

How to Create a Mathematical Model from a Straight Line Graph

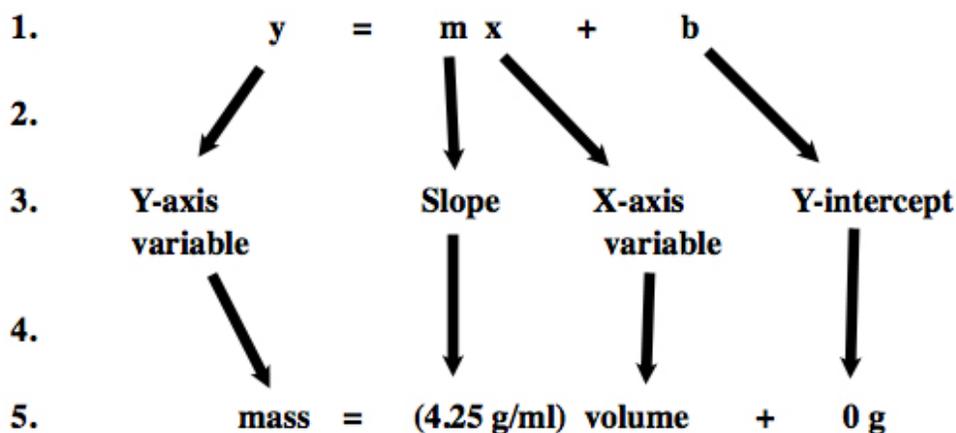
Finally a Way to Use: $y=mx + b$!!

Plot your data on a graph and create a line of best fit of the data

- Use the *Logger Pro* program to graph your data
- As long as your data looks to be in a straight line (roughly), do a linear fit (Analyze->Linear Fit). Make sure you DO NOT “Connect the dots.”
- Key Idea: The straight line the computer generates is the best representation of all the data you have collected and graphed. It is called a “regression line” or “line of best fit.”

Step One: Create a mathematical model from the graph of your data

Since your data appears to represent a straight line, you can go from the general equation for a straight line $y=mx + b$ to the specific equation for your straight line. The example below correlates to the graph on the handout, “How to Calculate the Slope of a Line.” You must show each of the 5 steps in order to get full credit on a lab. This includes the words on #3 and the arrows on #2 and #4. Do not forget **units** on the **slope** and **y-intercept**.



Step Two: Use the 5% Rule

As a result of possible human error in taking data in an experiment sometimes a y-intercept on a graph that should be zero might not be zero.

To determine if this is the case we use the 5% rule.

The rule will tell you whether to keep the y-intercept in your mathematical model, because it is significant and means something, or change the y-intercept to zero, since that is what it should have been if there had been no human error.

1. Find the maximum y-value from your data table.

2. Find your y-intercept.

•It can be found in the box that was created on your graph by *Logger Pro* when you selected: Analysis->Linear Fit

3. Use the following formula.

$$\left| \frac{\text{Y-intercept}}{\text{Maximum y-value from your data table}} \right| \times 100 = \quad \%$$

If the number you have calculated is less than 5% then you consider the y-intercept should have been zero. Make the y-intercept zero in your final model.

If the number you have calculated is greater than 5% then you realize the y-intercept is not due to human error- it is significant- and therefore you keep it in your final mathematical model.

Important thing to remember: A model is not a model unless you apply the 5% rule!

Step Three: Final Model

The final model will include the results of applying the 5% rule. Either keep or eliminate the y-intercept and box your final model. Be sure to explain why you keep or eliminate your y-intercept using the results of the 5% rule.

$$\boxed{\text{mass} = (4.25 \text{ g/ml}) \cdot \text{volume}}$$