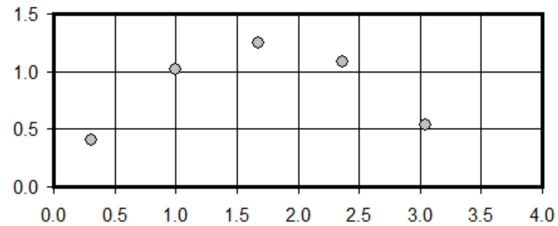
General Physics I Laboratory, Section 7 Due October 9, 2024
Dr. Pogo

Quiz #6

Name:____________________________ **Use a pencil, not a pen.**

This quiz should be done in Excel (no calculator!). The Excel document you create can then be copied and re-used as a prototype for your data collection when you perform the actual experiment. But, you will only submit this paper (not your Excel file). In this quiz, there will only be 5 data points. In the actual experiment, there might be 50.



The figure shows several frames of a video showing the motion of a ball through the air, as seen from the side. The squares are 50 cm each (so, the axis labels you already see are in meters). We think the ball started at (0, 0), but sadly, there is no image of the ball there. The video camera recorded 5 frames per second, so the amount of time between frames was 0.2 seconds.

t **(tracker, s)**	***(blank for now)***	***x*** **(m)**	***y*** **(m)**
0.0			
0.2			
0.4			
0.6			
0.8			

1. [2] In this chart, estimate (by eye) the (x, y) positions of the ball for these 5 video frames. Leave a blank column between *time* and x, as shown.

2. [2] Use Linest and/or Trendline to fit a straight line for x vs. t. You do not need uncertainties, but you must have units! Obviously, the slope and intercept have different units. Don't bother with y vs. t.

Slope ( )	***Intercept*** ( )

3. [1] As usual, Tracker (incorrectly) thinks the first *video frame* showed time zero. But we want $t = 0$ to instead refer to the moment that the ball left the launcher. To fix this, first compute the ratio of intercept over slope, and write it here, with units. This value represents the amount of time between the ball's launch and the first image of the ball, so it must be smaller than the frame rate of 0.2 seconds (which should also tell you the units!).

Intercept/Slope ( )

4. [0] In Excel, let's now use the "blank" column to make new, corrected time values. For this column, just add your answer for question #3 to each time value. You should not need to type any numbers, just one formula (with a dollar sign) that you drag down through all 5 rows.

5. [2] Make a plot of y vs. (true t). Find a parabolic fit of the form $c_1t^2 + c_2t + c_3$. Note that we expect that $c_3 \approx 0$ as a result of using the "new" times. Record the values here.

c_1 ( )	c_2 ( )	c_3 ( )

6. [1] As usual, we expect $g \approx -2c_1$ (and, since g is ALWAYS positive, this means you should have a negative number for c_1!). Write your discovered value of g here:

g ( )

7. [1] v_{0x} was the slope you found in step 2. v_{0y} is just c_2. Use the Pythagorean theorem to determine the initial speed of the ball.

v_0 ( )

8. [1] Review question 7. The initial angle of the ball is found using $\theta_0 = \tan^{-1}(v_{0y} / v_{0x})$. Note that in Excel, the result is in radians. So after finding it first in radians, make a second cell for θ_0 in degrees, by multiplying by 180 and dividing by π. Hint: in Excel, the function "pi()" generates a value for π having 15 digits of accuracy, so you don't need to type the number by hand.

θ_0 ( )