

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

Angle turned (rad)

Time taken (sec)

2. Example problems

1. Convert to radians:

a. 0 degrees

b. 10 degrees

c. 30 degrees

d. 45 degrees

e. 90 degrees

f. 180 degrees

g. 270 degrees

h. 360 degrees

2. Convert to degrees: 1.047 radians

3. A wheel is spinning with an angular speed of 15 radians/sec. What is the angular speed in revolutions per minute?

4. A bicycle with a front wheel that is 50 centimeters in diameter and a back wheel that is 74 cm in diameter is moving along with a linear speed of 16 km/hour. Find the angular speed of the wheels in radians/sec and in rpm (revolutions per minute).

5. A wheel that has a radius of 1 meter makes four turns in 3 seconds. Find the angular speed and the linear speed of this wheel.

6. A bicycle wheel with a radius of 0.5 meters is rolling with an angular speed of 1.75 rad/sec. What is the linear speed of the wheel?

7. A wheel with a radius of 0.25 meters is rolling with an angular speed of 0.75 rad/sec. How far will the wheel go in one minute?

8. A ball with a radius of 1 centimeter starts rolling down a ramp. The acceleration of the ball is 2 meters/sec².

a. What is the angular speed of the ball after 1 second? After 3 seconds?

b. Convert each answer in 8(a) to revolutions per second.
