

# Hello

- Find the circumference of a circle with a radius of 0.75m.



# This Week

- M: Intro to Uniform Circular Motion.
- T: Continue Uniform Circular Motion and universal gravitation.
- W: Circular Motion lab.
- R: Review for Quiz.
- F: Quiz.

# 2-D Kinematics Quizzes

- Grades are posted to IC.
- You have the opportunity to earn back  $\frac{1}{2}$  the points you lost by doing corrections after school Tuesday or Wednesday.
- Ex: if you got a 60% and do perfect corrections, you can earn an 80%.

# Uniform Circular Motion



# Determining Speed

- How do we determine the speed of an object moving in a straight line?

# Angular Velocity

- The velocity of an object moving in a circular path.
- If I know the radius of a circle, how can I determine the speed of an object traveling around it?

A car drives in a circle with a radius of \_\_\_m in \_\_\_sec. What is the car's velocity?

A motorcycle rides around a cage with a radius of 4m in 2.5sec. What is the velocity of the motorcycle?





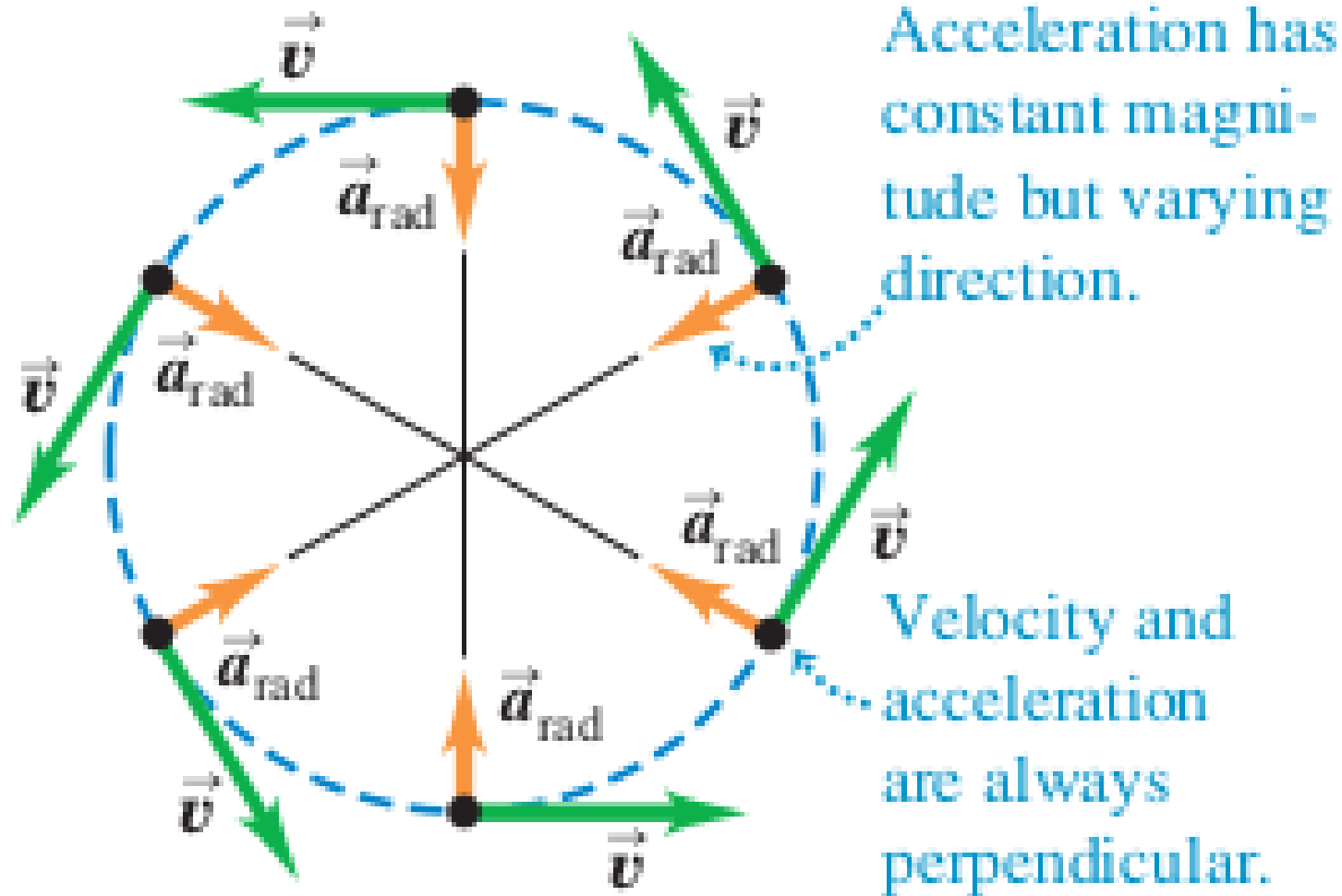
# Tangential and Angular Velocity

- Velocity in a straight line.
- When an object moves in a circle, something has to keep the object in the circle.
- Some force has to keep the object moving in a circle.

# Velocity and inward force

- What's keeping the object moving in a circle?
- What happens when that force is no longer present?

# Velocity Vector in Circular Motion



$$\text{Acceleration} = \Delta V/t$$

- $\Delta V = V_f - V_i$
- Draw the vectors for two points on a circle.

# Centripetal Acceleration

- A center seeking force.
- The tension on a rope is from the pull towards the center.
- There is NO centrifugal (center fleeing) force. You can't push with a rope.

# Determining Acceleration

- $V$  is the velocity that an object moves around a circle.
- $r$  is the radius of the circle.
- $a = (V^2)/r$

