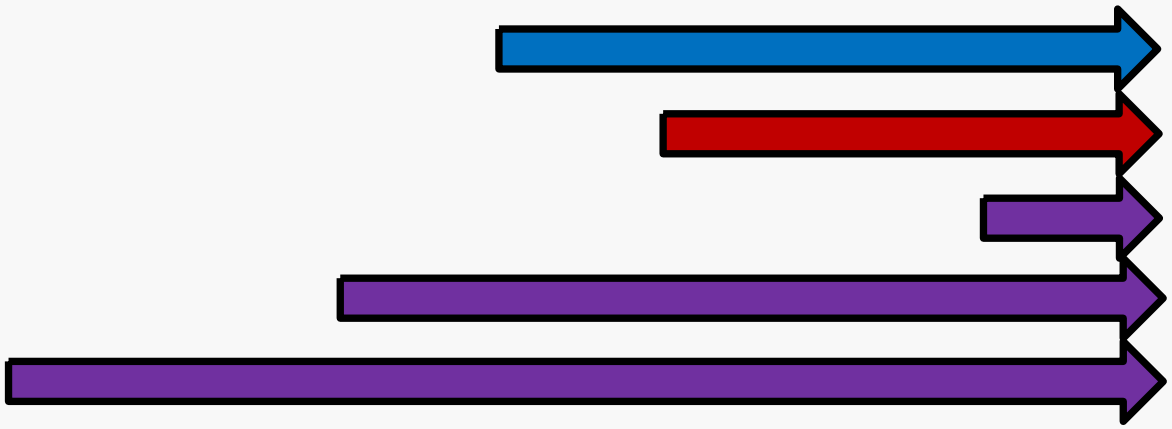
CHAPTERS 3 AND 4: 2-D KINEMATICS

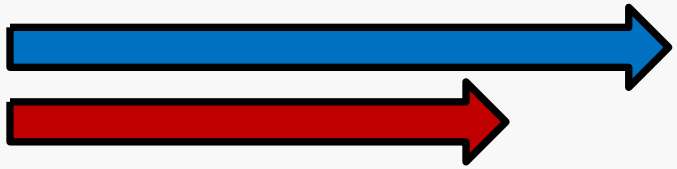
Vectors

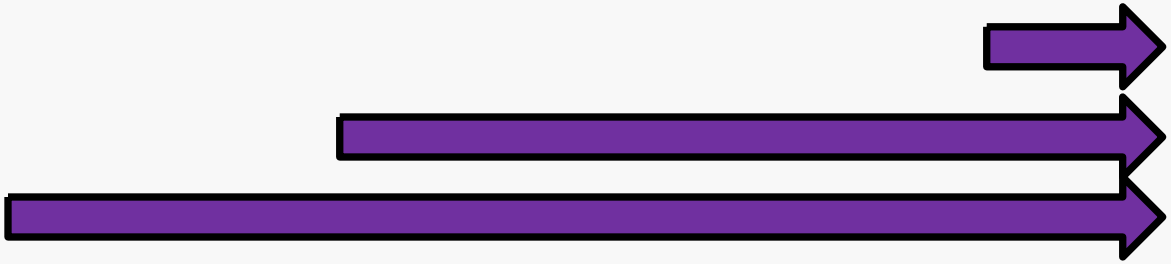
- Vectors have both magnitude and direction. We have encountered three vectors so far: displacement, velocity, and acceleration.
- Always add them head to tail.
- Resultant: the result of adding two vectors together.



Vectors

Vectors:
Blue: Magnitude of 4
Red: Magnitude of 3

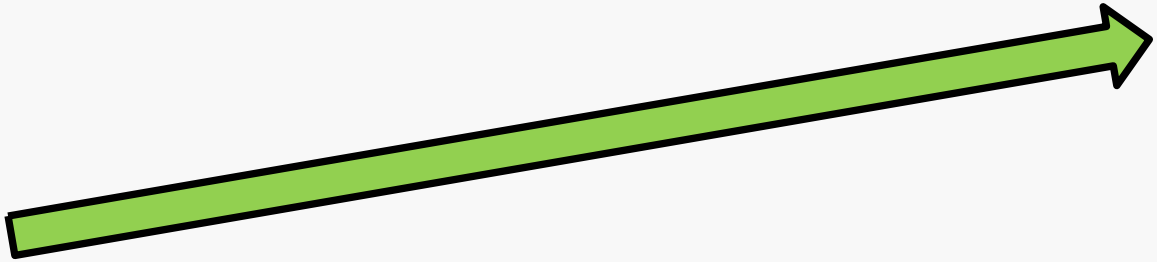




Resultants:
Shortest: Magnitude of 1
Medium: Magnitude of 5
Longest: Magnitude of 7

