# Translating Mathematical Formulas Into Excel's Language

Introduction

Microsoft Excel is a very powerful calculator; you can use it to compute a wide variety of mathematical expressions. Before exploring Excel's more advanced capabilities, however, it is necessary to have a good working knowledge of how to make Excel calculate a mathematical expression as you would by hand. Fortunately, translating math formulas into something Excel understands is quite intuitive; Excel uses many familiar symbols and follows the order of operations rules used in mathematics.

Entering Formulas in Excel[1]

Formulas can be entered into any cell on Excel's spreadsheet. You can enter a formula either by clicking on a cell or by clicking in the formula bar. Whatever you then decide to type will appear both in the cell and the formula bar, however, the cursor will only appear in the area where you clicked.
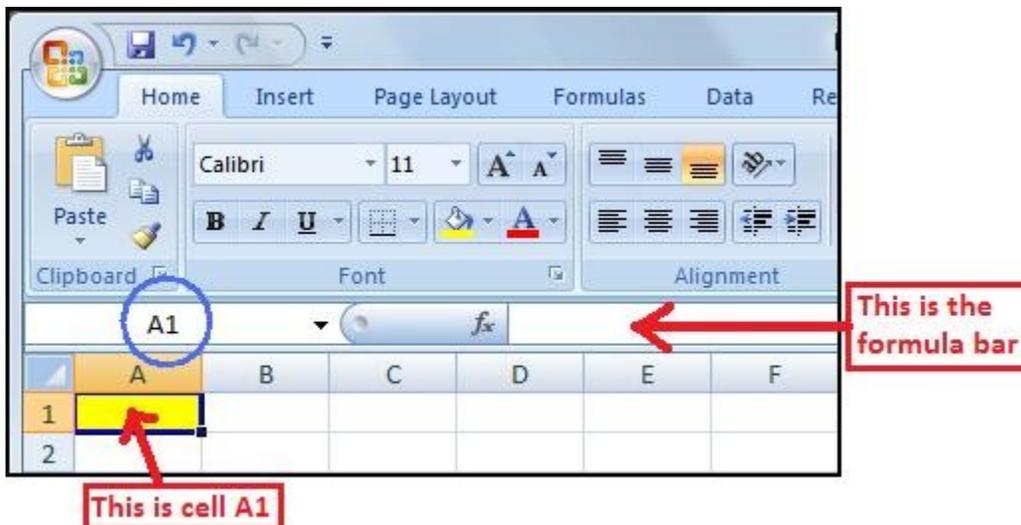
You may find that when modifying your formulas or working with large formulas, typing in the formula bar is easier. To use the formula bar, just click on the cell so that it is highlighted with the black box (the box filled with yellow in the picture above) and then click in the formula bar. The cursor will then flash in the formula bar. The name of the cell with which you are working appears in the space circled above.

You may remember PEMDAS from algebra class, which is an acronym indicated the correct order of operations in mathematics.

<div align="center">

Parentheses
Exponents
Multiplication
Division
Addition
Subtraction

</div>

Excel follows this order and using an expression on the next page, we will see the symbols Excel uses for these operations.

SAMLab Tip Sheet #1

Here is the formula we'll calculate:

$$\frac{\left(\left[\frac{(13+39)^2}{4}\right] - [3 \times 2^2]^2\right)}{\sqrt{25}} =$$

Here are the symbols Excel uses[2] in the PEMDAS order:

- Parentheses: **( )** Shift + 9 or 0
- Exponents: **^** Shift + 6
- Multiplication ***** Shift + 8 or * on numerical keyboard
- Division **/** On keyboard or numerical keypad
- Addition **+** Shift += or + on numerical keyboard
- Subtraction **–** Hyphen or – numerical keypad

