

Appendix B: Graphing Techniques

Graphing is one of the most useful tools for interpreting experimental data. By the means of a graph, relationships between dependent quantities can be easily visualized. In this laboratory, we will be concerned primarily with quantities which are linearly related to one another. This relationship can be mathematically represented by the equation for a straight line:

$$y = ax + b$$

In the above equation, y is said to be a linear function of x . If one were to graph this relationship with y plotted along the vertical axis or y -axis, and x plotted along the horizontal axis or x -axis, the graph would form a straight line. The **slope** of the line refers to the "rise over run" of the line. With the equation written in the above form, the slope is given by a . The **y-intercept** refers to the place where the line crosses the y -axis. In the above equation, this is given by b .

In practice, you will be measuring both quantities and then plotting them on graph paper. You can then determine the slope and y -intercept from the graph. Consider the case of a spring described by Hooke's Law:

$$F = -kx$$

That is, the force F exerted by the spring is equal to the negative of the spring constant k multiplied by the displacement x . Since this equation is in the same form as the linear equation above, a graph of force versus displacement should be linear. In addition, from the slope of such a graph, one could determine the spring constant.

Neat graphs are important for good reports. Here are a few rules to help you produce neat, clean graphs.

1. When making graphs, use a sharp pencil and a straight-edge.
2. Always label your graph at the top. The label should indicate which two quantities are being graphed and should read something like: "A versus B." The first of these two variables (A) is plotted along the y -axis, while the second is plotted along the x -axis.

3. Before you begin drawing, determine the range of data you wish to graph, and scale your graph appropriately. If your values for x range from 0 to 100, and your values for y from 1 to 10, you should use $1/10$ the number of ticks (graphing marks or lines) for x as for y . Before plotting anything, be sure that all your desired data points will fit on your graph. If your experiment requires only that you measure the slope and not the y -intercept, it is not necessary to have the origin (0,0) as part of your graph.

4. Label the axes of your graph with the appropriate units. For example, if you measured displacement in centimeters, your label would read, "Displacement (cm)."

Graphs with no labels are unintelligible.

5. Use a pencil to place dots at the point of the graph for each data point. Do not "connect the dots." If the experiment so instructs, you may use a straight-edge to estimate the "best-fit" line through the data. When graphing multiple data sets on the same graph, it may be useful to represent data points by squares, x's, or circles.