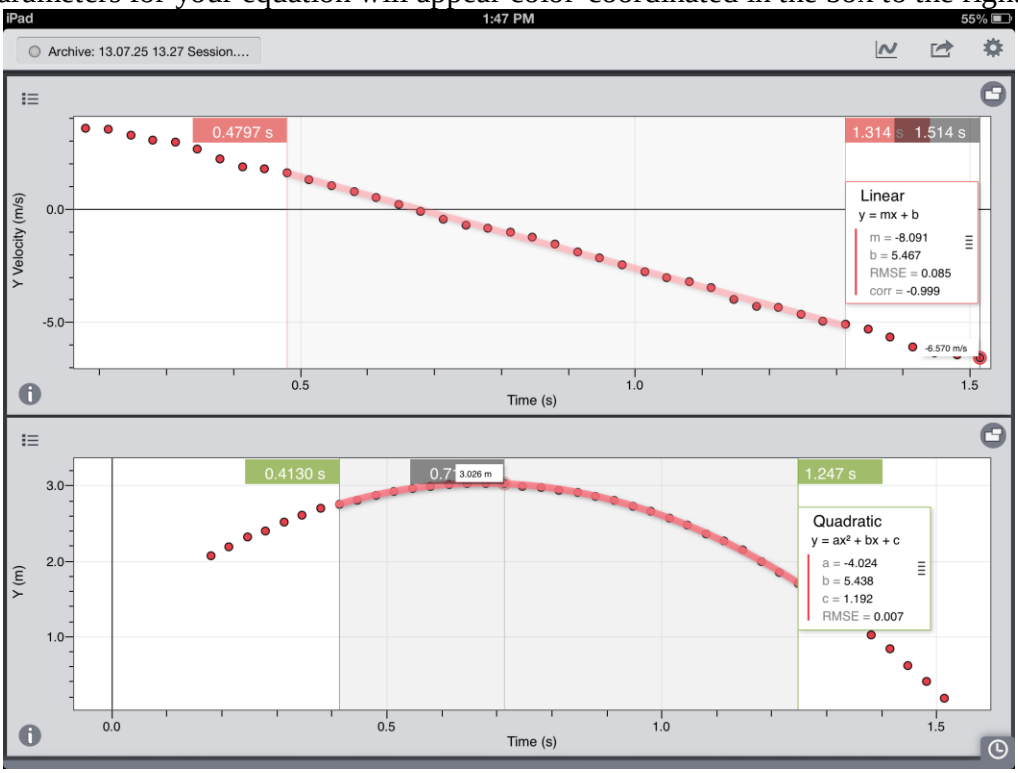
Vertical Motion Activity

This write up will include analysis of two different videos; (1) an object dropped from a height to the ground and (2) an object thrown vertically and caught.

Directions:

1) Have a partner film the two videos of you. Make sure to include something in the video so that you can accurately scale your video (accuracy will be very important in this activity).
2) Upload your video into Vernier Video Physics
3) In your navigation section, select the second icon from the left |←→| to set the scale for your video.
4) Select the x/y graph icon and move the origin of your graph to the starting location of the object.
5) Plot the position of the object with a <u>Δt of 0.1 second</u> for each point.
6) Click on the rightmost icon of an arrow in a box and select the "Open Data In" option and then "Graphical."
7) The top graph should show your v_y and v_x vs. t graphs together and your x and y vs. t graphs are together on the bottom.
8) Tap the bullet point icon above the vertical axis of each to select only the v_y vs. t option on one graph and the y vs. t option on the other graph.
9) Add a best fit line to your velocity graphs (top) by tapping and dragging your finger across the graph. Highlight the linear region only (see the grayed region below). Then tap the highlighted region and choose <u>a linear fit line</u> and press "Add". The parameters for your equation will appear color-coordinated in the box to the right.



10) Do the same with the velocity vs. time graph for the central region that is most parabolic (see grayed region above), but this time, fit the data with a quadratic line.
11) Take a picture of these two graphs that include the fit parameters and insert the photo into Notability.
12) Do all of this for both of the videos.
13) Answer the following questions in Notability

Analysis:

1) Based on the spacing of the dots in the Video Physics Analysis, describe the motion of the object for each video.
    - How does the spacing of the dots along the y-axis change with time?
    - What does the spacing suggest about how the velocity is changing?

2) Based on the graphs in Graphical Analysis, does the v_y vs. t graph support your answers above?

3) What does it mean for the velocity to be positive or negative?

4) Write the linear fit ($y = mx+b$) equations for each of your v_y vs t. graphs by substituting in the values provided for "m" and "b" and v_y and t where appropriate.

5) What should the value for "b" represent physically for each video?

6) What do you think the value for "m" corresponds to? This can be a guess; you have not learned this yet!

7) Go through the same steps (4-6) for the y vs. t graph. Substitute in the provided values for "a", "b", and "c" and "y" and "t" where appropriate.

8) Is there a relationship between "a" in this graph and "m" in the velocity graph?

9) What do you think the values for "b" and "c" represent?