How to Make a Quality Graph

Abstract

This application note describes a technique for producing high quality line graphs.

Introduction

Engineers are problem solvers. In addition to solving problems they are expected to identify problems. A tool that they use to do both is the graph. A graph is a simple, visual way of representing relationships between various quantities, parameters, or measureable variables. One of its greatest advantages is its ability to allow for the organization and presentation of large amounts of data in a way that most any user can understand.

Graphing Procedure

1. ***Collect your data.*** After you have it all in one place, you should have one *independent* variable (time for instance) and one *dependent* variable (like a parameter you measured as a function of time). Here are some points to use as an example; the measured position of a ball as a function of time:

Time(s)	Position (cm)
1	3.0
2	3.4
3	4.8
4	5.0
5	5.3

2. ***Determine the range of your data.*** In order to determine how large a graph to make and the axis ranges, it's important to find out how much the numbers vary. In this case, time varies from 1 to 5 seconds, and position varies from 3.0 to 5.3 cm. There needs to be enough space on the graph to fit all this data. *NOTE THAT YOU DO NOT HAVE TO USE THE WHOLE SHEET OF PAPER FOR YOUR GRAPH!* It's perfectly acceptable to use only part of the page as long as the graph can be read and interpreted without a magnifying glass. The independent variable (time, in this case) will go on the x-axis (the one parallel to the bottom of the page, and the dependent variable (position, in this case) will go on the y-axis (parallel to the left hand side of the page). Draw axes that are large enough for all of the data. (See Graph Example, p. 2)

3. ***Label your graph and your axes.*** THIS IS VERY IMPORTANT! When presented with your graph, *other people should be able to figure out what is plotted without asking you.*
Titles of graphs are usually "Y versus X"; so in this case, our title is "Position versus Time." (NOT position divided by time, or position minus time.)
Labels on the axes must have units! In this case, the label on the x axis (the one on the bottom) should be "Time (seconds)" and the label on the y axis (the one on the left) should be "Position (centimeters)."
Remember to write the numbers on the graph as well. The numbers should be evenly and logically spaced - what is meant by this is the following: for the position data here, the y-axis should be marked off in increments like (1,2,3,4,5,6) or (2,4,6,8), NOT (1.3, 2.6, 4.8,...) or anything else out of the ordinary.

4. ***Plot your data.*** Now, go ahead and place the data points on the graph. Make them big enough to be seen, but not big enough to look like you were eating pizza while making your graph.

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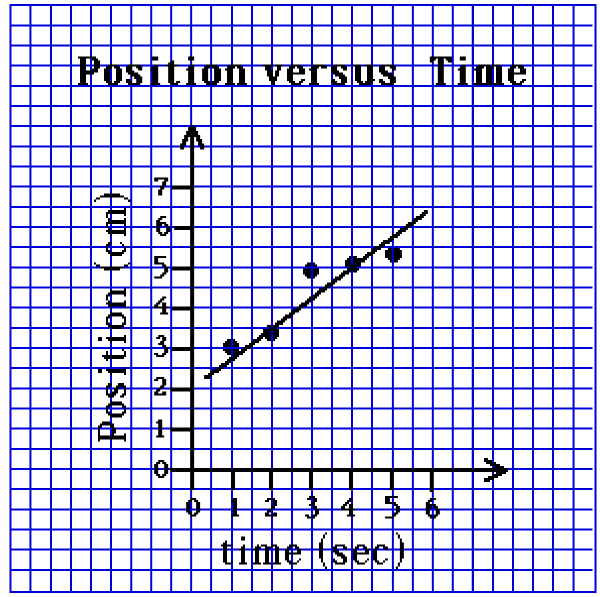
5. ***Draw a "line of best fit."*** THIS DOES NOT MEAN CONNECT THE DOTS! Only rarely will a graph need to have the data points connected by a jagged line. Usually, it's best to guess at a (straight) line that goes as near as possible to as many points as possible. (See example.) THE ORIGIN IS NOT ALWAYS INCLUDED AS A POINT! And, sometimes there will be a LOT of scatter and it might not be clear where a line should go.

Now you're done with your graph, but you're not *finished* yet.

6. ***Think about what your graph means.*** The slope of the line that you drew describes how fast your line rises (or falls). To find the slope of your line, pick two points on the line, as far apart as possible. These two points are described as (x1,y1) and (x2, y2). In this example, two points the line intersects are (x1,y1) = (1, 2.8) and (x2, y2)=(4, 5). The slope of the line is given by (y2-y1)/(x2-x1), which here is (5-2.8)/(4-1) = 2.2/3 = 0.73
The units of the slope are also important. In this case, y's have units of cm, and x's have units of seconds. So, the units of the slope are cm/s, or in this case, 0.73 centimeters per second (cm/s). Therefore, on the average, for every second measured, the ball moved about 0.73 centimeters.

Graph Example



Conclusion

This app note describes a technique for creating almost any type of line graph. There are many ways to analyze a graph, and you will encounter them as you work with graphs in various situations.

Reference

http://astro.uchicago.edu/cara/outreach/resources/other/howtograph.html