In order for Excel to know you want it to calculate something you must first type the "=" character in the cell. **Every formula always begins with the "=" character.** Here is what the above formula looks like in Excel:
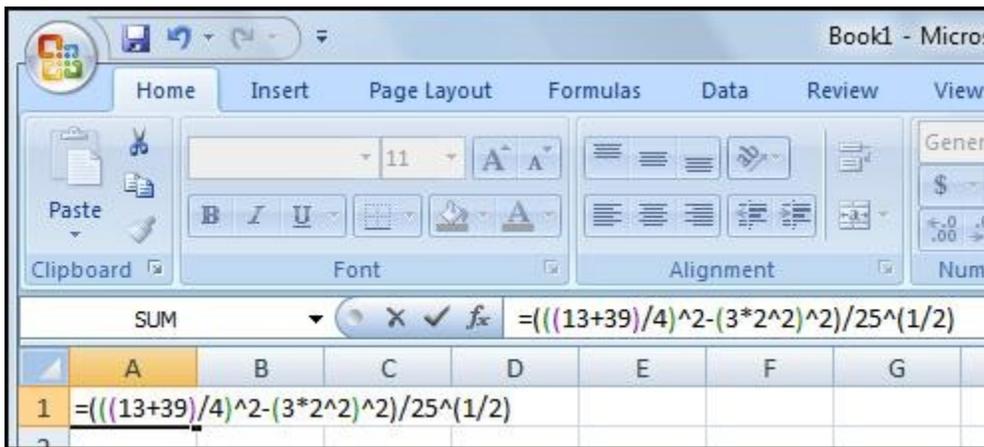
For a step-by step construction of the Excel input on the left see the very end of this handout.

The formula may look a little daunting in the cell, but it really is not as scary as it looks[2]. When typing this formula into the cell, you do NOT have to start typing what's on the left first. To make sure you're typing the formula in correctly, try starting with the expression in the innermost set of parentheses, which in this case is 13+39. Check out the picture below for how you might proceed.
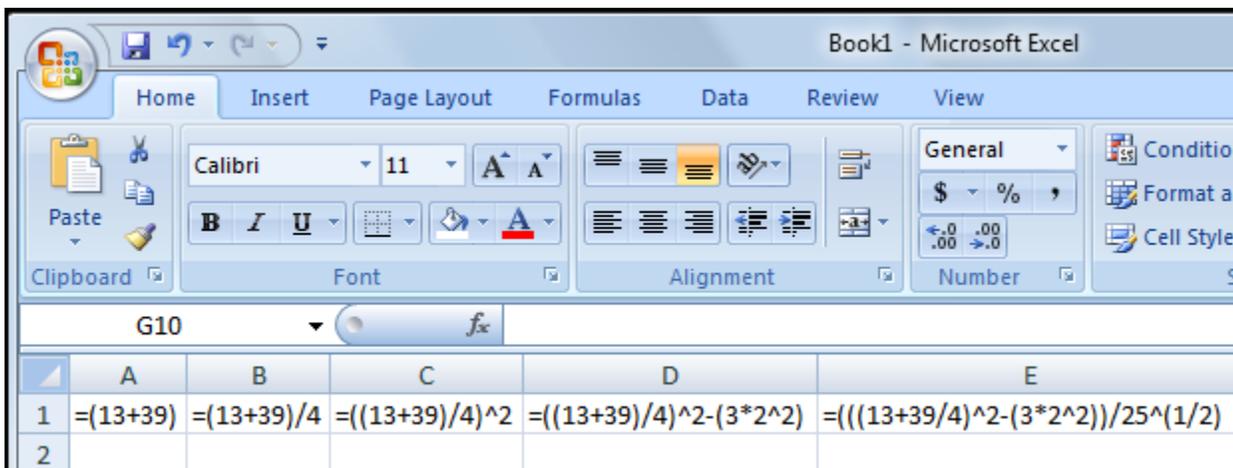

Note that the multiple cells are used above only to indicate the progression of building your formula in the formula bar for one particular cell.

