PHYS 1511 Discussion Section: Week 3

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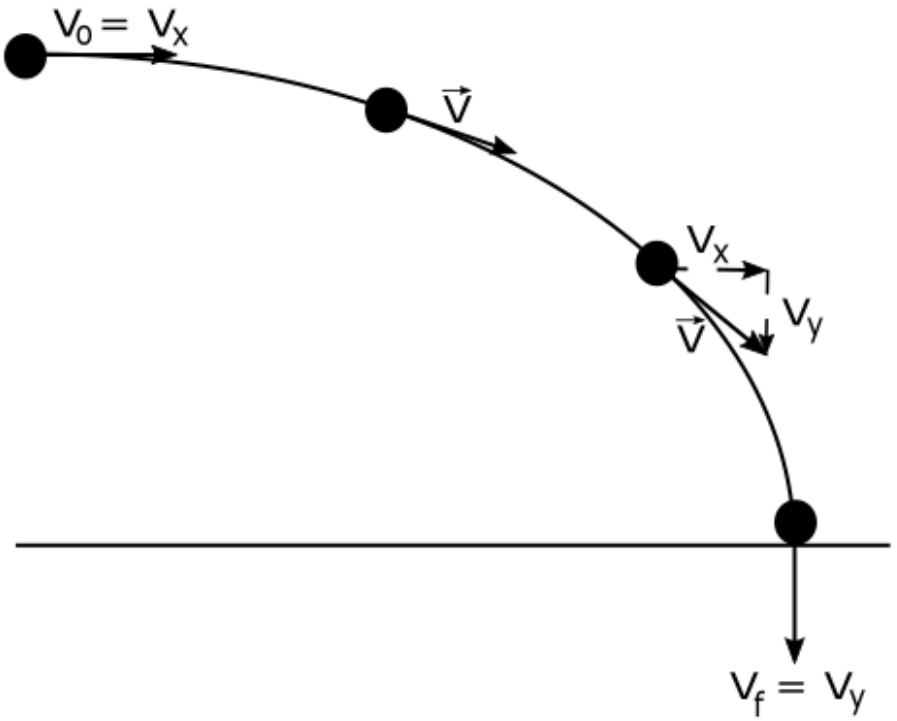
Review



Kinematic Chart

x	y
$V_0 = V_x$	$V_0 = 0$
$V_f = V_x$	$V_f = ?$
$a = 0$	$a = g$
$t = ?$	$t = ?$
$\Delta x = 0$	$\Delta y = ?$

(*There's a typo above: $\Delta x = ?$ not 0)

-Kinematics in 2D

-Relative Velocity

-All object accelerate the same on earth (without air resistance)

Review

Newton's Laws:

1) An object stays at rest (or constant velocity) unless acted upon by exterior net force.

2) When a net force ($\Sigma \vec{F}$) is exerted, an acceleration $\vec{a}$ results and is given by: $\vec{a} = \frac{\Sigma \vec{F}}{m}$

3) Whenever one object exerts a force on another, the 2nd object exerts an equal and opposite force on the first object.

Relevant Equations

The Kinematic Equations (Can be applied in x or y direction):

$$v = \frac{\Delta x}{\Delta t} \tag{1}$$

$$v_f = v_o + at \tag{2}$$

$$\Delta x = x_f - x_o = v_o t + \frac{1}{2} a t^2 \tag{3}$$

$$v_f^2 = v_o^2 + 2a\Delta x \tag{4}$$

Newton's 2nd Law:

$$\Sigma \vec{F} = m\vec{a} \tag{5}$$

Question #1

Parabolic Paths

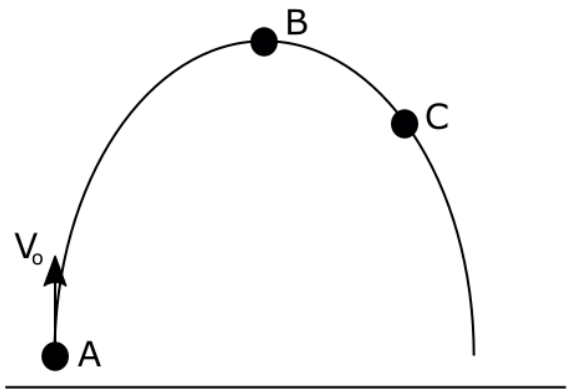
The figure below depicts an object undergoing a parabolic trajectory on earth. Only V_o in the y direction is shown. Answer the following (Assuming no air resistance and **+y** is pointing up):

a) Rank the speed in the y-direction in order from greatest to least.

b) Rank the velocity in the y-direction in order from greatest to least.

c) How does the acceleration in the y-direction compare for A,B,C?.

d) What would the acceleration in the x-direction be for the object once launched?



Question #2

Whatever a spider can

Spider-Man is runs off a rooftop horizontally at a speed of V_o m/s, hoping to land on the roof of an adjacent building below. The horizontal distance between the two buildings is "D" and the roof of the second building is Δy below the jumping-off point. Symbolically solve for "D" in terms of V_0, Δy and any known constants.

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If $V_o = 5.3$ m/s and $\Delta y =$ -2.0m what is the maximum value for "D" for Spider-Man to make it? (assume up is +y and right is +x)

Question #3

Equation Ratio

Two stones are thrown horizontally with the same initial velocity from the tops of two different buildings. The stone from the taller building lands twice as far horizontally as compared to the stone from the shorter building. Find the ratio of the height of the taller building to the height of the shorter building.

Question #4

Relative Motion

Some airports (like O'hare in Chicago) have speed ramps to help people move in-between terminals. These ramps are made of conveyor belts that you can stand on. Suppose one such speed ramp has a length of 105m and is moving at a speed of 2.0 m/s relative to the ground. In addition, suppose you can cover this distance in 75 seconds when walking on the ground.

a) If you walk on the speed ramp at the same rate as when you walked on the ground, what is your velocity relative to ground now? (Assume zero accelerations for you and speed ramp)

b) How long does it take you to traverse the ramp with your new relative speed?

c) If you walk on the speed ramp in the opposite direction but at **double your ground speed**, how long does it take you to traverse the distance?

Question #5

Force detective

Two forces $\vec{F}_A$ and $\vec{F}_B$ are applied to an object whose mass is 8.0kg. The larger force is $\vec{F}_A$. When both forces point right, the object's acceleration has a magnitude of 0.5 m/s^2. However, when $\vec{F}_A$ points right and $\vec{F}_B$ points left, the acceleration is 0.40 m/s^2 pointing right. Find:

a) The magnitude of $\vec{F}_A$
b) The magnitude of $\vec{F}_B$