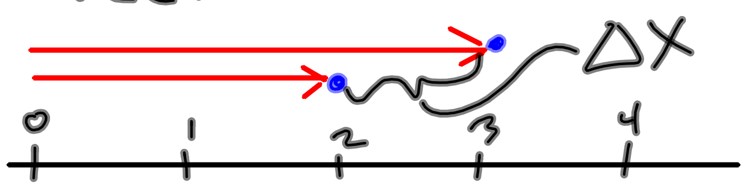
Circular Motion

(Constant Speed)

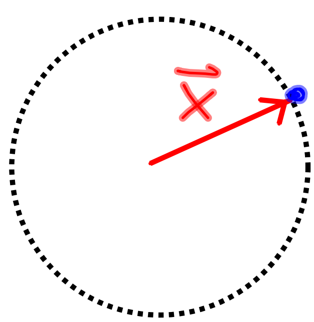
- Position, Velocity, Acceleration (Force)

Position Vectors



- start at the origin
- Point toward the object
- magnitude of the arrow = distance

In Circles:

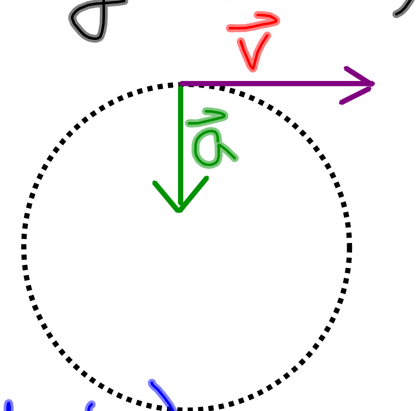


$X_{pos} = |X| \cos\theta$

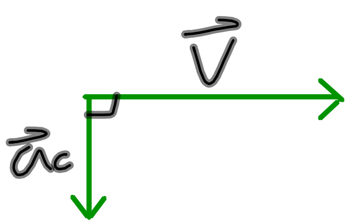
$Y_{pos} = |X| \sin\theta$

In Circular Motion with constant Velocity"

- The velocity points tangent to the curve (along the circle)
- The acceleration points twords the center of the circle.

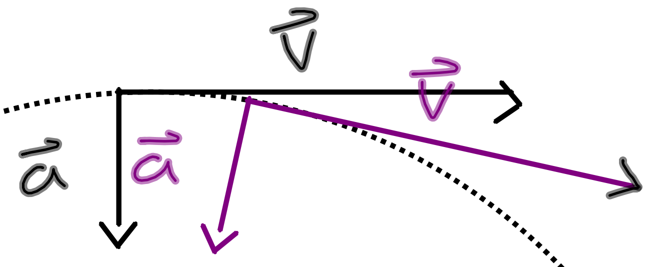


Velocity and acceleration are constantly changing (direction) while speed remains constant



you have done this before in projectile motion

But now acceleration is always changing



Because the acceleration is continually changing so that it is perpendicular to velocity, it only changes the direction of the velocity, not its magnitude.

3 Core Rules:

1. Velocity is tangent to the circle

2. the acceleration points toward the center

   (center pointing = centripetal)

3. If the acceleration points toward the center, what direction does the net force point?

The Center!

$\vec{a} = \frac{\sum \vec{F}}{m}$

3: ie: because the acceleration points toward the center, the net force points toward the center.

Angular Velocity:

$$\boxed{\omega = \frac{\Delta \text{angle}}{\Delta \text{time}} = \frac{\Delta\theta}{\Delta t}}$$

only when angular a is zero

omega

units: $\frac{\text{degrees}}{\text{second}} = \frac{\text{radians}}{\text{second}}$

$360° = 2\pi$ radians

$V = \frac{d}{t}$ - only when acceleration is zero

Period - Time for 1 cycle

$$\boxed{T = \frac{\text{Time}}{\text{cycle}}}$$

units: sec/cycle

t (F_T = Force of tension)

$\omega \cdot T = 2\pi$

angular velocity

Period

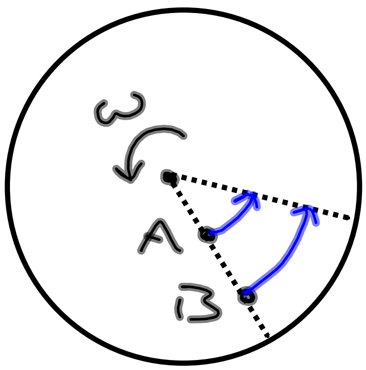
$$\boxed{T = \frac{2\pi}{\omega}}$$

Frequency

$\frac{\text{cycles}}{\text{Time}}$ $\left(\frac{1}{s} = Hz\right)$

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

Relate ω to V



A & B have the same ω

Because B travels a larger distance in the same time its V must be larger

$V \cdot T = \text{circumfrance}$

$V \cdot T = 2\pi r$

$V \cdot \frac{\cancel{2\pi}}{\omega} = \cancel{2\pi} r$

$$\boxed{V = \omega r}$$