A thick black L-shaped frame surrounds the text. It consists of a vertical line on the left and a horizontal line at the top, meeting at a corner in the upper-left. Another L-shaped frame is on the right, consisting of a vertical line and a horizontal line at the bottom, meeting at a corner in the lower-right.

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.

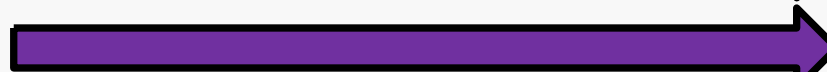


Vectors

Vectors:

Blue: Magnitude of 4

Red: Magnitude of 3



Resultants:

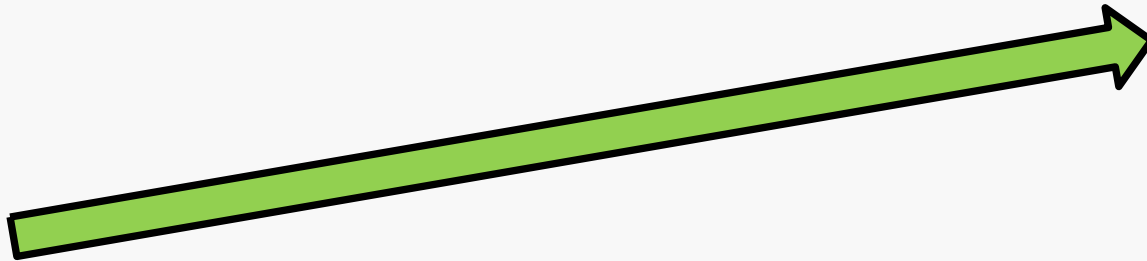
Shortest: Magnitude of 1

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

A thick black L-shaped frame is positioned around the text. It starts at the top-left, goes right, then down, then right again, and finally down to the bottom-right corner.

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?

