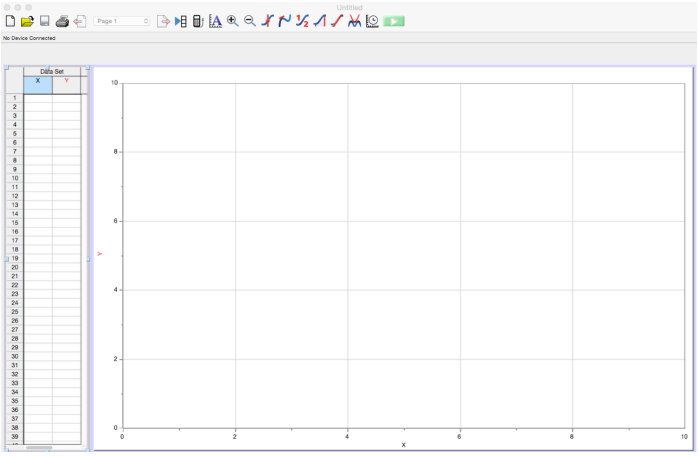
Graphical Analysis Using Logger Pro 3.8

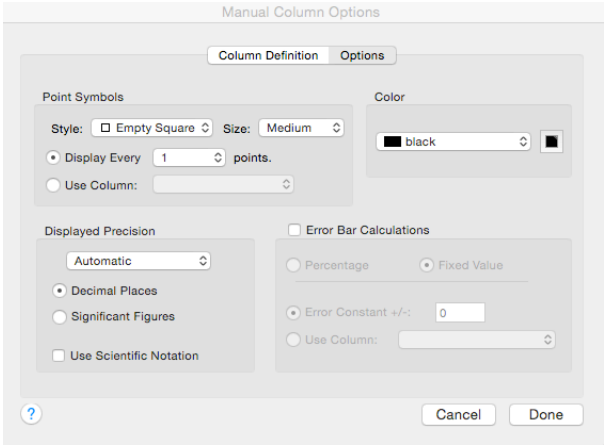
Find the mathematical relationship between distance and time for a ball rolling down a hill. The distance was measured for a ball rolling 1.0 s, 2.0 s and so on.

time (s)	distance (cm)
1.0	1.98
2.0	8.12
3.0	17.55
4.0	32.67
5.0	51.00
6.0	72.17

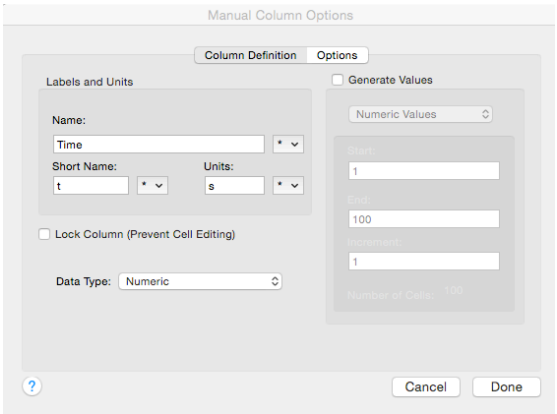


1. To open the program LoggerPro is not on the desktop, go to **My Computer>Local Disk (C:)>Program Files>Vernier Software>LoggerPro 3** and click on **LoggerPro.exe**. The window above on the right will come up.

2. Under "Data Set", double click the "X". Enter the "Name" of the independent variable you are graphing on the x-axis, a letter for the "short name" (i.e "t" for "time") and the units (i.e. "s" for "seconds"). Clicking the black triangle to the side of each of these will give you a menu to put in things like superscripts, etc.