SAMLab Tip Sheet #1
Style tip

It's a good idea to use only as many parentheses as you need because too many can be confusing. In the example below, the extra parentheses in column B are unnecessary, but you might use the parentheses in column C as it is easier to understand that formula quickly. All three formulas give the same answer. The expression is:

$$\frac{2^2 \times 3^2}{4^2} = 2.25$$

	A	B	C
1	=2^2*3^2/4^2	=(((2)^2*((3)^2/((4)^2))))	=(2^2)*(3^2)/(4^2)
2			
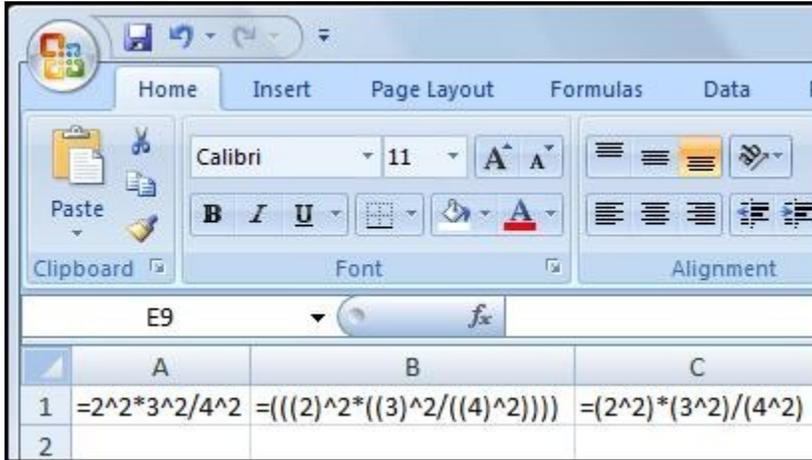
Practice

Put these formulas into Excel and see what you get (if you get the right answers you will see a very simple pattern; **answers are upside down on the bottom of the last page**).

$$\frac{17^2 - 15^2}{8^2}$$

$$\frac{18 - 17}{2} - \sqrt{\frac{1}{4}} + \frac{\sqrt{64}}{2^2}$$

$$\frac{27 - (1-2)^2}{\frac{12}{\sqrt{4}}}$$

$$\sqrt{25^2 - 24^2} - 3$$

$$\frac{4 \times 100^2}{20^3}$$

$$\left(\frac{5+4}{\frac{27}{\sqrt{81}}}\right)^2 \times \frac{6 \times 9}{3^4}$$

Notes

[1]There are many ways to do things in Excel and even these simple operations can be done multiple ways, using Excel's library of functions. Tip Sheet #3 covers some of the many ways to do the same thing in Excel.

[2]Remember that taking the square root of a number is the same operation as raising that number to the ½ power.

SAMLab Tip Sheet #1
Step-By-Step Construction of an Excel Formula

$$\frac{\left(\left[\frac{(13+39)^2}{4}\right] - [3 \times 2^2]^2\right)}{\sqrt{25}} =$$

1. First we need an "=" character and then we need to let Excel know in what order we want it to make the calculations. Here's where PEMDAS comes in. We know that we're supposed to calculate the parts in parentheses first so we'll start with what is in the innermost set of parentheses.
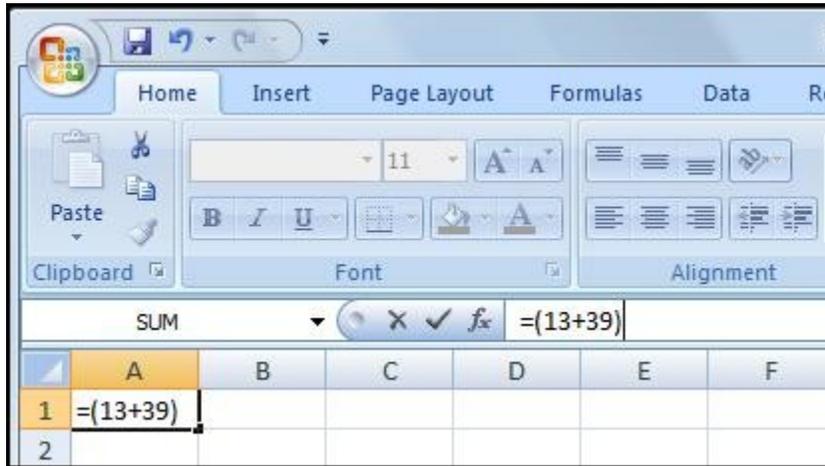