Breaking vectors apart into x- and y- components

Resultant: 13 meters at an angle of 22.6° from the +x-axis



x-component:
- Magnitude:
- Direction:

y-component:
- Magnitude:
- Direction:

Draw vectors on the District Map from Home to AHS

- http://www.avondale.k12.mi.us/district/district

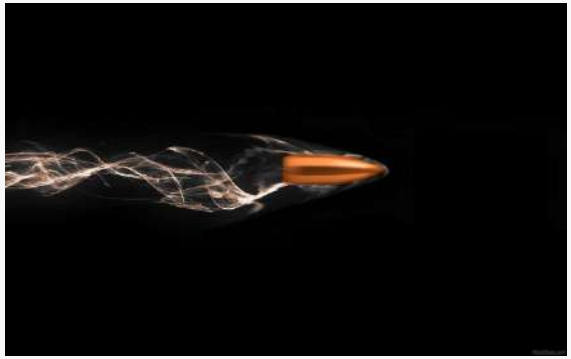
Displacement Vectors at AHS Assignment

WS: Displacement vectors and Velocity vectors

PROJECTILE MOTION

Think about this…

- If I fire a bullet and drop something from the same height at the same time, which one hits the ground first?

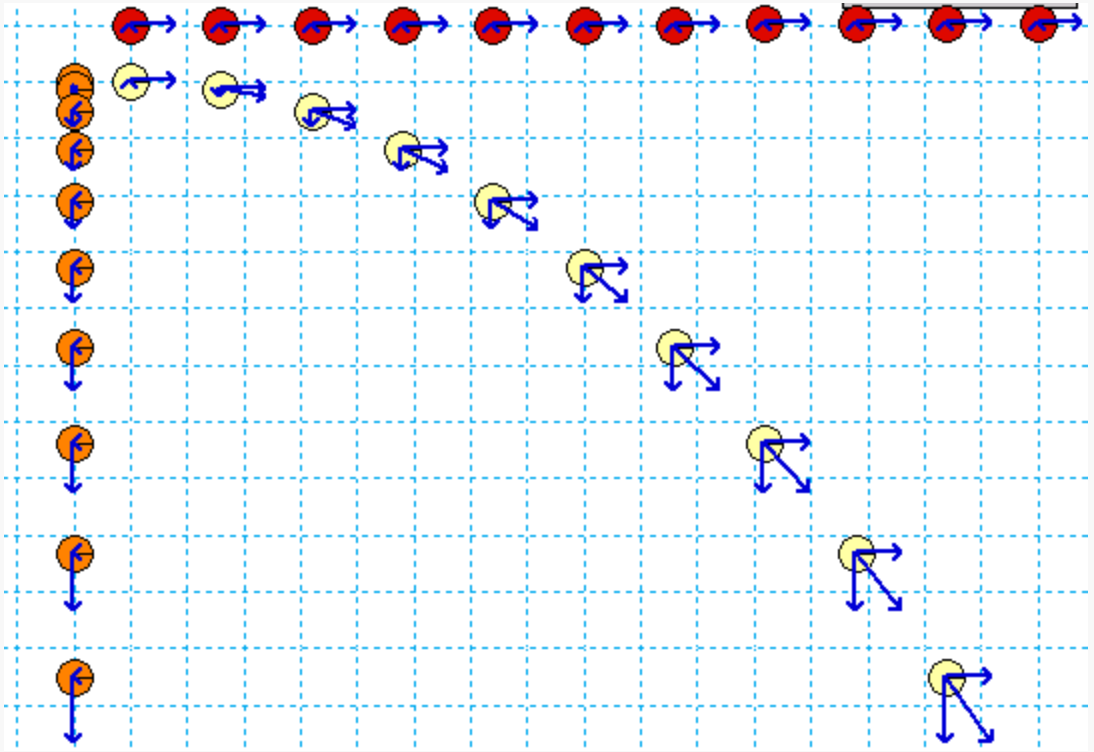


Mythbusters

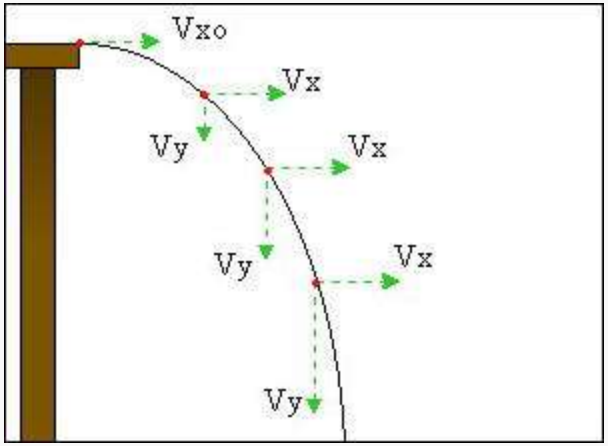