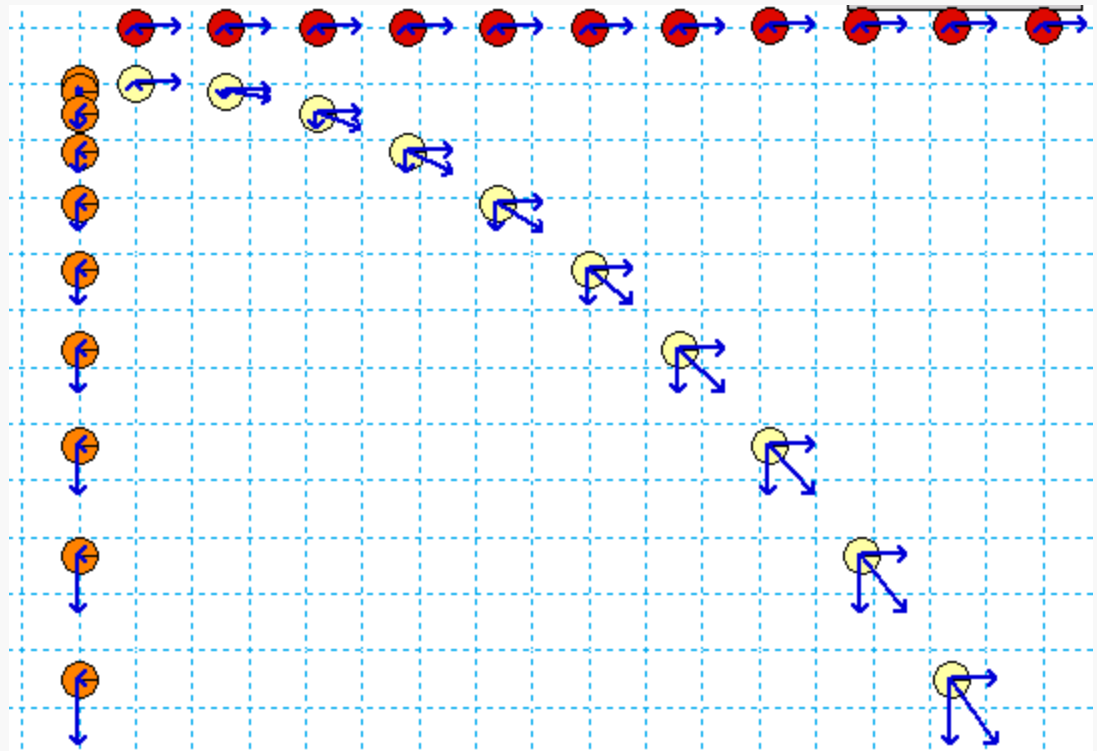


Mythbusters

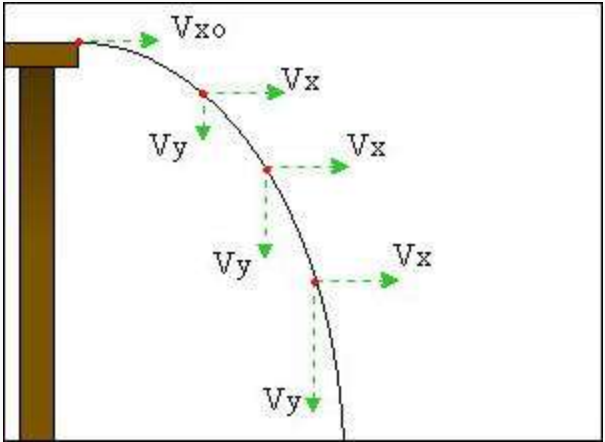
■ <https://www.youtube.com/watch?v=D9wQVIEdKh8>

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

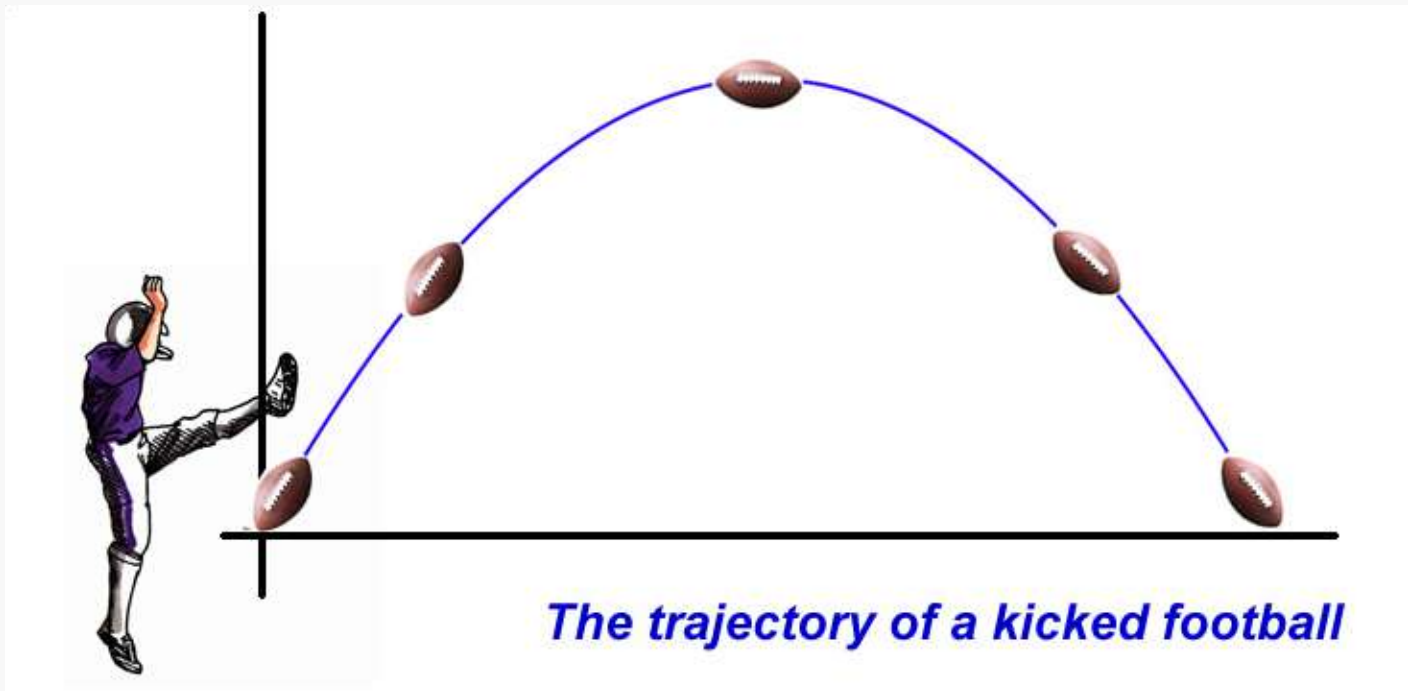
- You take a running leap off of a high dive platform. You were running at 2.8 m/s and you hit the water 2.6 seconds later. How high was the platform, and how far from the edge of the platform did you hit the water?

