

1. Pick an initial horizontal velocity between 15 m/s and 100 m/s: ______ Pick an initial vertical velocity between 15 m/s and 100 m/s (not the same as v_x): _____

Now imagine that a projectile is launched across level ground $(y_i = 0)$ with the initial velocity that you chose. Determine the following three things:

- a. The time to the maximum height.
- b. The maximum height of the projectile.
- c. The range of the projectile.
- 2. Now go to the website: <u>https://ophysics.com/k8.html</u>. Play around for a minute or so to see how the controls on the simulation work.
 - a. When you are ready, set the initial velocity and gravity to what you used in question 1. Run the simulation to see if you got the correct answers above. Then check the appropriate box:



b. Hopefully, your answers were the same as the simulation. Now, think and predict what will happen to your calculations if you make the following changes (all with respect to your very initial conditions.) Then try them. Predict and test one at a time.

Changing This	Results in This		
	Time to Max Height.	Max Height	Range
Double v _x	no change	no change	double
Halve v _x	no change	no change	1/2
Double v _y	double	four times !	double
Halve v _y	1/2	1/4	1/2
Double g	1/2	1/2	1/2
Halve g	double	double	double

 $(\underline{\cdot})$



Projectile Concepts

3. Now let's do the same thing theoretically. For a projectile with an initial velocity of $v_x \mathbf{i} + v_{yi} \mathbf{j}$ that is launched across a level field, find expressions for the following:



 Finally, look at the expressions you just derived. Compare each of those with the results from question 2. Do the expressions support what you found? Explain.
 a. Time to Max Height



- No Vx, so horizontal component of velocity cannot effect the time
 tmax is directly proportional to Vy;
- · tmax is inversely proportional to g
- b. Max Height









- No Vx, so horizontal component of velocity cannot effect the vertical motion
- max height is directly proportional to the square of Vy;
- · maxheight is inversely proportional to g
 - · range is directly propertional to Vx
- · range is directly propertional to Vy.
- · range is inversely proportional to g

So $Y_{max} = \begin{pmatrix} y_{1} \\ y_{2} \end{pmatrix} \begin{pmatrix} y_{1} \\ \frac{y_{1}}{g} \end{pmatrix}$

Side 2