- https://www.youtube.com/watch?v=D9wQVIEdKh8

Independence of x- and y-directions

- **x- direction: The projectile has a constant horizontal velocity**
  - ***WHY?***
- **y-direction: The projectile has a vertical velocity that changes due to the influence of the gravity.**



Rya



How to solve projectile motion problems

- Draw a diagram
- Separate your x- direction and y- direction variables

- Formulas:

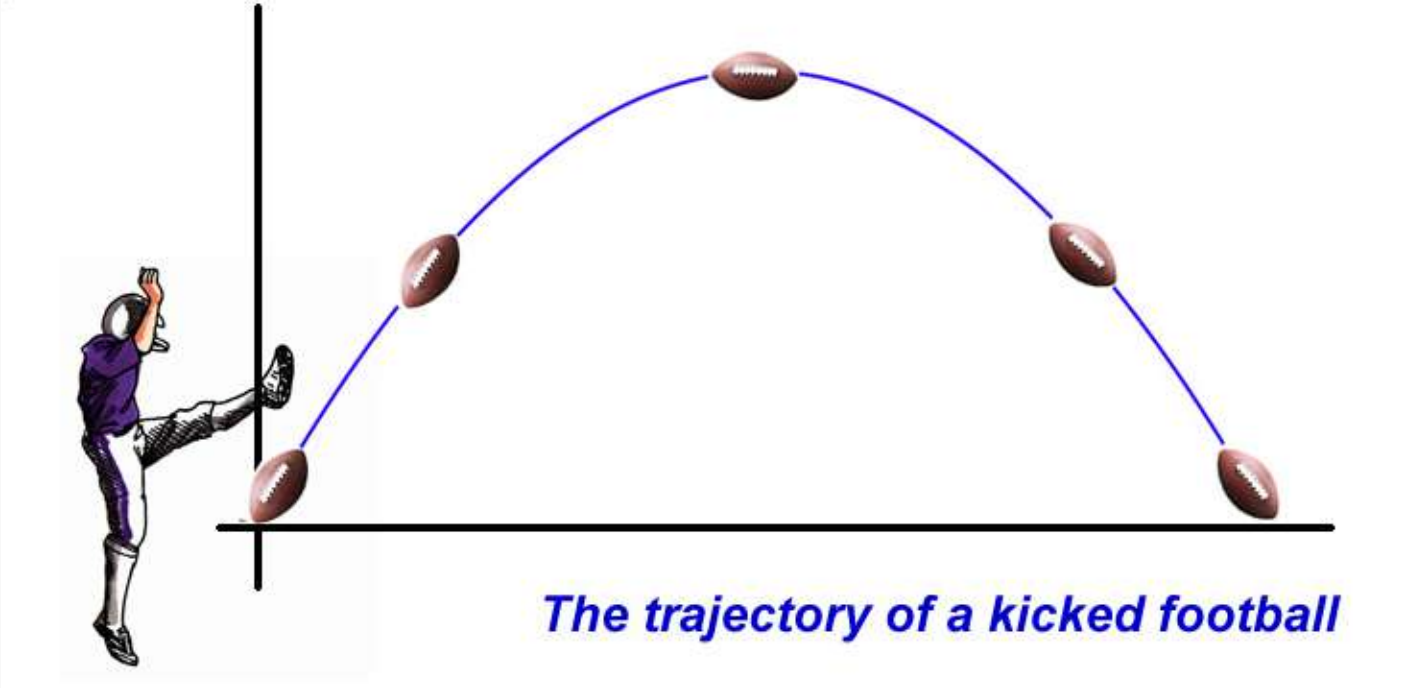
Half Projectile Problem

- **You take a running leap off of a high dive platform. You were running at 2.8 m/s and you hit the water 2.6 seconds later. How high was the platform, and how far from the edge of the platform did you hit the water?**

