

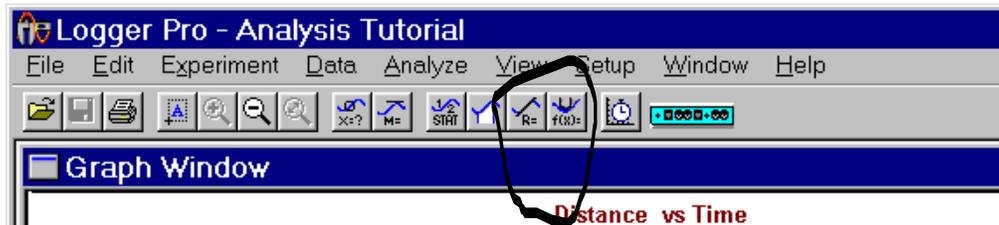
## Analysis of data using LoggerPro Pre-Lab

Start LoggerPro. Open the sample data file by going to the file → Import from → text file menu item and a data file selecting window will popup. Click on the “Desktop” on the left panel then find the data file in the Tutorial folder. Select any of the file named “data##.txt”, where ## is the number of the data set assigned to you, from the dialog box. Once you open this file you will be presented with a set of sample position data and a position – time graph. You may need to rename the columns. To do this, simply double click on the column heading. You should create a velocity data column.

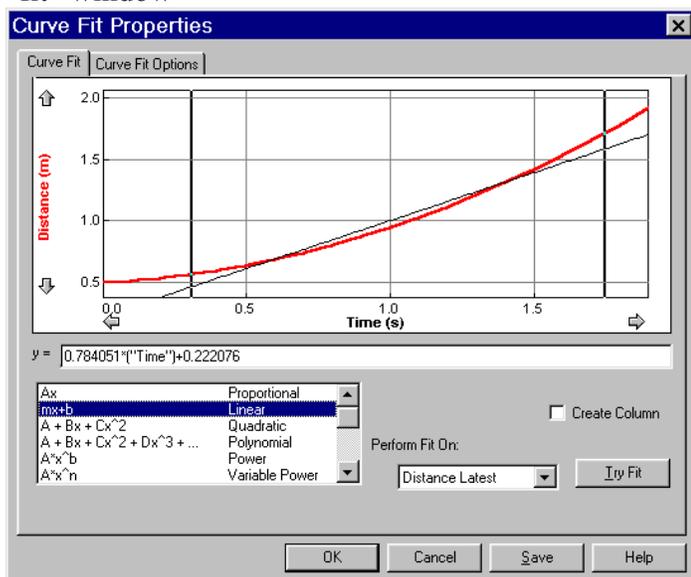
Data number:

**Position analysis:** Right click the mouse at one end of the region of interest on the graph (i.e. where the cart was moving) and then drag the mouse to the end of the region of interest (just before the cart stops). This selects the set of data that will be fit by the fitting routines. When you select a region of interest on one graph, it selects the same region for all of the data sets (i.e. if you select a region of interest for the position – time data, then the same region is selected for the velocity and acceleration data).

There are two buttons on the menu bar for curve fitting: the one on the left (a line with R=) is for “linear regression.” The button on the right (with f(X)=) is for functional fits. The latter is a more general system that includes linear, polynomial, logarithmic, exponential, power, etc. If your data looks linear, then it might be reasonable to use a linear fit. If it does not, then perhaps a more complex function should be used. One must get used to the idea that rapid variations are often noise and the best-fit curve goes through the center of this noise. (Please note, the graph shown here is an earlier version of Logger Pro. It might be slightly different from what you see on your screen.)



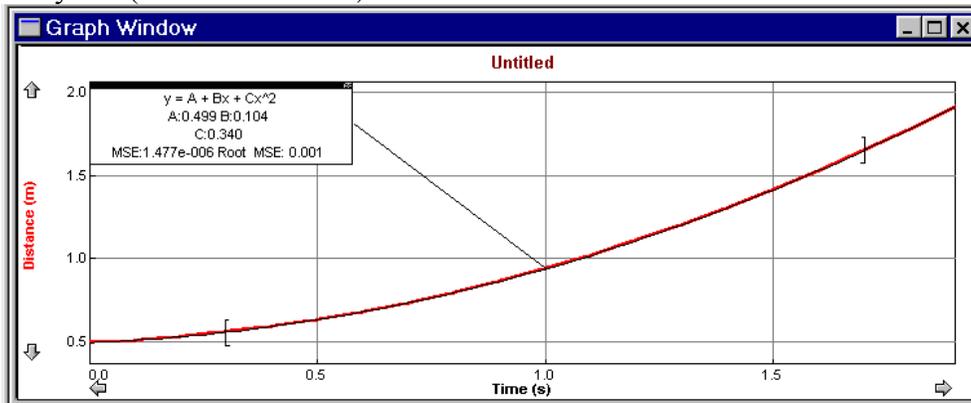
Select a region of interest in the distance vs. time window and then press the “curve fit button.” This opens a “fit” window



