Graphical Analysis

Purpose: To gain experience in drawing graphs and in using graphing software.

Equipment Needed: Windows based computer with Graphical Analysis software.

Procedure:

Part I.

1. Turn on the computer and open the **Physics Apps** folder by double clicking on its icon. Load the **Graphical Analysis** software by double clicking on its icon. Notice, as the program starts running, that there are three separate windows (text, data table, and graph) on the screen. These windows are always available when using Graphical Analysis. You can close any of the windows that you do not need. Try closing the text window by clicking the right mouse and using delete (text window has to be blank). Can you figure out how to get it back?
2. Click on **File** on the menu bar at the top of the left of the screen and choose **Open**. Double click on **Physics** folder and then double click on the filename **functionplot**. You are opening a file that was previously prepared for this lab. It should show a graph of a function and the data used to create the graph. Read the instructions that appear in the text window to see how to enter your own function.
3. Choose a mathematical function of your own to plot or ask your instructor to give you a function. Make up a name for your function and the variable that it depends on. For example, function name: *my grade in physics*, variable that it depends on: *number of hours that I study*. Label your axes on the graph with the names you chose by double clicking on the heading of the **X** column in the data table window and typing the new name in the **Name** box. Also put in the proper units in the **Units** box. Click on okay and observe the corresponding changes in the graph window. In a similar way, give a name for the Y column and enter the proper units as well. You can also choose a color for the data points. Choose a title and place it on your graph by double clicking on the **Y vs X** at the top of the graph and typing in your title. Enlarge the graph window to fill the entire screen. You can move your window using the right mouse.
4. Double check to see that your graph has the appearance that you want and then ask your instructor to okay it. Obtain a printout of your graph (no data table please) by selecting **File/Print.**

Part II.

5. The data shown below is representative of an experiment done with a freely falling body. It gives distance traveled (neglecting air resistance) as a function of time. Create a graph of this data using the same Graphical Analysis software. Choose **File/New** and click on the first blank cell in the **X** column. Enter *time* from the data table below. Push the **Enter** key and enter *distance* in the **Y** column. Continue in a like manner until all the data pairs have been entered. Notice that as each data pair is entered the corresponding point appears in the graph window.

Falling Body Data				
Time(s)	Distance(m)		Time(s)	Distance(m)
1.00	4.85		6.00	175
2.00	19.2		7.00	225
3.00	46.8		8.00	310
4.00	72.0		9.00	399
5.00	127		10.00	482

6. Double click anywhere in the graph window and examine the **Graph Options** window that has opened. You can control various features of the graph by choosing different options. Try a few, but do remove the **Connecting Lines** option (a practice we will normally follow when graphing experimental data). Double click on the heading of the **X** column in the data table window and type in "Time" for the column heading in the **Name** box. Also put in the proper units in the **Units** box. Click on okay and observe the corresponding changes in the graph window. In a similar way, name the Y column "Distance" and enter the proper units as well.
7. Choose a title and place it on your graph by double clicking on the **Y vs X** at the top of the graph and typing in your title.

8. We can study the relationship between distance and time for a freely falling body by asking the computer to analyze the data and come up with a mathematical function that best fits this relationship. This is sometimes a difficult challenge, but in the case of a falling body the relationship is not too complex. Select the data to use in the fitting process by clicking and dragging across all of the data points in the graph window. **Choose Analyze/Curve Fit**. The program will present you with a list of potential functions. Can you choose the best function by looking at the data point on the graph? Double click on your choice and observe the fitted curve drawn through the data. If the fit looks good, click on **ok**. Get an okay from your instructor also and then print out your graph and the data table by selecting **File/Print**.
9. Write the equation describing the curve in your graph by using the fit data supplied by the computer. Use the symbols **x** for distance and **t** for time. Write the equation on your graph printout.
10. Answer the following questions about your newly found equation (in part 9) for a freely falling object (**Express the answers to these last two questions as a percentage.)**:

    According to your equation, what would happen to the distance that an object falls if the time of fall was increased by 12 percent?

    According to your equation, how much further would you allow an object to fall if you wanted to increase the time of fall by 15 percent?