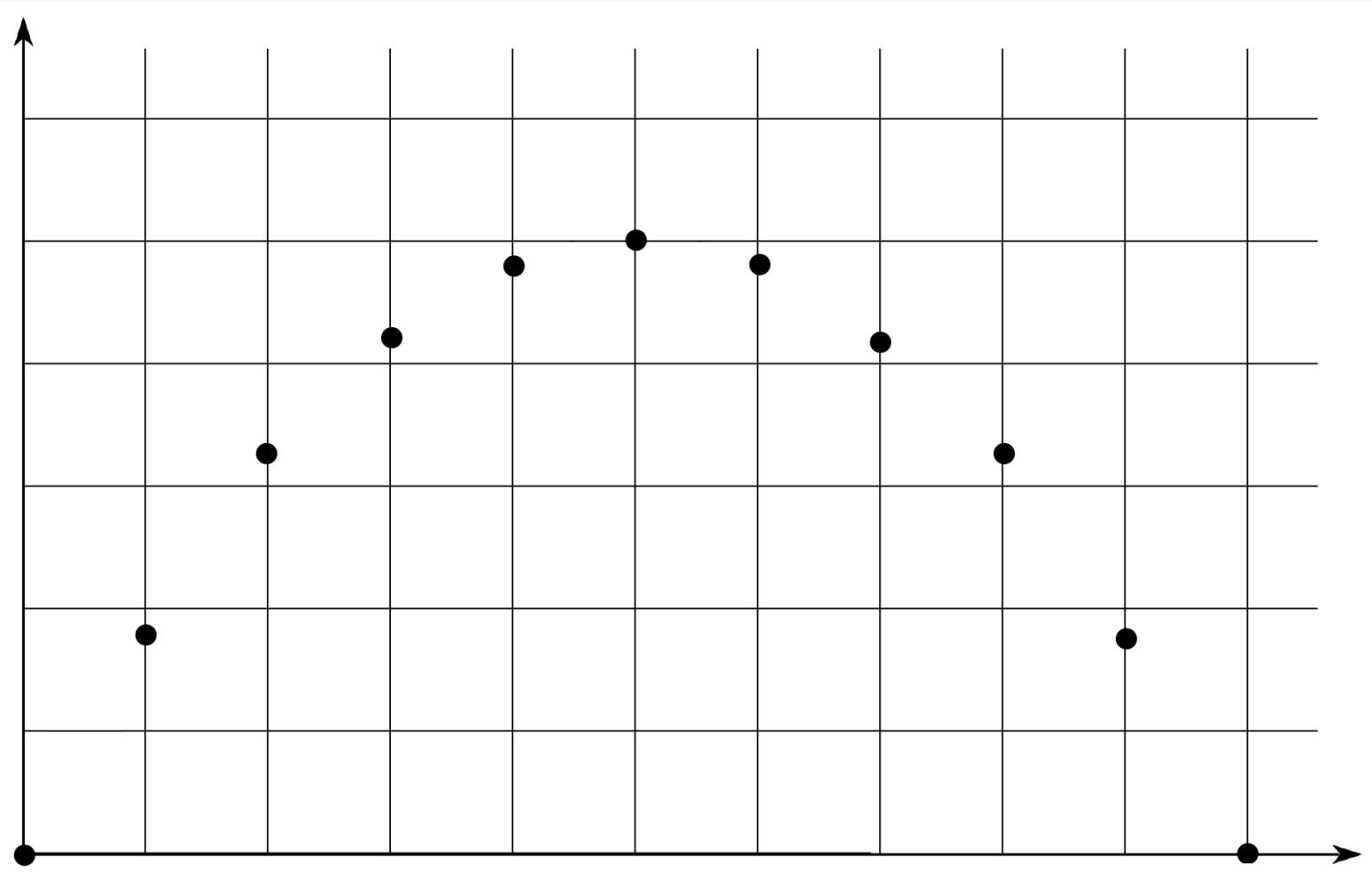
FULL PROJECTILE

Full Projectile Motion

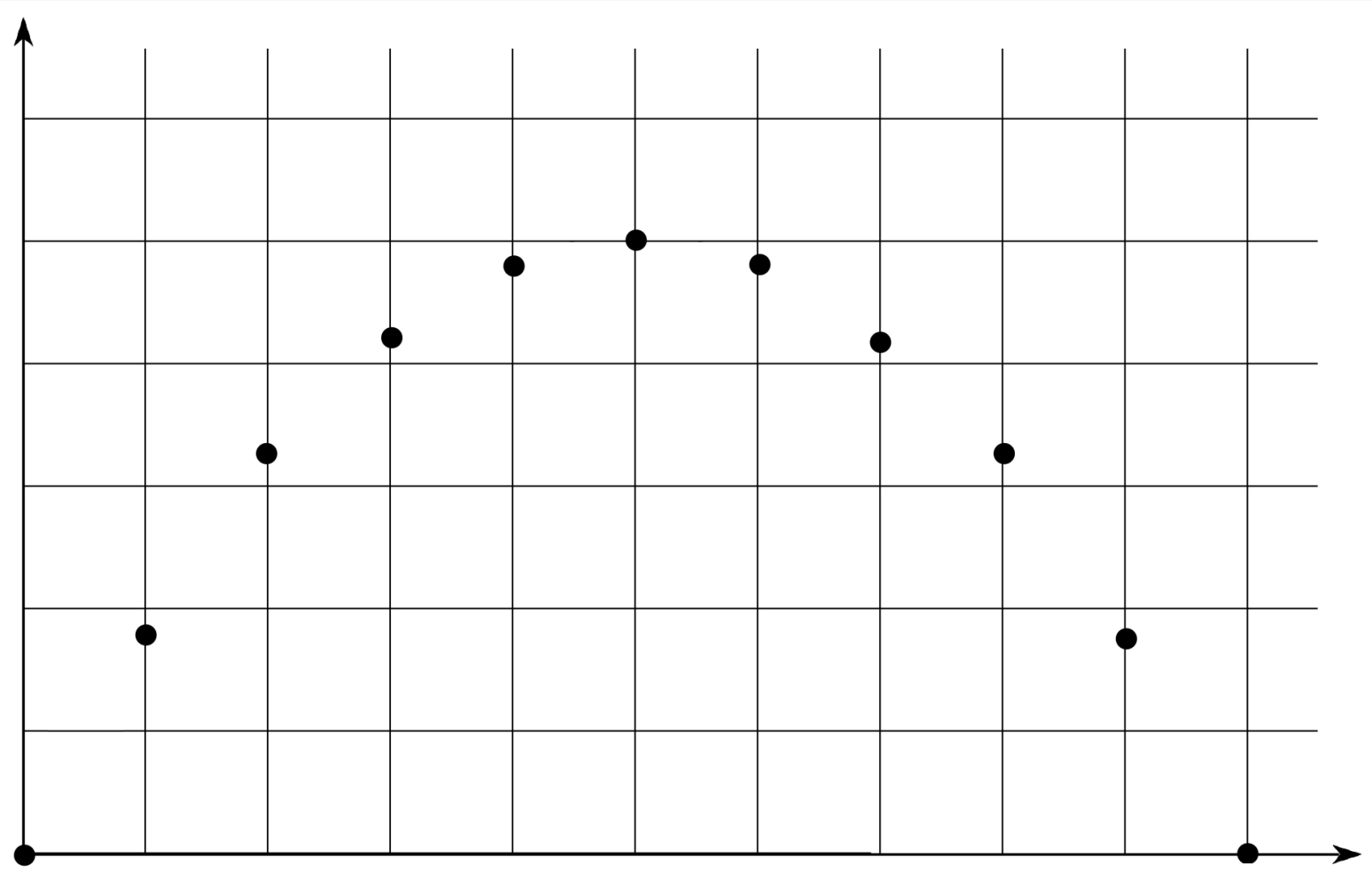
- Launched at an angle
  - *What does that do to initial velocity in x- and y-directions?*
- Start and end at same height



