

Experiment 0 ~ Introduction to Laboratory Practice

Equipment:

lab manual, textbook, scientific calculator, meter stick.

Procedure:

This experiment may *seem* really trivial, but it is important, because it will show you how tricky it is to get good and reproducible measurements, and give you a chance to calculate mean values and standard deviations.

You will measure the length and width of a rectangular object (a wooden board, or your textbook) with a meter stick. To make the measurements, each person in the group will take turns placing the meter stick on top of the board, keeping it parallel to an edge. **DO NOT** try to place the meter stick at a specific number. Then write down the values for l_1 and l_2 in Data Table 1. These values are the positions of the two edges of the side you are measuring; the difference between them is the length of that side. Repeat this for the width. Then calculate the mean and standard deviation by hand, as described above.

l_1 (m)	l_2 (m)	$l_2 - l_1$ (m)

w_1 (m)	w_2 (m)	$w_2 - w_1$ (m)

$\langle Length \rangle =$ $\sigma_{Length} =$

$\langle Width \rangle =$ $\sigma_{Width} =$

Type the numbers you have measured above into an Excel spreadsheet. You can actually calculate the mean and standard deviation using Excel! **Much** easier than doing it by hand, but

we forced you to do it by hand the first time around, so that you would see exactly how the calculations are really done. Now, use Excel to calculate the means and standard deviations:

$$\langle \text{Length} \rangle = \quad \sigma_{\text{Length}} =$$

$$\langle \text{Width} \rangle = \quad \sigma_{\text{Width}} =$$

Questions (to be answered in your lab report):

1. Did you get the same values for mean and standard deviation from your hand calculations as when you used Excel? If not, what do you think the sources of error might be?
2. Earlier, we discussed types of systematic errors caused by problems with equipment, or biases on the part of the person doing the experiment. What about systematic errors arising from the design of the experiment? We didn't give any example of those. Can you think of an experiment that might have a systematic error built into its design?
3. In the Excel tutorial, you got an equation for each of the three data sets you plotted, when you plotted the trendline. Are these equations the same as the ones you used originally in order to generate the numbers in columns E, F and G? Why or why not?
4. Suppose you were to calculate the area of the rectangle you measured in the experiment. How might you estimate the error of the area measurement? (Remember that you have already calculated the standard deviation for each side.)