FULL PROJECTILE

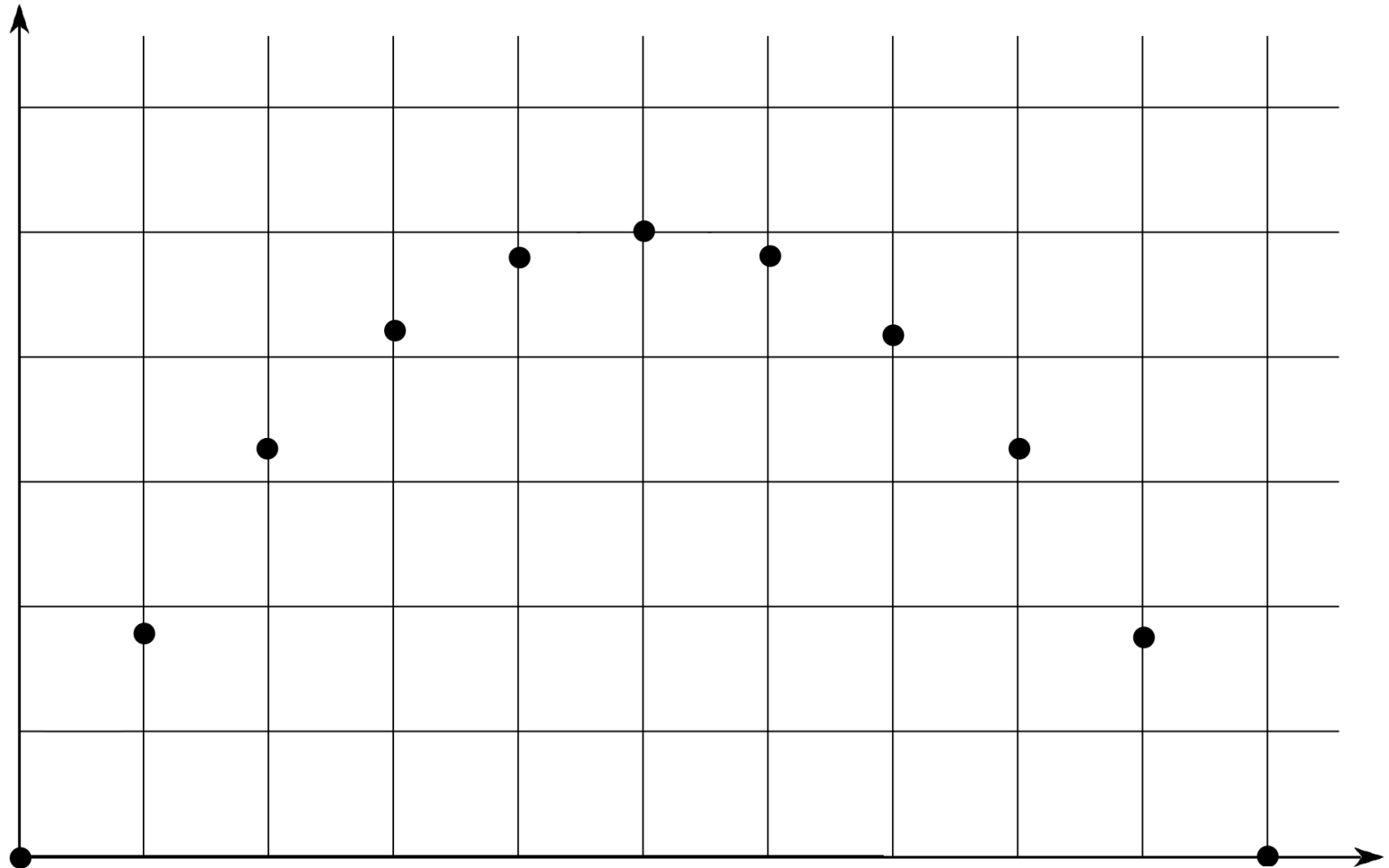


Full Projectile Motion

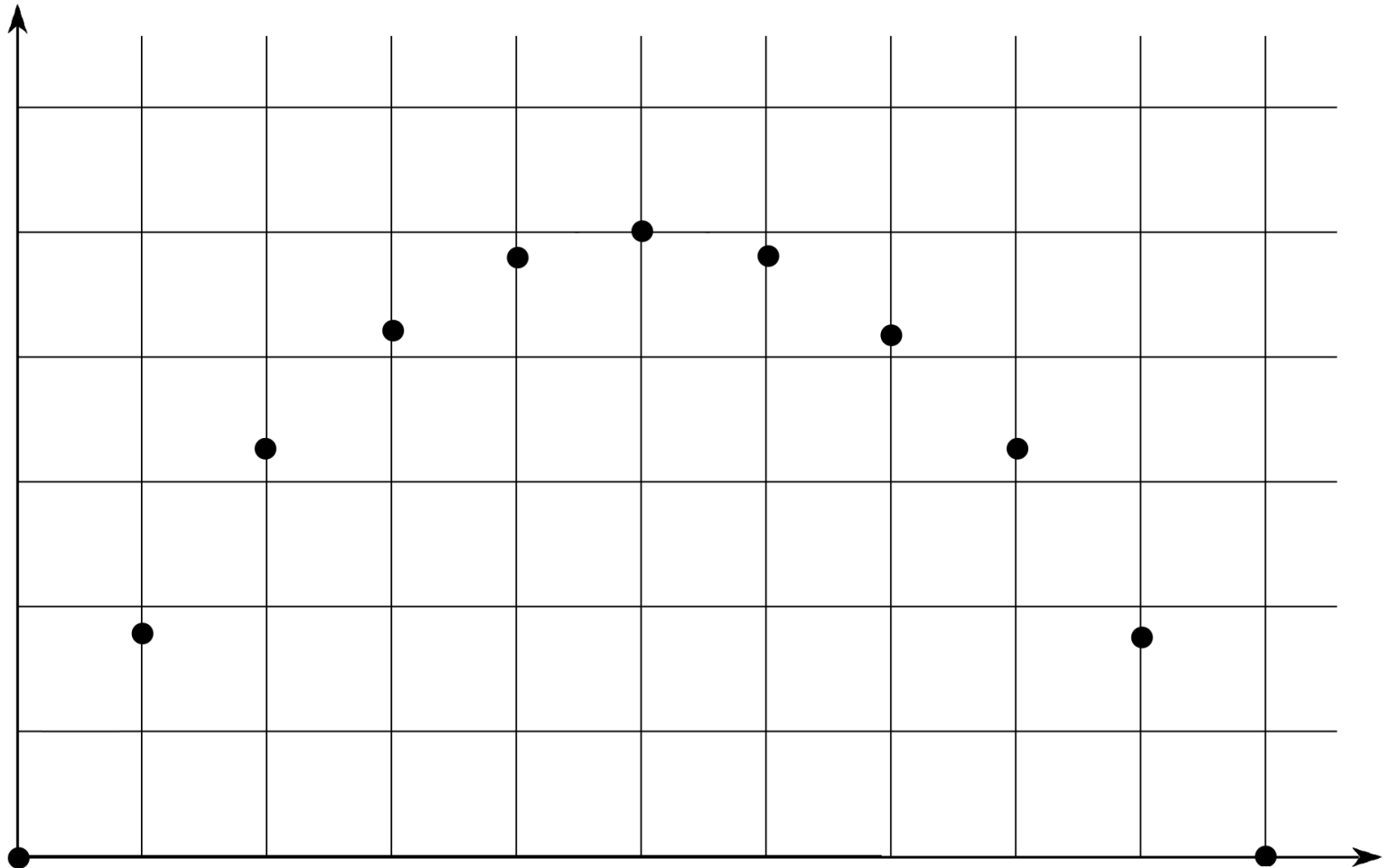
- Launched at an angle
 - *What does that do to initial velocity in x - and y -directions?*
- Start and end at same height



