

# Data Analysis Using Microsoft EXCEL

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## Introduction

The use of computer technology in the experimental sciences has facilitated the way physicists, engineers, chemists, mathematicians, and many others are able to acquire and analyze large amounts of experimental data. There are several hardware and software programs available for this purpose. Examples of software include Microsoft EXCEL, Mathematica, Math Cad, Data Studio, and Cricket Graph. One of the objectives of the science laboratory course is that the student becomes proficient in using computer technology for analyzing data. In industry most data is acquired and analyzed using some type of hardware and software and seldom is it touched by human hands. Therefore, providing the science student with a proficiency in using computer technology to analyze data in the laboratory will be a very valuable skill that will certainly benefit them in their future careers.

## Equipment

1. Windows/Macintosh computer.
2. Microsoft EXCEL (already installed on computers).

## Objective

### **To use Microsoft EXCEL to:**

- a) Enter a given set of data into an EXCEL spreadsheet.
- b) Graph the data
- c) Label the title of the graph
- d) Label the axis with appropriate units
- e) Make minor and major gridlines on graph
- f) Scale axis
- g) Obtain the best-curve fit along with the equation
- h) Manipulate data using the mathematical functions of EXCEL without the use of a calculator.

## Exercise 1: Graphical Analysis with EXCEL

*In this exercise you will learn how to enter a given set of data into an EXCEL spreadsheet and use the graphical analysis features.*

1. Open the program EXCEL.
2. Enter the following set of data in column format.

time	position
0	2
3	5.67
5	14.25
7	22.6
10	39
13	60
16	85

3. Select the entire set of data including the headings 'time' and 'position'. Noticed that I have entered the data for 'time' **first and then** 'position'. The reason for doing this is because EXCEL automatically plots the first column of data on the horizontal X-axis and the second column of data on the vertical Y-axis. EXCEL is able to plot the data in any order regardless of how you enter the data, but for now we will use the simplest method.
4. While having the data selected click on the 'Chart Wizard' icon on the Tool Bar. This will bring up a screen menu that will take you through 4 steps on graphing the data you have entered.
5. Select 'XY(Scatter)' from the options available and click 'Next'.
6. A graph will appear with the appropriate data range. Click 'Next'.
7. The 'Titles' screen will appear. In this screen you will be able to enter the title of the graph and label the axis with their appropriate units. Enter the following information:

Chart Title: Position vs. Time

Value (X) Axis: time (s)

Value (Y) Axis: position (m)

8. Next click on the 'Gridlines' tab. Here you enter minor and major gridlines for the X-axis and Y-axis for easier reading of graphical data. Click on 'Next' when finished.
9. The screen that now appears gives you the option of saving the data as a new sheet or as an object in a sheet. Select whichever one is appropriate and then click on 'Finish'.
10. As with any graphical representation of data you must scale your graph appropriately to help interpret the data entered. To scale the horizontal axis double-click on the horizontal axis. The 'Format Axis' screen will appear. Click on the tab that reads 'Scale' and enter the numbers for an appropriate scale.
11. Repeat step 10 to scale the Y-axis.
12. Next, you will obtain the equation of the best curve-fit for the data you have entered. Click anywhere inside the graph to select the graph. Go to the 'Chart' menu and select 'Add Trendline....' Click on the 'Type' tab and select the type of curve that best fits the data. Now click on the 'Options' tab and select 'Display Equation on Chart'. The best curve-fit along with the equation should be displayed on the graph.
13. Print graph and data and hand in.

### **Exercise 2: Using EXCEL functions for data analysis**

EXCEL has the capability of using various mathematical functions to perform data analysis for a given set of data. Large sets of data can be manipulated with ease and efficiency quite rapidly. Consider the following set of data for the variable X:

X
2
4.5
7
9
12.5
16
20

Suppose an experiment requires that you perform the calculation  $\ln(X) + 5$ . Let's go over the steps on how you would do this on EXCEL.

1. Enter the above set of data into EXCEL in column format. Label the next column  $\ln(X) + 5$ .
2. Click on the cell to the right of the first data number and enter the equal sign =. When you enter the equal sign you are telling EXCEL that you will be entering an equation.
3. Now go to the 'Insert' menu and select 'Function'. Here you have a list of functions available which are sorted out by category.
4. Select 'Math & Trig' and choose the natural log function LN on the right of the screen. Click 'OK'.
5. The screen that now appears wants you to enter the **cell number** that belongs to the data number that you want to calculate the natural log. **Click** on the first data number, which is 2. **DO NOT ENTER THE NUMBER 2!**
6. Click 'OK'. The numerical number to the right of the number should be 0.693 which is  $\ln(2)$ .
7. Click on the cell with the number 0.693. Add 5 to the equation in the 'Equation Bar' so that it reads  $= \ln(X) + 5$ . The value X in  $\ln(X)$  will refer to the cell number and *not the data number*. Push 'ENTER' and see that the value now reads 5.639.
8. Click on the cell with the number 5.639. Notice that there is a small square at the bottom right-hand corner of the cell. Move the pointer to this corner. The pointer will change to a small, black cross. Click and drag this corner down until you reach the last cell corresponding to the last data number. Release the mouse button and notice that you have calculated  $\ln(X) + 5$  for all the data values.
9. Print data and hand-in.

### Summary

After completing these 2 exercises you should be able to analyze and manipulate data acquired in the physics laboratory using Microsoft EXCEL. These skills will be valuable to you, not only in your physics course, but in other engineering and science courses that you may take. Although you may work with different data analysis software, the process and approach will be similar. If time permits, feel free to 'play around' with the other data analysis features of the program.