Velocity vectors



Acceleration vectors



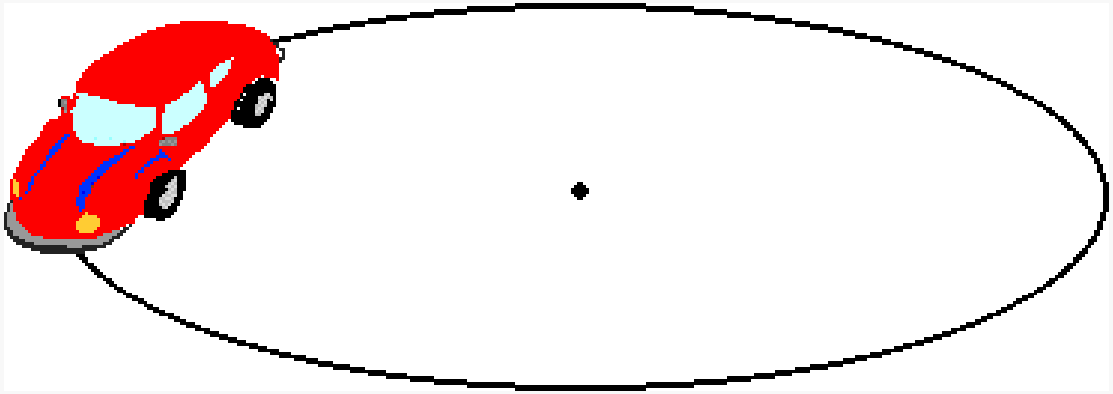
Differences and Similarities

	Half Projectile		Full Projectile	
	x	y	x	y
V_0				
V				
a				
d				
t				

Full Projectile Problem

- Derek Dawson kicks a soccer ball from the ground with a velocity of 20 m/s at an angle of 30°.
  - *How long is the ball in flight?*
  - *How far does it travel?*
  - *How high does it go?*

CIRCULAR MOTION




WiseGEEK

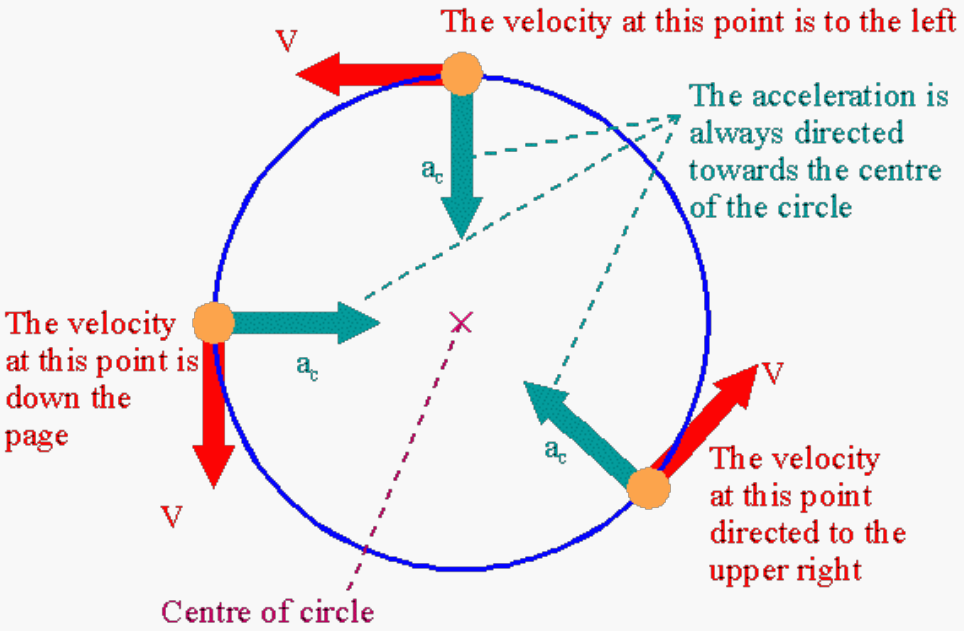
Centripetal force vs. Centrifugal force

- Centripetal force: center-seeking force. A force that pulls you towards the center.
- Centrifugal force: center-fleeing force. A force that pushes you away from the center.

- Only one exists: Which one do you think it is?