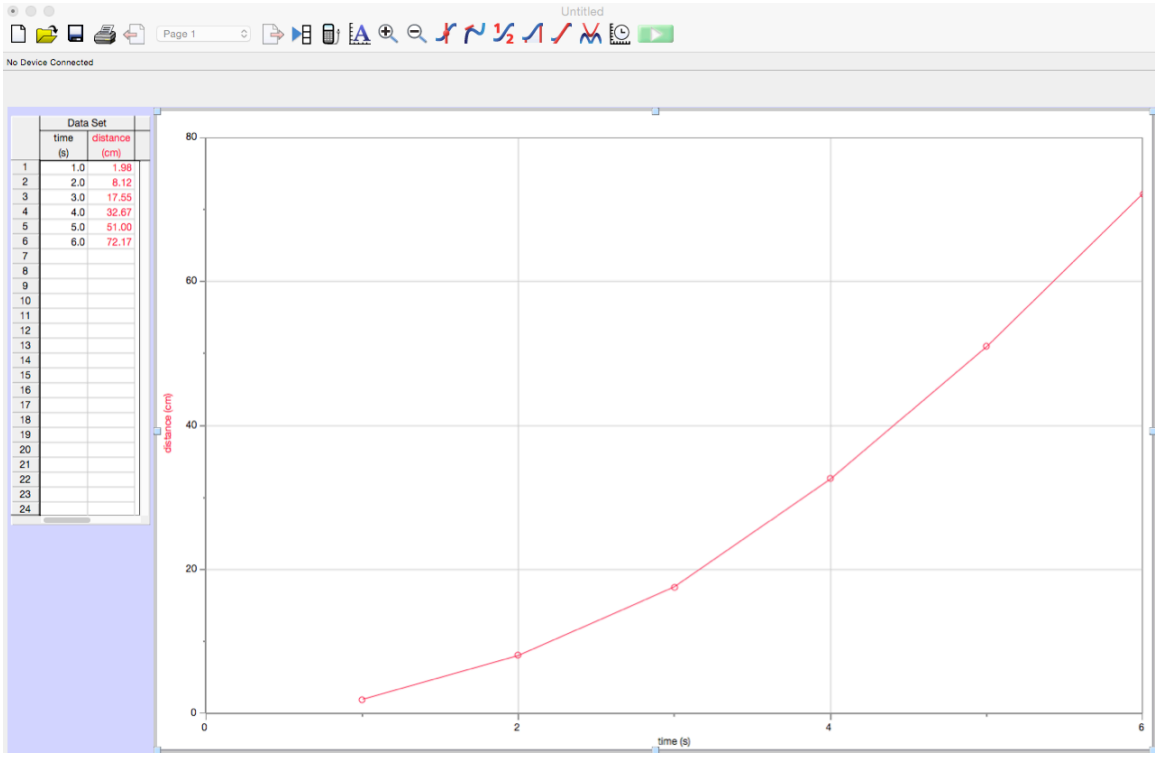


3. Now click the "Options" tab on the same window. Under "Displayed Precision", choose the correct number of decimal places or significant figures for your data from the pull-down menu. Repeat steps #2 and #3 for the "Y" (y-axis).

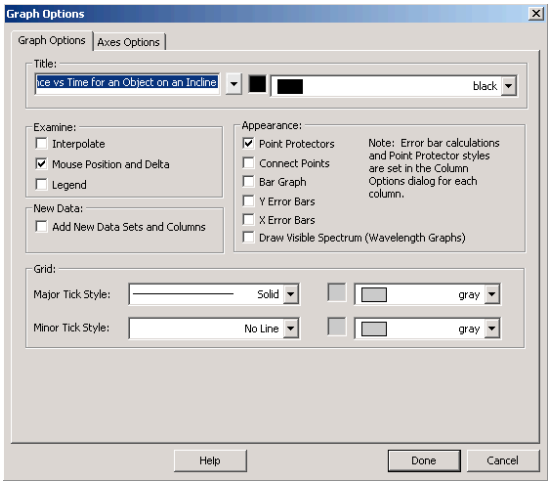


4. Enter your data in the cells under the appropriate column. If you click "Enter" after entering a value, you will automatically go to the next cell across. If you use the down arrow button instead, you will go to the next cell down.

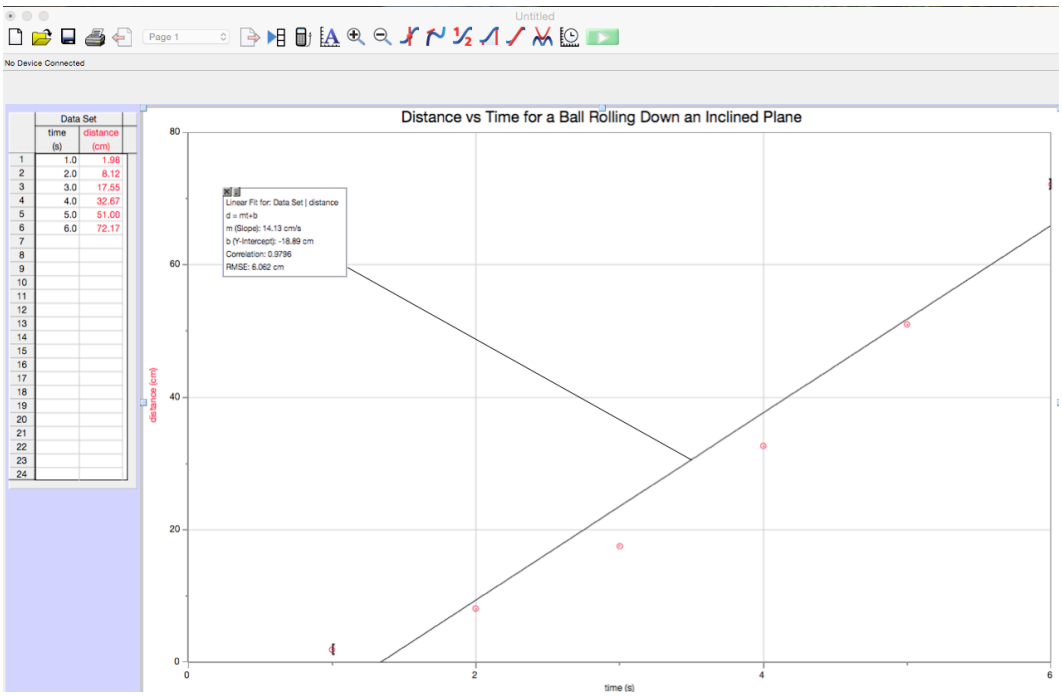
5. Click "Autoscale Graph"  to change the range of values on the axes to fit your data. It is nice to have (0,0) in the bottom left corner. If you don't after hitting "Autoscale", click on the lowest number on each axis on the graph and type "0" into the box that comes up for both axes.



