Analyzing Movement

Group Members: Date:

Instructions:

1. Place the ruler on the desk and the ball at one end of the ruler.
2. Open up *Video Physics* on the iPad. Start videotaping and have someone push the ball so it rolls of the desk.
	1. The video should be taped such that the ruler is parallel to the floor, and the ball can be seen rolling off the table and hitting the floor without moving the camera.
3. Using *Video Physics*, setup your origin where the ball begins to fall off the desk, and each unit aligned with the ruler so all units are in feet.
4. Starting with the frame where the ball is rolling off the desk, place a dot on where the ball is. Do this for each frame until the ball hits the floor.
5. Have *Video Physics* analyze the video to create graphs and equations.

Complete the following with your group based on the information from the video, graphs, and equations:

On the Cartesian Plane below, place the first five dots that represent the velocity of the ball along the x-direction and connect them with a best fit line/curve. Let each unit in the x-axis be one frame.



What forces are acting on the ball in the x-direction?

What is the equation for this graph?

What is the slope of this graph?

On the Cartesian Plane below, place the first five dots the represent the velocity of the ball along the y-direction and connect them with a best fit line/curve. Let each unit in the x-axis be one frame.



What forces are acting on the ball in the y-direction?

What is the equation for this graph?

What is the slope of this graph?

Using the ruler, draw a line between every other dot on the last graph:

What are the slopes of these lines?

Can you find lines that are tangent to the curve AND parallel to lines you just drew with the ruler? *You can redraw it below if the plane above is getting crowded.*

Graph the change for the tangent lines. The x-values should be the same to the place of tangency on the y-direction graph.



Give an approximate equation for the graph above.

What do you think this change-of-slope graph and equation represent from the original video and y-direction graph? Why?

How do you think the change-of-slope graph would look if one were to throw the ball straight up and catch it?

Test your hypothesis. Show your work and results on a separate sheet(s) of paper.