2. The next step is to calculate what is in the next level of parentheses. There are two sets of parentheses at this next level so we'll type them both. We won't worry just yet with how they will be combined.
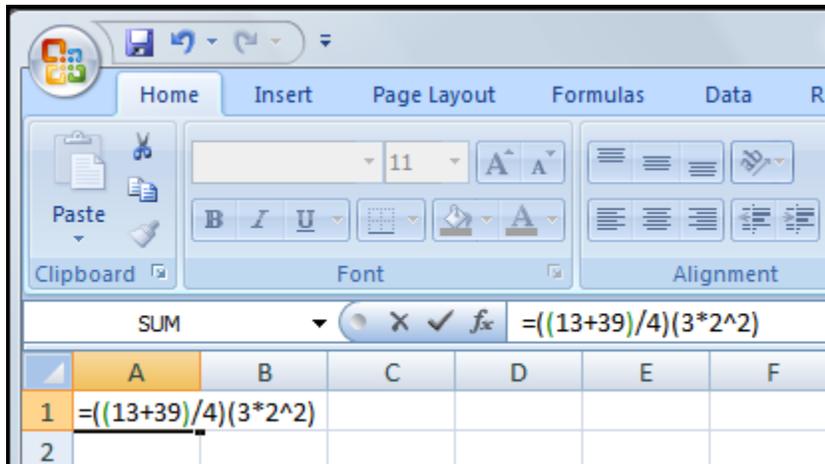