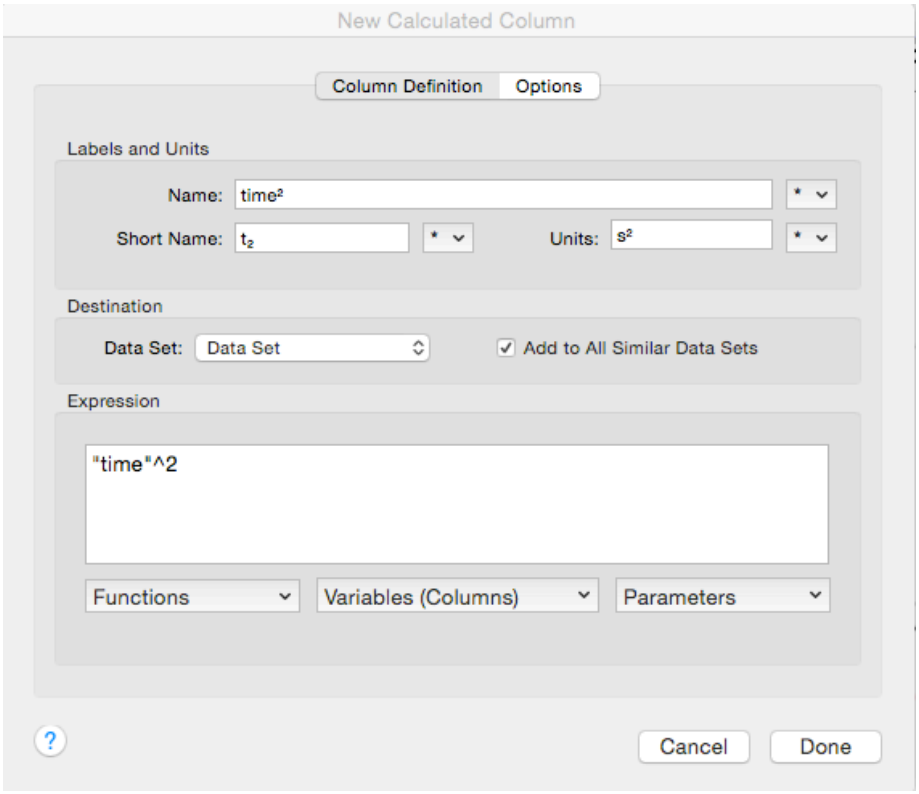
6. Click on the graph window. Go to **Options>Graph Options**. Type in a title for your graph. Under "Appearance", the only box that should be checked is "Point Protectors". You do NOT want "Connect Points" because you will be adding a best fit curve to your data.



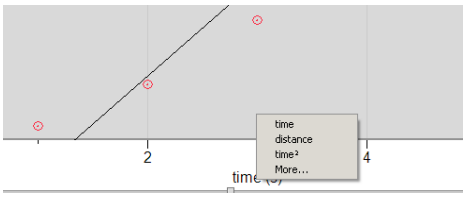
7. To fit a line to your data, click the graph. Holding the left mouse button down, drag a box from the upper left corner to the lower right corner to highlight your points in gray. Go to **Analyze>Linear Fit** or this button,  . In the box that comes up, you are given the slope and y-intercept of the best fit line. "Correlation" is a number that tells you how well the data fits this line. The better the fit, the closer this value is to '1". Note that in this case, the line doesn't hit very many points. We may be able to get a correlation value closer to 1 than 0.9796.



