Projectile Motion

1. X and Y components are independent
	1. This means that what happens in the Y direction does not affect what happens in the X direction and visa versa.
	2. Therefore we can use equations which deal in *only* one direction!
	3. <Draw basketball being shot with x-component and y-component>
2. Important points of a “projectile”
	1. Constant Y acceleration
	2. Constant X velocity
		1. What is x-acceleration, then?
3. Equations
	1. Reminder:
		1. $∆x=\frac{1}{2}(v\_{i}+v\_{f})∆t$
		2. $v\_{f}=v\_{i}+a∆t$
		3. $∆x=v\_{i}∆t+\frac{1}{2}a\left(∆t\right)^{2}$
		4. $v\_{f}^{2}=v\_{i}^{2}+2a∆x$
	2. The above equations can be done *entirely* in just the x or y direction!
		1. $D\_{x}=\frac{1}{2}(v\_{i, x}+v\_{f,x})∆t$
		2. $v\_{f,x}=v\_{i,x}+a\_{x}∆t$
		3. $D\_{x}=v\_{i,x}∆t+\frac{1}{2}a\_{x}\left(∆t\right)^{2}$
		4. $v\_{f,x}^{2}=v\_{i,x}^{2}+2a\_{x}D\_{x}$
	3. If you are given an angle, reminder:
		1. $v\_{x}=v∙cos⁡(θ)$
		2. $v\_{y}=v∙sin⁡(θ)$
4. Steps
	1. Break all units into components!
	2. Easiest:
		1. y-acceleration = gravity
		2. x-acceleration = 0 (for projectile graphs)
	3. Velocity:
		1. Use trig definitions (these will be given to you on the test)
	4. Solve for unknown variable
		1. Draw a picture of the situation to think critically about positive/negative values.
5. Example
	1. (Have on ppt)
	2. A football is kicked with an initial velocity of 20 m/s at a 55-degrees angle (with the horizon).
		1. What is the final velocity of the football when it lands? <Draw picture>
		2. How long was it in the air?
		3. How far did it land from the point of the kick?
		4. What was the highest point of the football?
	3. There are many ways to solve this last question:
		1. What would time be at this point? Half of the total!
		2. What would vertical velocity be at this point? 0 m/s
6. Practice Problem:
	1. A soccer ball is kicked by the sweeper with an initial velocity of 30 m/s at a 30 degrees angle with the horizon.
		1. What is the final velocity of the football when it lands? <Draw picture>
		2. How long was it in the air?
		3. How far did it land from the point of the kick?
		4. What was the highest point of the soccer ball?
7. Example Problem
	1. A soccer ball is kicked with an initial velocity of 20 m/s. It traveled for 2 seconds.
		1. Find the initial vertical velocity.
		2. Find the initial horizontal velocity.
		3. How far did it travel?
		4. What was the angle of the kick?
		5. How high did the ball go?
8. Practice Problem
	1. A physics student jumps with an initial velocity of 5 m/s. The student travels for 0.3 seconds.
		1. Find the initial vertical velocity.
		2. Find the initial horizontal velocity.
		3. How far did he/she travel?
		4. What was the angle of the jump?
		5. How high did the student jump (not including height of the student)?