

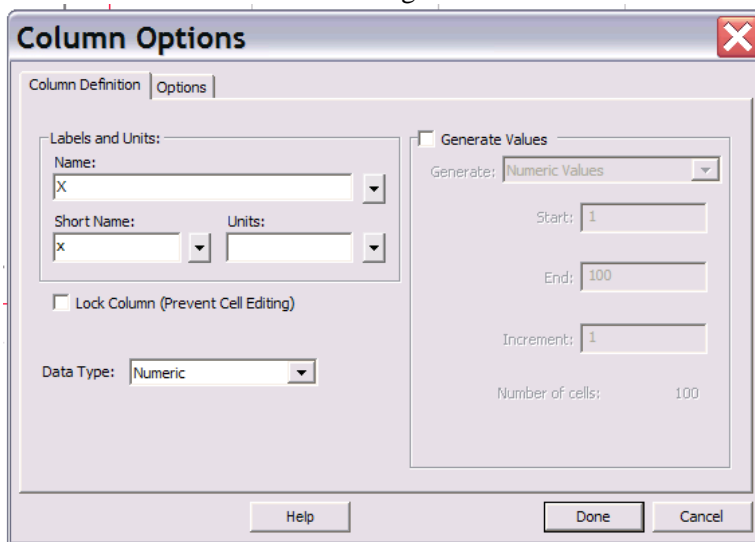
LAB EXERCISE: Graphing Physical Data and Finding Relationships with Logger Pro

SAMPLE DATA TABLE: The independent variable 't' represents elapsed time and the dependent variable 'd' represents the distance of the object from the starting point at time t.

t(sec)	d(meters)
0.00	0.0
1.00	5.0
2.00	20.0
3.00	45.0
4.00	80.0
5.00	125.0

ENTERING DATA: In order to create graphs and analyze the data, you must first enter your data into the software. Follow the steps below to enter the data into the data table.

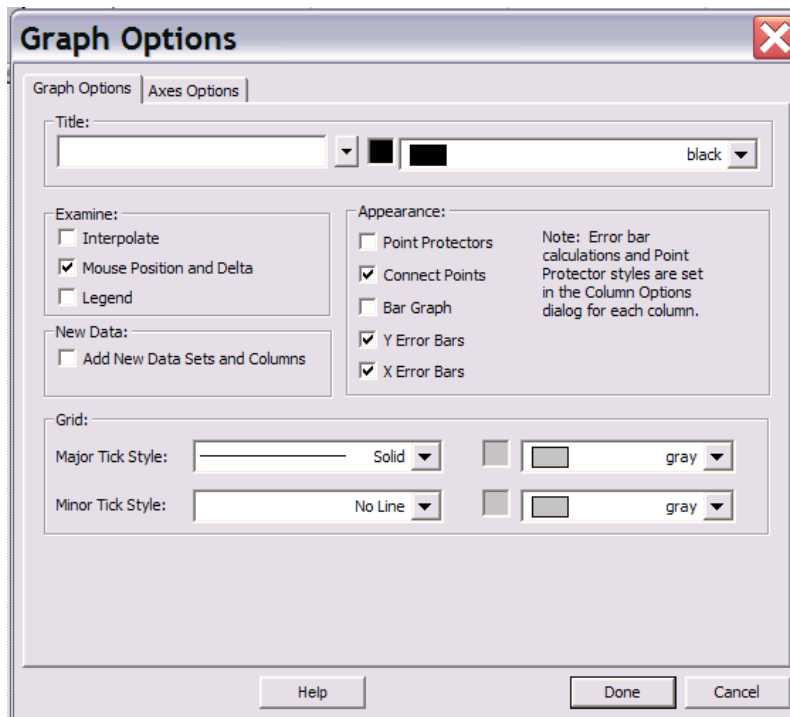
1. Open the Logger Pro software using the shortcut on the desktop. This will automatically open a blank data table and the corresponding blank graph.
2. Type your independent variable data in column X and your dependent variable data in column Y. Note how as you make changes to the data table they are reflected on the corresponding graph.
3. In order to clearly present the data, you will want to label the quantity in each column with the variable name and the units. To do this, right click the mouse anywhere in the data frame. This will bring up a menu from which you should use COLUMN OPTIONS and then DATA SET X. You now should be looking at a new frame like the one shown below.



4. In this new frame you will want to edit three areas. First, change the name from X to a more reasonable name for the data in column X (I would recommend changing the name to “Time” since this is the type of data entered into the column). Second, under short name you will want to change the x to a new variable name that represents your data (I recommend changing the short name to “t” since a good variable to represent time is a letter t.) Third, enter the appropriate units in the unit field. In this case “seconds” or “sec” is appropriate. Once you are finished click done and the changes to your data table will take effect.
5. Repeat step three above to label the data in column Y.
6. Name the data set something that represents the overall type of data recorded. To do this, right click anywhere in the data frame and choose DATA SET OPTIONS and then your data which is currently called DATA SET. This will open a new frame where you can change the name of your data set. For this activity simply call your data set “Data for Object in Motion” and then click ok.