Velocity vectors



Acceleration vectors



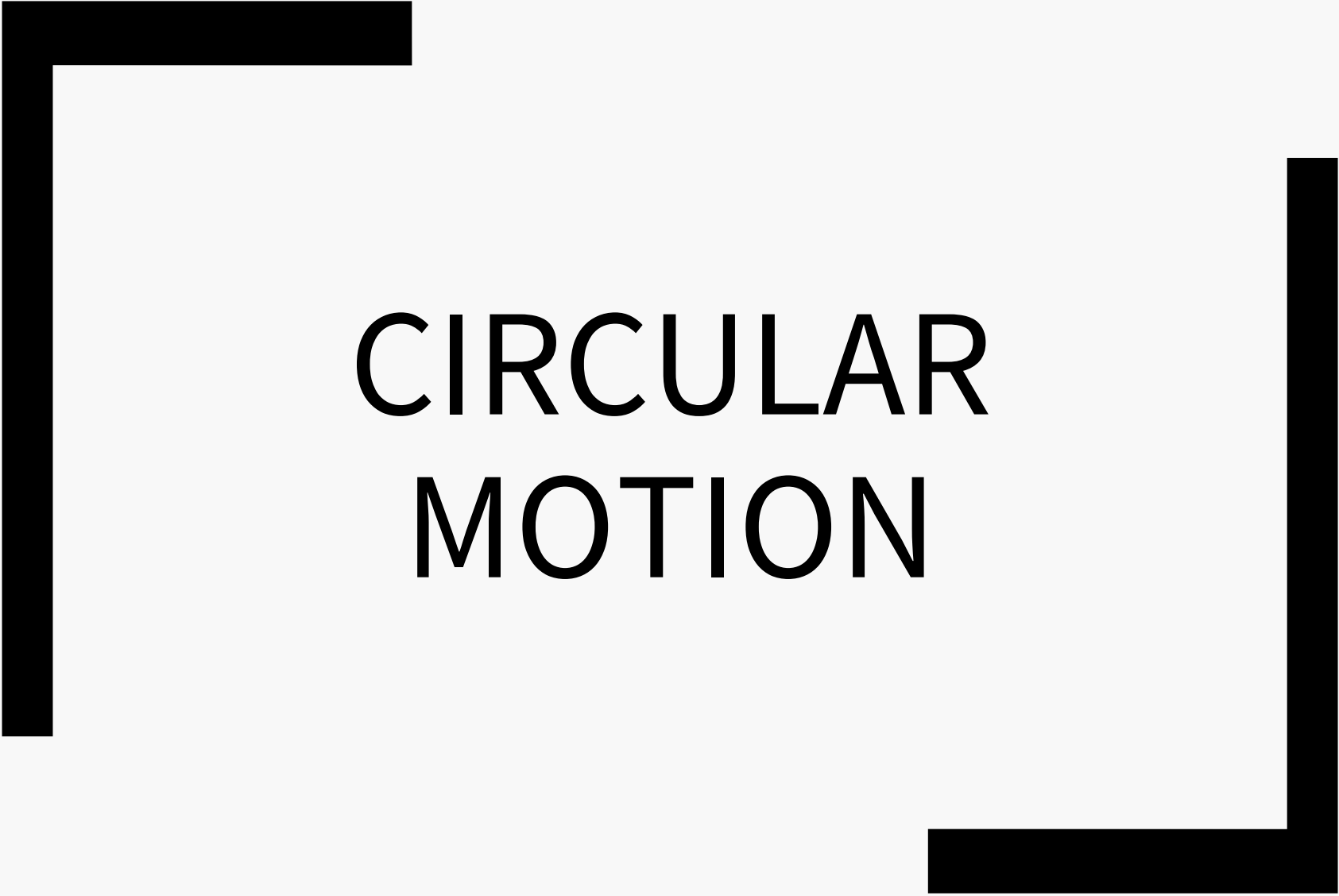
Differences and Similarities

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

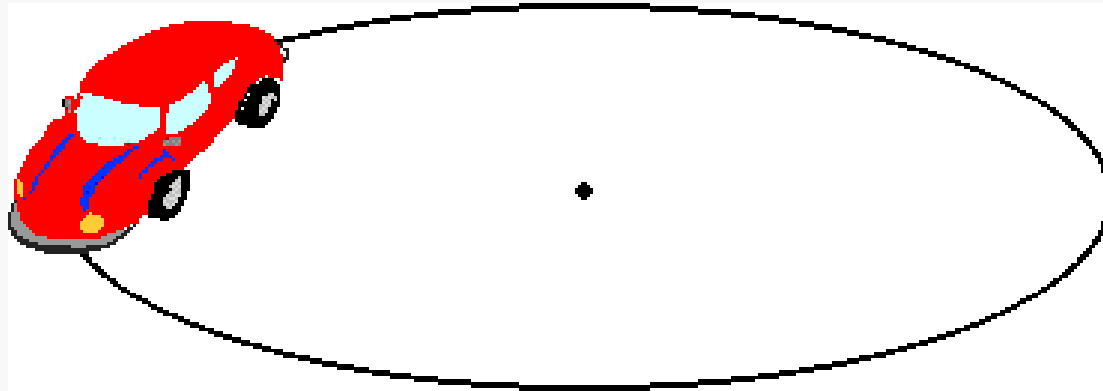
Full Projectile Problem

- 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?*



The image features two large, thick, black L-shaped brackets. One is positioned on the left side, with