8. Click the data set. Go to **Data>New Calculated Column**. Using your "Graphical Methods Summary Sheet", you see that since this data appears to be a top-opening parabola, we want to graph y vs x^2, or in this case distance vs $time^2$. Type in the name of the new data column (i.e. $time^2$), the short name (t^2) and the new units (s^2). Note you can use the pull-down menu to get a superscript. In "Equation", under "Variables (Columns)", choose the name of the column you want to manipulate (in this case "time"). To raise this to a power use "^" (^2 to square it). Additional functions +, -, / (divide), * (multiply).

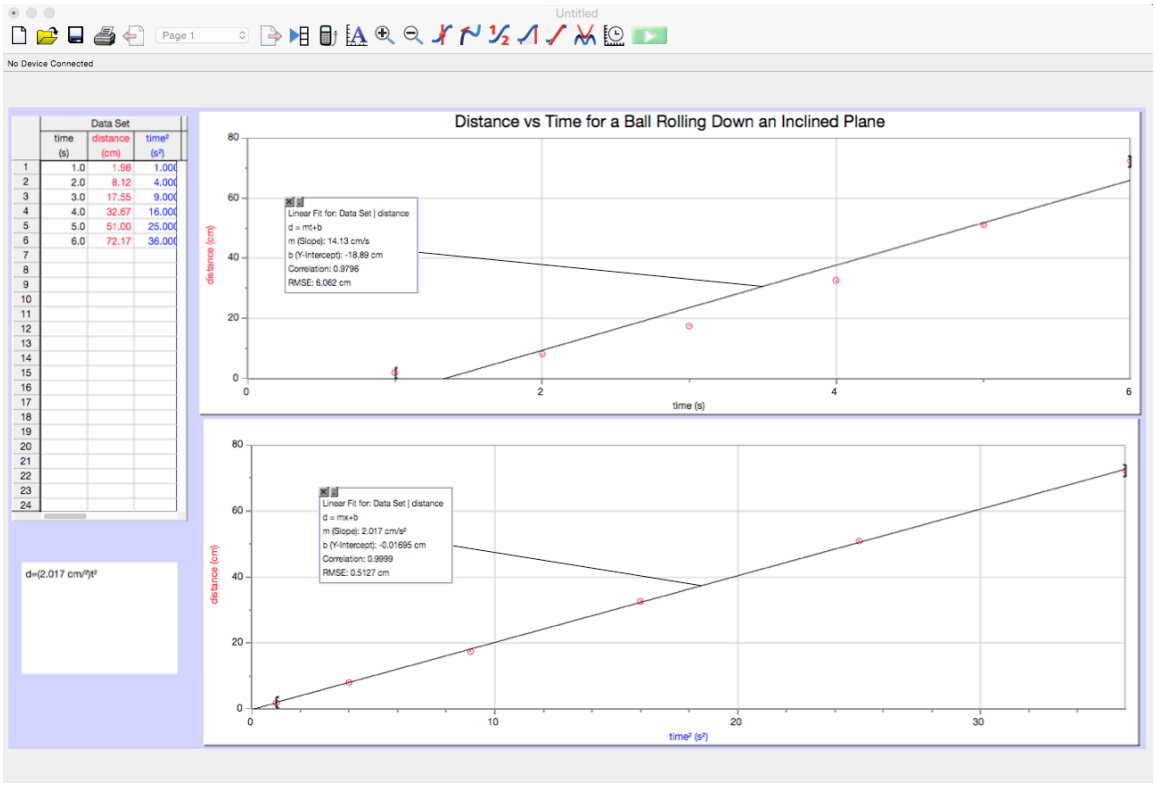


9. Go to **Insert>Graph**. On the new graph graph. Click the label on the x-axis. A pull-down menu comes up. Choose the name of your new data column (in this case $time^2$). Do the same for your y-axis (in this case chose "distance"). You can resize any of the data and graph windows by clicking on them and dragging the boxes in the corners. Make everything fit within the window, so that when you go to **File>Print** everything will be visible.



10. Repeat step #8 to fit a line to this data. Note in our example that the new correlation is 0.9999 which is much closer to 1.

11. Write the equation for the line with the best correlation. (in this case: **$d=(2.071 cm/s^2)\ t^2$**, the y-intercept falls within the 5% rule* and can be set to zero.)



* The 5% rule means that if your y-intercept value is less than 5% of the highest y-value of your data, then it can be assumed to be zero.