GRAPHICALLY REPRESENTING THE DATA: Once you have entered the data and edited the column information, your graph frame will automatically be changed to match your entries. In order to make the graph more user friendly and easier to interpret, you will want to make a few changes to the graph setup. Follow the steps below to more clearly represent the data graphically.

7. Give your graph a title. To do this, right click anywhere in the graph frame. This will bring up a menu from which you should choose GRAPH OPTIONS. You should now be looking at a new frame like the one shown below. Type an appropriate title in the space provided in the frame. Your title should be written as follows: “Dependent variable” (symbol) vs. “Independent Variable” (symbol) for “Scenario”. In this case you title might read “Distance (d) vs. Time (t) for an Object in Motion”. To see your title on your graph click done.




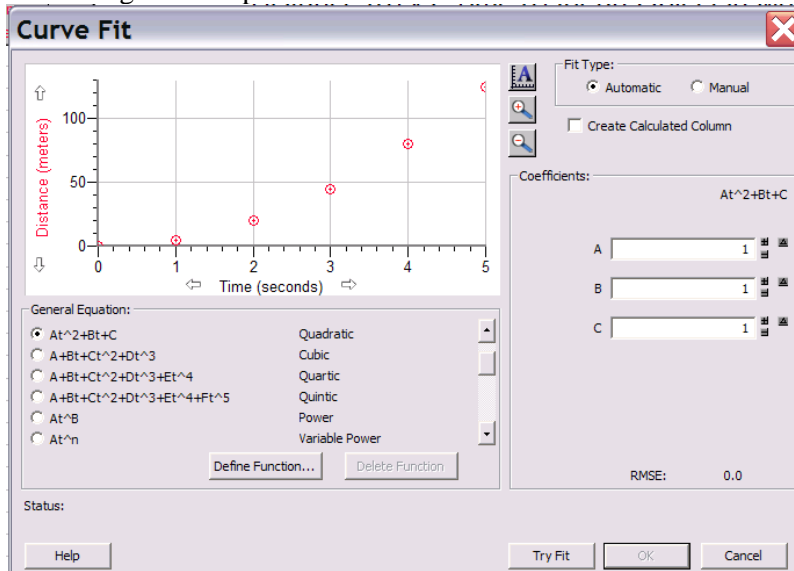
8. Remove the auto-fit data connecting lines and make the data points visible. To do this, once

again right click on the graph frame and choose GRAPH OPTIONS. In the graph options frame, un-select the “Connect Points” option and select the “Point Protectors” option. To see your data displayed properly as independent points on the graph click done.

9. Rescale the graph to appropriately fit the data. To do this, right click anywhere on the graph frame and select AUTOSCALE from the menu that appears and then AUTOSCALE from the second list. To see your rescaled graph click done.
10. Save your work so far in your student folder and then print off a copy of your data table and your graph. In the physics lab you will need your data and graph to be on SEPARATE SHEETS. To print the data table only, choose FILE from the top left and then PRINT DATA TABLE. To print the graph only, choose FILE and then PRINT GRAPH.

DETERMING AND PLOTTING THE REGRESSION LINE AND EQUATIONS: In almost all cases in the physics lab you will need to find a curve (regression line) that models your data so you can analyze or explain a relationship between two variables. Follow the steps below to model and analyze your data.

11. To model your data with a regression line (curve), click on the  button at the top of the screen. Doing so will open a new frame like the one shown below.



12. You now will need to draw on your math background (or look at chapter 7 in the bible) to decide which type of regression equation will best fit your data. Choose your equation type from the “General Equation” options and then push “Try Fit”. If you have chosen the correct type of curve most of your data should be on or close to the sample curve now placed in the graph in the frame. If you feel confident that your chosen equation is the model with the curve that best fits your data click ok.
13. Your graph frame should now automatically your graph so the curve and regression equation information are displayed clearly on the graph. Note that in the box the general equation for your regression line is shown with the variables ‘d’ and ‘t’ plugged in and the regression equation coefficients are given. This information mathematically describes the relationship between the data you have been working with. Verifying mathematical relationships is almost always the purpose of labs conducted in physics.
14. When you are done plotting the regression line and obtaining your regression equation save your work again. Now, print off your new graph showing the regression curve and regression equation. Lastly, put your name ON ALL THREE sheets you have printed and turn them in to Mr. Berger.