Announcements:

- Homework Quizzes: Never be announced...
  Happen no sooner than one week after class review.
- Kinematics Video Analysis: In-class due date today
  Extension due date W, 10/11
- Friday and Monday: No Bregar
- Practice quiz (1D Motion): Wed 10/11 (Effort)

Intro to Parabolic Motion - Objectives:

1. Students will understand that 2D motion of objects in free-fall is described by a parabolic arc
2. Students will be able to explain how motion in different axes is completely independent
3. Students will be able to use the Big 4 separately for x- and y- motion of projectiles

Parabolic/Projectile Motion:

Two dimensional motion of objects in free fall.

Downward acceleration* is 9.8 m/s^2.

Horizontal acceleration is 0!

All vectors** (displacement, velocity, acceleration) can be broken into x- and y-components (true for ANY two-dimensional motion).

Variables in the x- and y-dimensions can be considered completely independently (i.e., set up one Big 4 for each dimension) - but are linked by time (the "t" variable will always have the same value).

For the horizontal dimension: x_0, x, v_{x0}, v_x, a_x, t

For the vertical dimension: y_0, y, v_{y0}, v_y, a_y, t

*What Does Acceleration Do:

Acceleration tells us how the velocity of an object changes (m/s^2) -

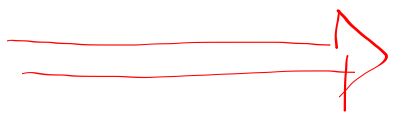
"Each second, an object's velocity will change by..."

Acceleration is a vector - the velocity can change in either direction -

+a : add the acceleration to v

-a : subtracting it

Negative acceleration does NOT mean slowing down -



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Slowing down/speeding up in a nutshell -

signs of v & a are the same: speeding up

signs are opposite: slowing down

$a = 2\ m/s^2$

t	v
0	$1\ m/s$
1	$3\ m/s$
2	$5\ m/s$
3	$7\ m/s$

speeding up...

$a = -2\ m/s^2$

t	v
0	$12\ m/s$
1	$10\ m/s$
2	$8\ m/s$
3	$6\ m/s$

slowing down...

$a = 2\ m/s^2$

t	v
0	$-15\ m/s$
1	$-13\ m/s$
2	$-11\ m/s$
3	$-9\ m/s$

slowing down...

$a = -2\ m/s^2$

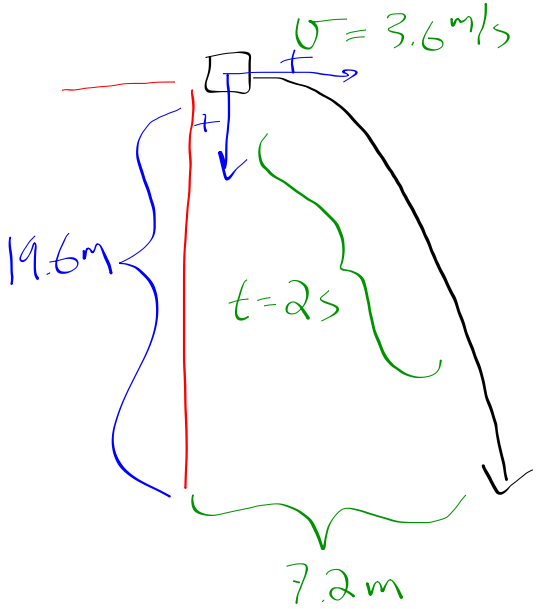
t	v
0	$-4\ m/s$
1	$-6\ m/s$
2	$-8\ m/s$
3	$-10\ m/s$

speeding up

$a = -2\ m/s^2$

t	v
0	$4\ m/s$
1	$2\ m/s$
2	$0\ m/s$
3	$-2\ m/s$
4	$-4\ m/s$

A diver running at 3.6 m/s dives out horizontally from the edge of a vertical cliff and reaches the water below 2.0 s later. How high was the cliff and how far from its base did the diver hit the water?



$x_0 = \emptyset$

$x =$

$v_{0x} = 3.6\ m/s$

$v_x = 3.6\ m/s$

$a_x = \emptyset$

$\Delta t = 2\ s$

$x = x_0 + v_{0x}t + \frac{1}{2}a_x t^2$

$x = (3.6)(2)$

$= 7.2\ m$

$y_0 = \emptyset$

$y =$

$v_{0y} = \emptyset$

$v_y =$

$a_y = 9.8\ m/s^2$

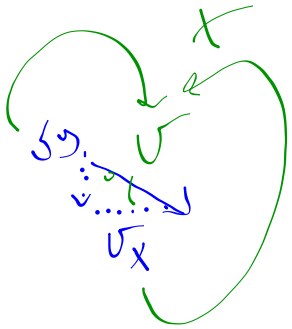
$t = 2s$

$y = y_0 + v_{0y}t + \frac{1}{2}a_y t^2$

$y = \frac{1}{2}(9.8)(2^2)$

$= 19.6m$

An athlete executing a long jump leaves the ground at a 30° angle (initial overall velocity is *v* at a 30° angle from the horizontal) and travels 8.90 m horizontally. What was the takeoff speed?



$$v_{0x} = v_0 \cdot \cos 30^\circ$$

$$v_{0y} = v_0 \cdot \sin 30^\circ$$