its vertical leg extending downwards and its horizontal leg extending to the right. The other is on the right side, with its vertical leg extending upwards and its horizontal leg extending to the left. These brackets frame the central text.

CIRCULAR MOTION

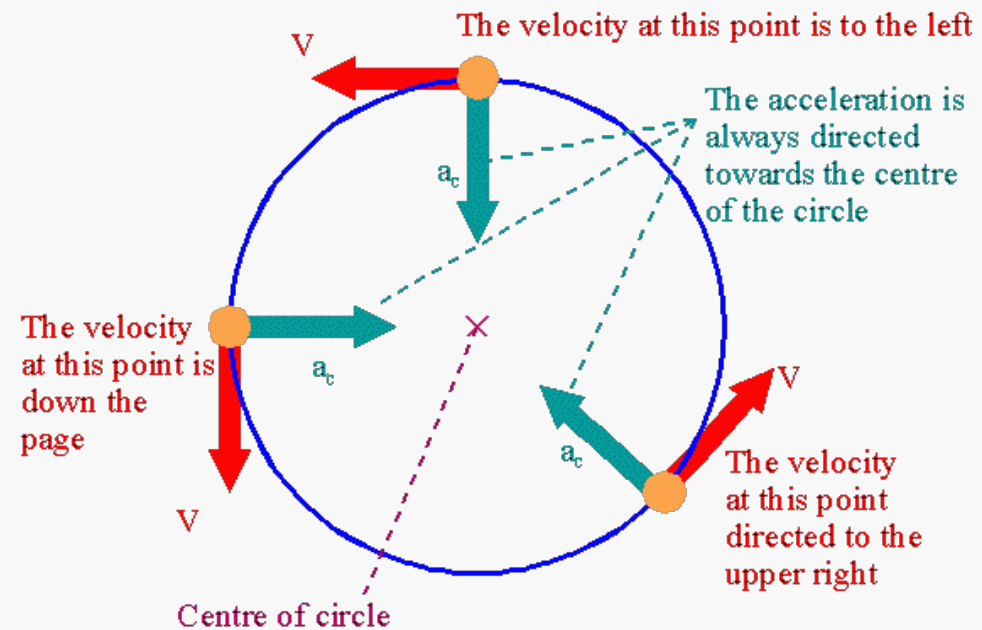


Centripetal force vs. Centrifugal force

- 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.

