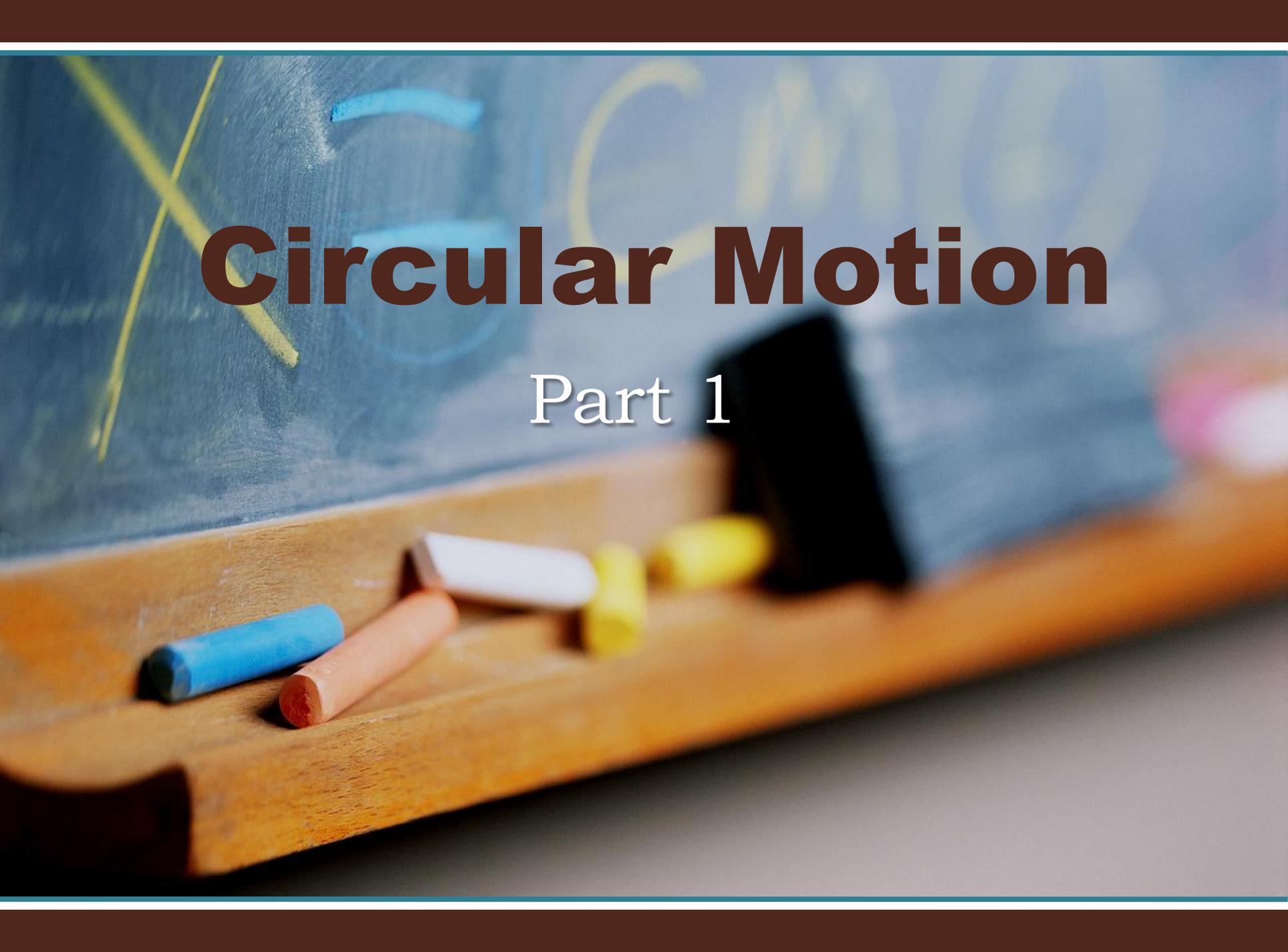


Circular Motion

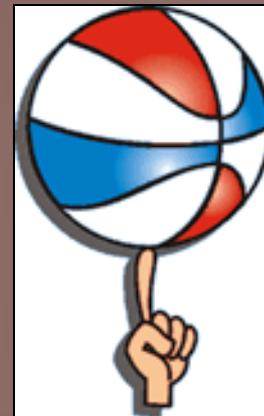
Part 1



Rotation and Revoltuion

Rotation- when an object turns about an internal axis

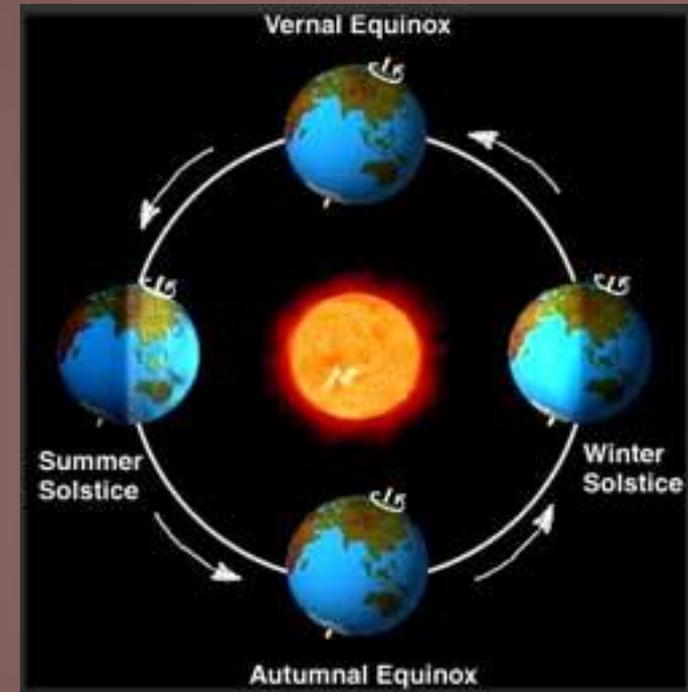
Examples: Merry Go Round, Earth, Basketball on a finger



Rotation and Revoltuion

Revolution- when an object turns about an external axis

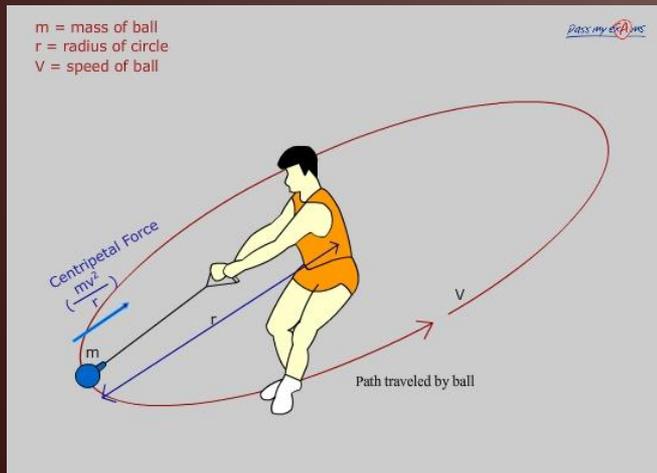
Examples: Riders on a Merry Go Round, Earth going around the Sun



Rotational Speed