Choose a function such as say “Linear” and then click “Try Fit.” This will show the fitted curve (a line in this instance) in Black overlaying your data. Notice that this is not a stellar fit to the data.

1. Explain fully and precisely why this fit would be rejected.

Next try a “Quadratic” fit. If this looks appropriate, then click “OK” and continue. The graph will now show the fit parameters (A, B and C). These quantities have meaning that can be partly discerned by dimensional analysis. (You should do so).

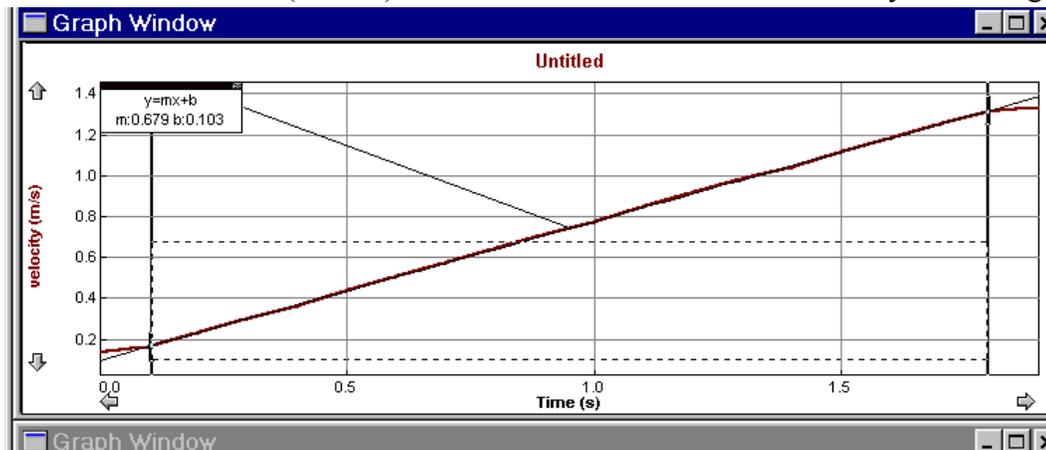


In the example above: A has a value of 0.499, B has a value of 0.104, and C has a value of 0.340, with units of \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_ respectively. A has a value of 0.499 with units of \_\_\_\_\_ which means it is a \_\_\_\_\_ (physical quantity). B has a value of 0.104 with units of \_\_\_\_\_ which means it is a \_\_\_\_\_ (physical quantity). C has a value of 0.340 with units of \_\_\_\_\_ which means it is a \_\_\_\_\_ (physical quantity).

Your values will differ. Record them in the table.

A=	
B=	
C=	

When we perform similar types of fits on the velocity curve, we must be aware that this data is calculated from the distance data. Any errors in the distance data gets magnified in the velocity data. Furthermore, the leading and trailing data points of the velocity data are invalid because they average in zero or constant values for the initial and final data points in the smoothing function. These data points are actually outside of our interval of interest. The duration (in time) of this invalid data can be decreased by increasing the sampling rate.



Regardless, upon examination of the velocity - time graph, we found that we could use a linear fit. Doing so, we arrive at the picture at left.

Notice the regions at the beginning and end of the data that are flat. These regions are an artifact of the way LoggerPro calculates the velocity

(when using the smooth function in the velocity definition) and are therefore excluded from the fit. This graph contains a fit line with a slope of 0.679 and an intercept of 0.103 (Again, your values will differ). These quantities also have units and by dimensional analysis we are able to compare them with the quantities determined by fitting the distance – time data. The appropriate units for the example above are 0.679 \_\_\_\_\_ and 0.103 \_\_\_\_\_.

Your value for the slope is \_\_\_\_\_ with units of \_\_\_\_\_ which means it is a \_\_\_\_\_. Your value for the intercept is \_\_\_\_\_ with units of \_\_\_\_\_ which means it is a \_\_\_\_\_.