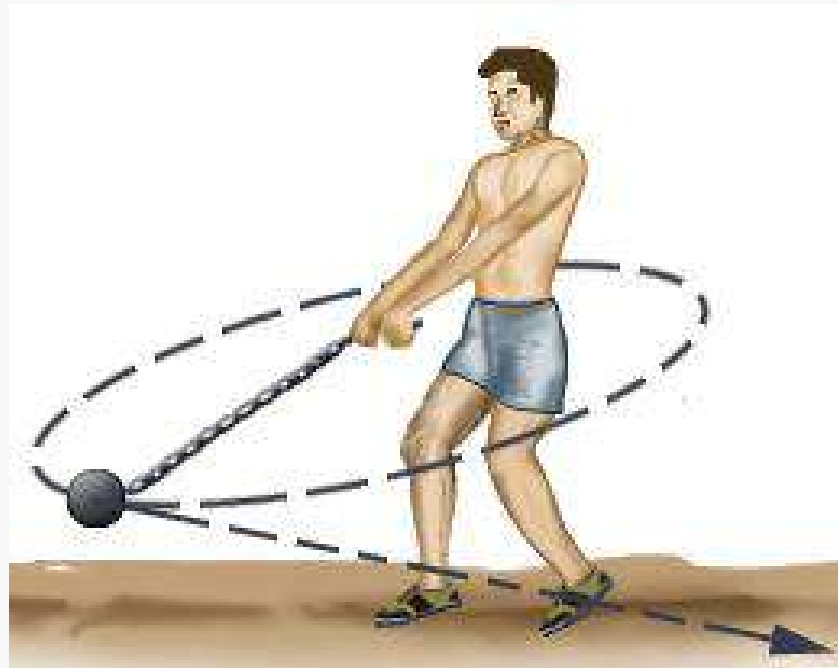


Demonstration

■ What happens when I take away centripetal acceleration?

■ Girl #1

■ Girl #22



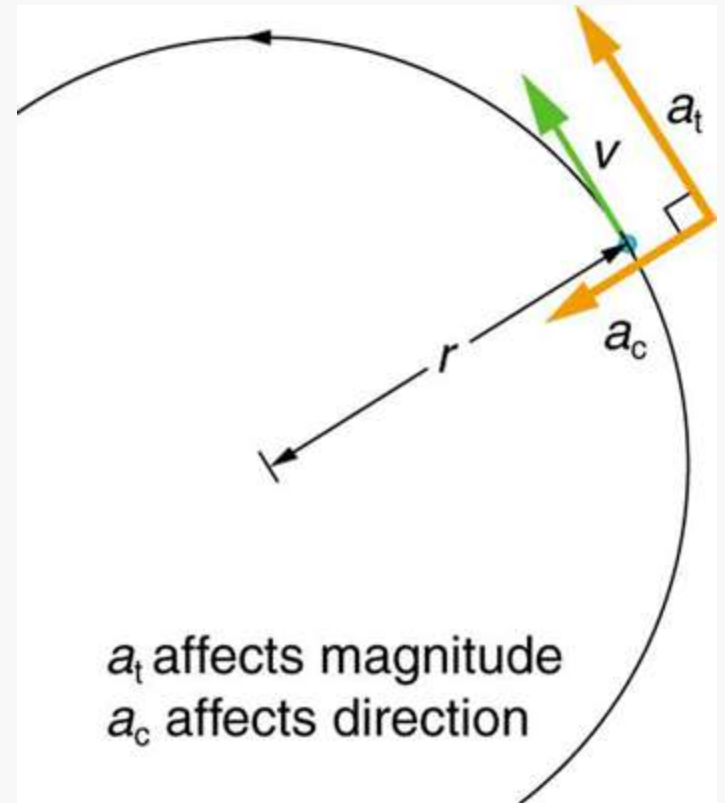
Centripetal acceleration

- 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?