Students are playing crack the whip. If the person on the outside (5m from the center) is running at 4m/s, what is their acceleration?



A child sits 3.5m from the center of a merry go round. If it makes one revolution every 11 sec, what is the centripetal acceleration of the child?





# Determining Centripetal Force

- $F=ma$ .
- If we know the centripetal acceleration of an object and its mass, we can solve for the force on the object.

If the student from the previous problems has a mass of 62kg, what is the force on their arm?

If the motorcycle and its rider have a combined mass of 200kg, what is the force exerted on the cage?

Determine the average acceleration of the demo.

- How are you going to collect the data?
- What is the magnitude of the force acting on the object?

# Sum of the Accelerations

- I have a bucket of water on a rope.
- I swing it over my head and do not want the water to spill out.
- The centripetal acceleration needs to be greater than the acceleration of gravity.

# Approach

- The centripetal acceleration has to be greater than or equal to the acceleration due to gravity.
- If they are equal, draw an FBD for the bucket at the top and the bottom of the circular path.

The radius of the circle is \_\_\_\_m. What is the longest period that will allow the water to stay in the bucket?

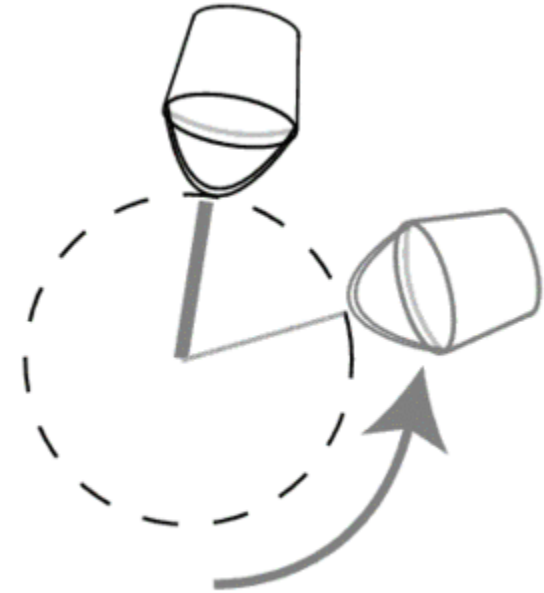


Figure 17-1 Spinning a bucket filled with water over your head.

# Put it all together

- If you know the radius and the period, you can solve for velocity.
- You can now solve for acceleration.
- If you know the mass of the object, you can determine the centripetal force on the object.



# Why we don't fly off the spinning Earth

- Earth has a radius of  $6.37 \times 10^6 \text{m}$ .
- If the period is one day, what is the centripetal acceleration of Earth?
- What is the centripetal force on a 65kg person?