

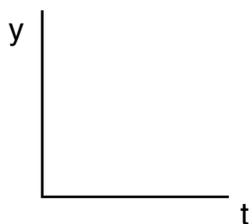
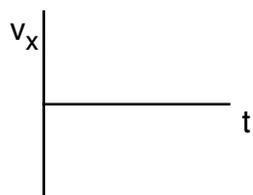
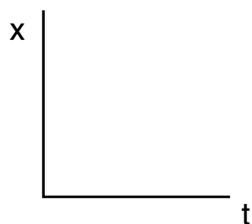
Lab 3-6: Projectile Motion

- Purpose:**
1. To examine the motion of a projectile through the use of a camcorder.
 2. To produce position and velocity graphs of a projectile's motion for horizontal and vertical components.
 3. To analyze the motion of the projectile.

Procedure:

1. Two students will be video-taped tossing a tennis ball back and forth. This video will be converted into a small computer file, which will be analyzed using Logger Pro.
2. Make sure that the LabPro is NOT plugged into the computer. Open up Logger Pro. Under **Insert**, choose **Movie....** Choose the correct movie. It will open up in the middle of the screen of Logger Pro.
3.  Enable video analysis by clicking on the box on the bottom right of the movie that looks like the button to the left.
4.  Set the scale of the movie by clicking on the "Set Scale" button (upper right corner), then clicking and dragging across the length of the meter stick on the wall.
5.  Set the origin by clicking on the "Set Origin" button (upper right corner), and then clicking on the first position of the tennis ball.
6.  Now to record the actual position of the tennis ball for each frame of the movie, click on the "Add Point" button (upper right corner.) Carefully center the mouse on the tennis ball, and click. Logger Pro will record the x and y coordinates of the mouse click, and the movie will automatically go the next frame. Do this for each frame of the movie.
7. To clean up the window, under **Page**, choose **Auto Arrange**. You should now see the position vs. time graphs on the main screen.
8. To add the velocity vs. time graphs, under **Insert**, choose **Graph**. A floating window will appear with a new graph in it. Again, under **Page**, choose **Auto Arrange**.
9. To add the second velocity graph, click on the axis label (probably "X Velocity" or "Y Velocity") and then choose **More...** in the pop-up window that appears. Make sure both "X Velocity" and "Y Velocity" are checked off and then click **OK**.
10. Sketch what the graphs look like in the space below. Make sure you label each graph. Three of the graphs should be lines; write down the slopes for those underneath the graph.
11. Answer the questions on the other side.

Graphs from Logger Pro



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Questions:

1. The graph of horizontal position verses time is a straight line. What is the slope of the line, and what does the slope represent?
2. The graph of horizontal velocity verses time should be basically horizontal. How do you interpret this graph, taking into account the graph of horizontal position verses time? Was there any acceleration?
3. The graph of vertical position verses time is a curve – what does this graph tell you about the motion of the projectile? (It should look like a graph from an earlier lab, if that helps to interpret the graph.)
4. The graph of vertical velocity verses time is a straight line. What is the slope of the line, and what does the slope represent?
5. What were the components of the initial velocity of the ball?
6. What was the initial speed of the ball?
7. For an object that is caught at the same height from which it was thrown and ignoring air resistance
 - a. what is true about the time needed to go up compared to the time needed to go down?
 - b. what is true about the initial horizontal velocity compared to the final horizontal velocity?
 - c. what is true about the initial vertical velocity compared to the final vertical velocity?
 - d. what is its velocity at its maximum height? Be careful!
 - e. what is its acceleration initially, at its maximum height and finally?