3. Notice how the parentheses are color-coded in the formula bar. This comes in handy when trying to figure out which parentheses make a pair. Also, since Excel follows PEMDAS, we don't have to put the 2^2 in parentheses; Excel will square the 2 then multiply it by 3. Okay, on to the next level.
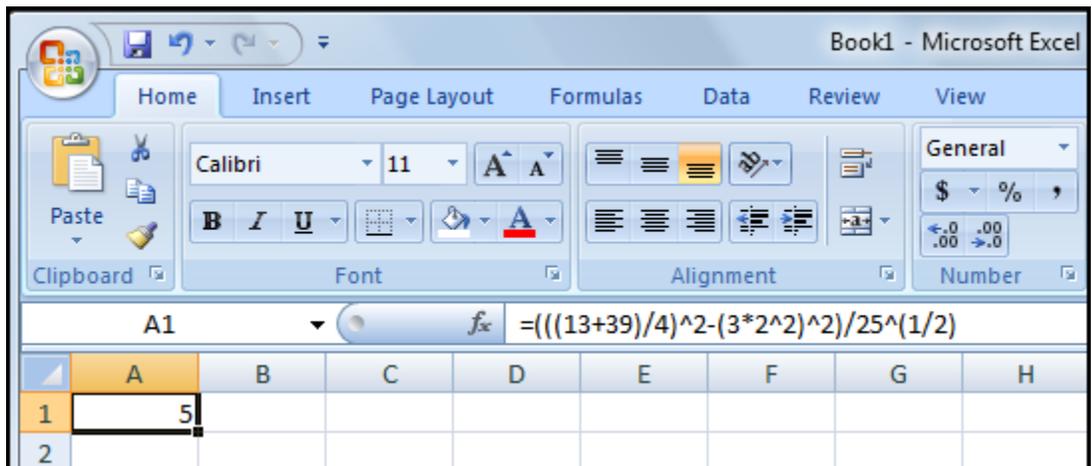
SAMLab Tip Sheet #1
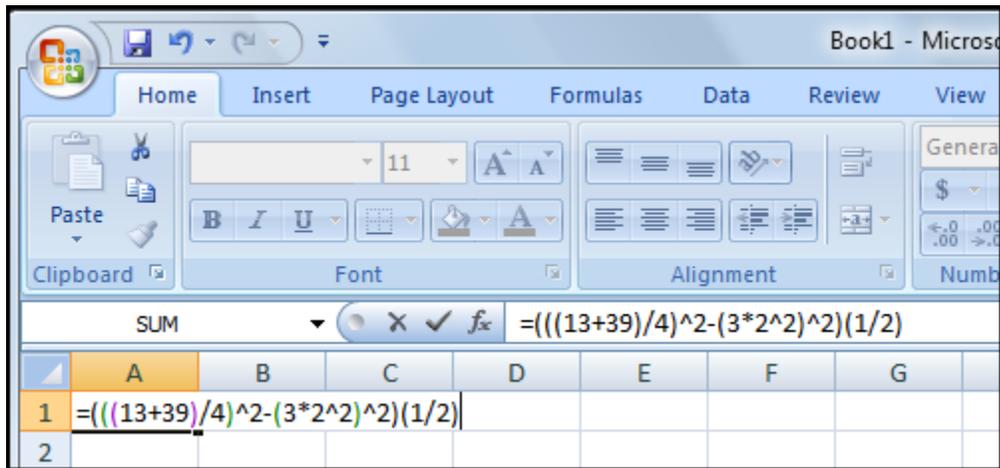
4. Note that we had to put the (1/2) in because we are going to raise 25 to the ½ power in order to get its square root. Because Excel follows PEMDAS we have to make sure to put parentheses around the ½. If we did not use these parentheses, Excel would raise 25 to the 1st power and then divide the result by 2 to make 12.5 rather than 5. Also, we could have just combined Steps 2 & 3 above, and as you get better at translating formulas, you'll want to do that to save time. Nevertheless, entering everything strictly in the PEMDAS order can help you avoid errors. On to the final level of parentheses.
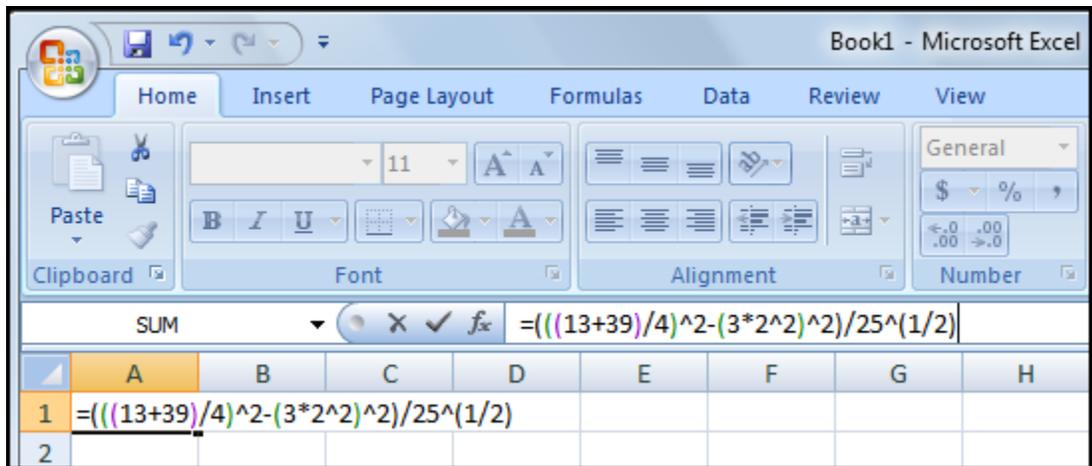
Now we finished typing in our formula. Again note that we did not have to put parentheses around the 25^(1/2) because Excel does the exponent operation before it does the division by 25. Now the only thing left to do is to press ENTER and see what we get.

1, 2, 3, 4, 5, 6