Centripetal force

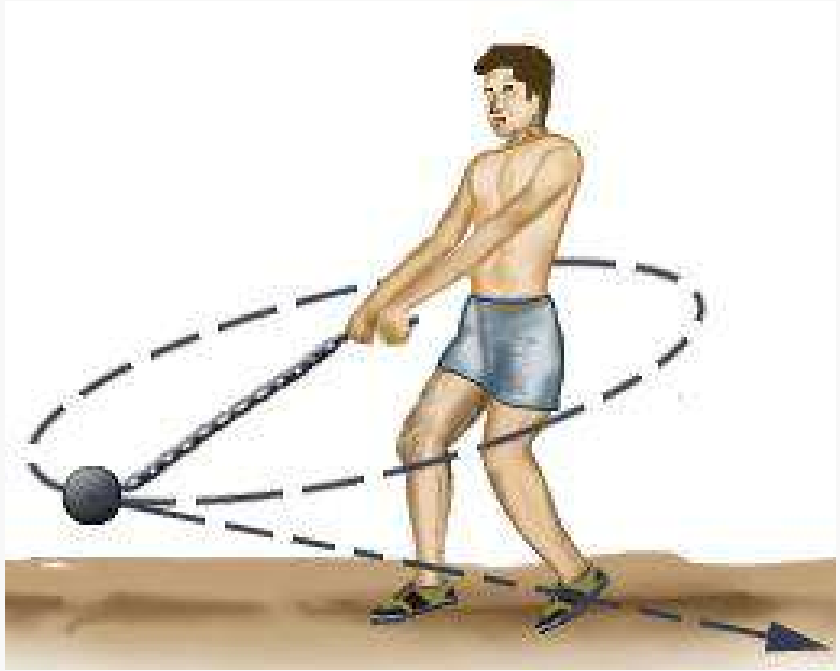
- Centripetal force, like the gravitational force in projectile motion, leads to an acceleration.



Demonstration

- What happens when I take away centripetal acceleration?

- Girl #1
- Girl #22



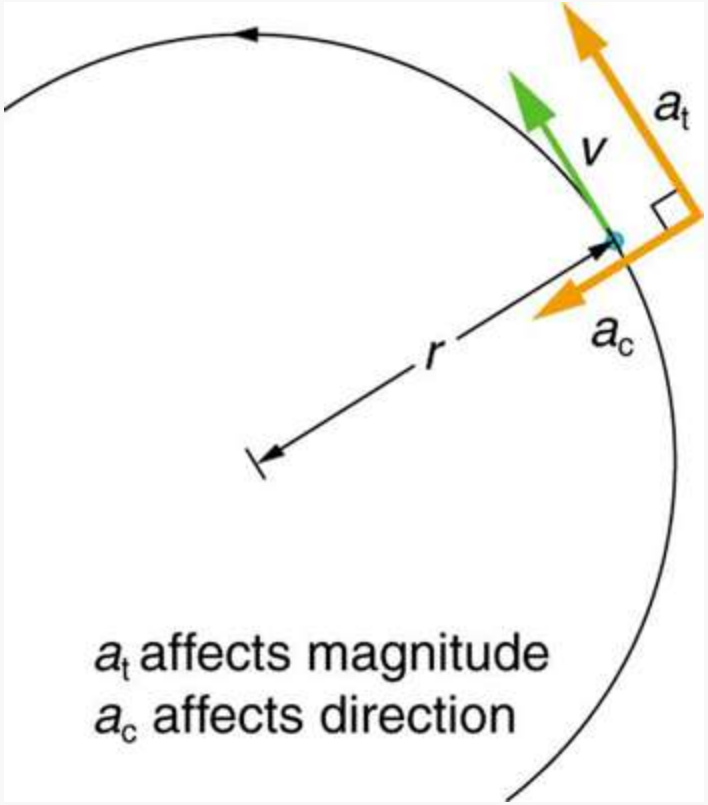
Centripetal acceleration

- The acceleration needed to keep an object moving around a circle of radius *r* at a velocity of *v* is:

$$a_c = \frac{v^2}{r}$$

Centripetal acceleration

- In circular motion, velocity and acceleration are always perpendicular to each other.
- This never leads to a change in speed, only a change in direction.



Problems

- A car is traveling at 4 m/s when it is traveling around a curve with a radius of 25 m. What is the centripetal acceleration experienced by the car?

Problems

- In order to create artificial gravity in space, some people have proposed a spinning space ship. If the ship has a radius of 100 meters, how fast does it have to spin to replicate gravity on Earth?