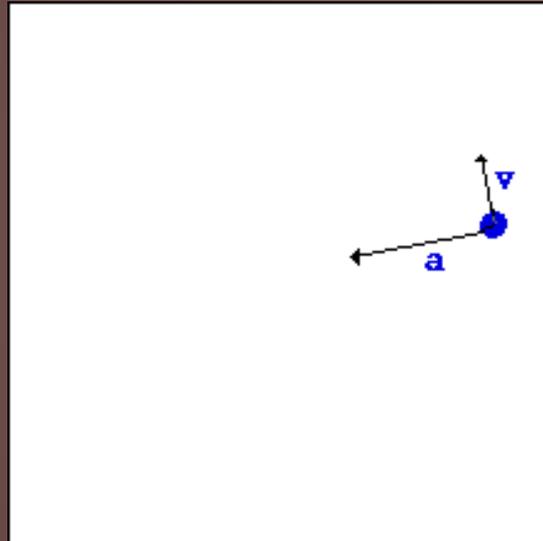
Linear speed- how fast something is moving in a straight line (linear means *in a line*)

Tangential Speed - the speed of something moving along a circular path.

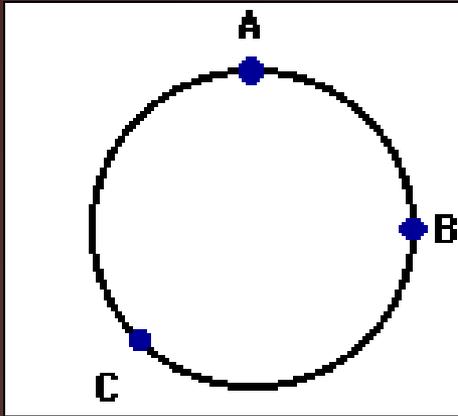


Rotational Speed

The reason it is called tangential speed is because the direction of motion is always tangent to the circle.



Rotational Speed

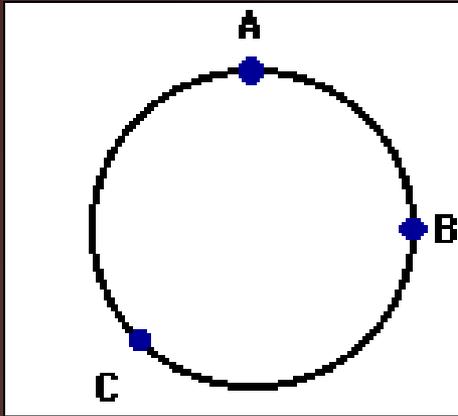


An object is moving in a clockwise direction around a circle at constant speed.

