

Name: _____

Date: _____



Circular Motion

READ


You have learned several important terms used to describe circular motion:

- **Rotate** means to spin around an internal axis. Example: Earth makes one complete rotation every 24 hours.
- **Revolve** means to travel in a circle around an external axis. Example: Earth makes one complete revolution around the sun each year.
- **Angular speed** describes how fast something rotates. Degrees per minute and rotations per minute (rpm) are two common units of angular speed.

$$\text{Angular speed} = \frac{\text{rotations or degrees}}{\text{time}}$$

- The **radius** is the distance from the axis of rotation to any point on the outside of the circle.
- **Circumference** describes the distance traveled during one revolution.

$$\text{Circumference} = 2\pi r, \text{ where } r \text{ is the radius of the circle.}$$

- **Linear speed** describes how fast a revolving object travels. Linear speed is often given in meters per second.

$$\text{Linear speed } (v) = \frac{2\pi r}{t} \text{ where } r \text{ is the radius and } t \text{ is the time for one revolution.}$$

EXAMPLES


1. A merry-go-round makes 18 rotations in 3 minutes. What is its angular speed in rpm?

$$\text{Angular speed} = \frac{18 \text{ rotations}}{3 \text{ minutes}} = 6 \text{ rpm}$$

2. A coin rolls across the floor at an angular speed of 4 rotations per second. What is its speed in degrees per second? Hint: One full rotation equals 360 degrees.

$$\text{Angular speed} = \frac{4 \times 360^\circ}{1 \text{ second}} = 1440^\circ/\text{second}$$

3. A child sits two meters from the center of a merry-go-round. How far does she travel during one revolution?

$$\text{Circumference} = 2\pi(2 \text{ meters}) = 12.6 \text{ meters}$$

4. If the merry-go-round makes one revolution in 10 seconds, what is the child's linear speed?

$$\text{Linear speed} = \frac{2\pi(2 \text{ meters})}{10 \text{ seconds}} = 1.3 \text{ m/sec}$$

PRACTICE 

- A compact disc is spinning with an angular speed of 3.3 rotations per second.
 - What is its angular speed in degrees per second?
 - What is its angular speed in rotations per minute (rpm)?
- A compact disc has a radius of 6 centimeters.
 - What is its circumference in meters?
 - If the cd rotates 4 times per second, what is the linear speed of a point on the outer edge of the cd? Give your answer in meters per second.
 - What is the linear speed of a point 3 centimeters from the center of the cd? (Assume the angular speed has not changed).
- Challenge!** When a computer reads a cd-rom, the “read-head” must read the data at a constant linear velocity. That means the same amount of information must pass by the “read-head” each second no matter what part of the cd is being read. The cd spins at different angular speeds to keep the linear speed the same. If the “read-head” moves from reading data at the inner edge of the cd to read data at the outer edge, will the cd need to spin faster or slower to maintain a constant linear velocity?
- Rolling is a combination of linear and rotating motion. When a wheel makes one full rotation, it moves forward a distance equal to the wheel’s circumference.
 - A child’s first bicycle has 12-inch tires. These tires have a 6-inch radius. How far does the bicycle move forward each time the wheel makes one complete rotation? Give your answer in meters. (1 inch = 0.022 meters)
 - A woman’s ten-speed bicycle has 27-inch tires (13.5-inch radius). How far does this bicycle move forward each time the wheel makes one complete rotation? Give your answer in meters.
 - How many times does the child’s bicycle tire have to rotate for the bicycle to travel 1 kilometer?
 - How many times does the woman’s bicycle tire have to rotate for the bicycle to travel 1 kilometer?