Which vector below represents the direction of the velocity vector when the object is located at point C on the circle?



Rotational Speed



An object is moving in a clockwise direction around a circle at constant speed.

Which vector below represents the direction of the velocity vector when the object is located at point B on the circle?



Rotational Speed

Rotational Speed- the number of rotations per unit time.

Objects rotational speed is sometimes referred to as rpm, or revolutions per minute.



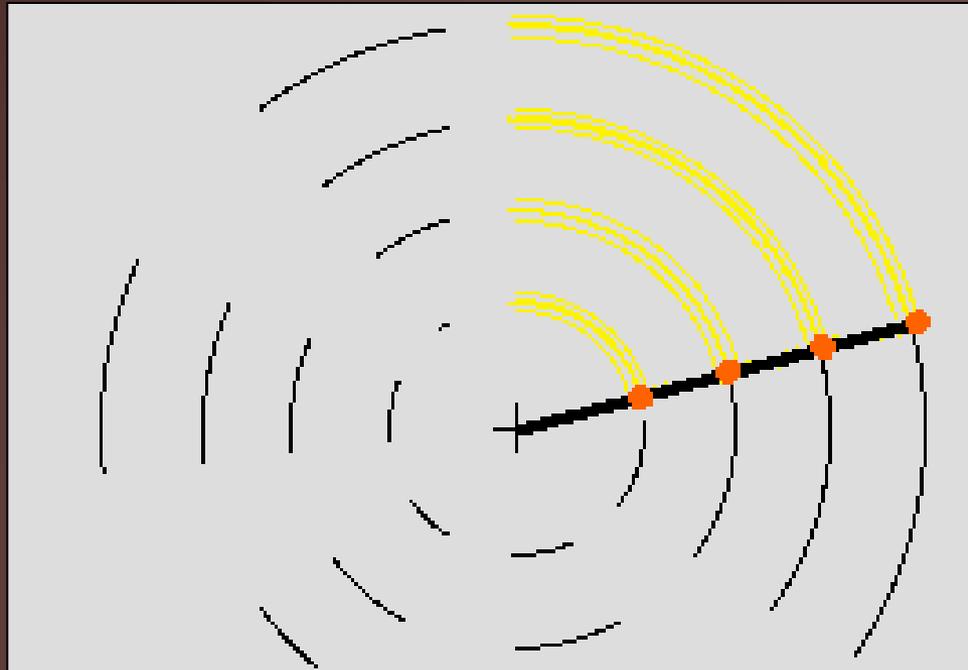
Rotational Speed

An object on a **turntable** will have the same rotational speed no matter how far from the axis it is.

An object on a turntable will have greater tangential speed the further away from the axis it is.



Rotational Speed



Each bulb on the wire moves around the perimeter of the circle in the same amount of time; but the larger the radius of the circle, the greater the speed.



Rotational Speed

Speed is defined as distance over time.

Circumference is distance around a circle.

Circumference

$$cir = 2\pi r$$

Measured in meters



Rotational Speed

Period: is the time it takes to make one full rotation or revolution of an object.

Frequency: is the **number** of rotations or revolutions per unit time.

Period and Frequency

$$T = \frac{1}{f} \qquad f = \frac{1}{T}$$

Period (T) is measured in seconds

Frequency (f) is measured in Hertz (Hz)

Tangential Speed

$$v = \frac{2\pi r}{T} \quad v = 2\pi r f$$

Measured in meters/second

Tangential Speed

A horse on the far edge of a Merry Go Round travels around once every 45 seconds. The radius of the Merry Go Round is 7.5 meters.

- a) What is the circumference of the Merry Go Round?
- b) What is horse's tangential speed?
- c) What is the horse's tangential speed if the radius of the ride doubles?

Tangential Speed

A horse on the far edge of a Merry Go Round travels around once every 45 seconds. The radius of the Merry Go Round is 7.5 meters.

a) What is the circumference of the Merry Go Round?

$$cir = 2\pi r$$

$$cir = 2\pi(7.5)$$

$$cir = 47.12 \text{ m}$$

Tangential Speed

b) What is horse's tangential speed?

$$v = \frac{2\pi r}{T} \quad v = \frac{(47.12)}{45}$$

$$v = 1.05 \text{ m/s}$$

Tangential Speed

c) What is the horse's tangential speed if the radius of the ride doubles?

$$v = \frac{2\pi r}{T} \qquad v = \frac{2\pi(15)}{45}$$

$$v = 2.10 \text{ m/s}$$