Assignment 1: Expressions and Functions (0.1) **Name_____**
Please provide a handwritten response.

1a. *Mathematica* can be used just like an ordinary calculator; addition is denoted by **+** , subtraction by **-** , multiplication by ***** , and division by **/** . For example, $\frac{3.017(56+45.26)}{-97.3}$ would be represented in *Mathematica* by

```
3.017*(56 + 45.26)/(-97.3)
```

Execute this command and record the result below; does your calculator confirm your result?

1b. Exponents are denoted in *Mathematica* using the **^** symbol, located above the "6" on your keyboard. Execute the command **4^2** and record the result below; repeat with **27^(1/3)** ; are the results correct? Explain.

1c. Find $\sqrt{25}$ by executing **Sqrt[25]** , and record the result below. Is the answer correct?

1d. In general, you can ask *Mathematica* about commands or variables using **?** ; for example, execute **?Sqrt** and record the result below.

1e. What happens when you execute **Sqrt[26]** to find $\sqrt{26}$? The reason *Mathematica* does not give you a decimal answer is that $\sqrt{26}$ is an irrational number, and therefore cannot be exactly expressed as a decimal. However, we can apply the **N** command to get an approximate decimal value: Execute the command **N[Sqrt[26]]** (careful with those brackets!) and record the result below. Finally, execute **Sqrt[26.]** (note the decimal point); does this give the "exact" value or a decimal? Why?

2a. You can also apply these operations to a variable, say x , to create algebraic expressions in *Mathematica*; for example, the expression $\frac{x^2+7x-11}{x^2-4}$ would be represented by

```
(x^2 + 7x - 11)/(x^2 - 4)
```

(Note that a multiplication symbol ***** is not necessary in this case between the **7** and the **x** ; however, it's always safe to include one if in doubt.) Execute this command and record the output below. Did *Mathematica* rearrange the parts of the expression in any way?

2b. Often we want to substitute a particular value of x , say $x = -2.3$, into an expression like the one above; this is done in *Mathematica* by applying a "replacement rule". In this particular example we would type

```
(x^2 + 7x - 11)/(x^2 - 4) /. x->-2.3
```

Here, the "replacement operator" **/.** applies the "rule" **x->-2.3** to our expression, which causes *Mathematica* to make the substitution we want. (The arrow **->** is made of two characters, a hyphen **-** followed by a "greater than" sign **>** found just to the left of the question mark on your keyboard.) Execute this command and record the result below; does your calculator give the same result?

3a. Just as in precalculus, we can also use our expression $\frac{x^2+7x-11}{x^2-4}$ to define a rational function $f(x)$ in *Mathematica*. Execute the command

```
f[x_] = (x^2 + 7x - 11)/(x^2 - 4)
```

and record the result below. (Make sure you type **x_** , not just **x** , on the left side! The under-score character "_" is found just to the left of the "+" sign, above the hyphen, on your keyboard, and must be included for *Mathematica* to define a function properly.)

3b. Execute the command **f[-2.3]** to calculate $f(-2.3)$; your result should agree with that of Question **2b**. Does it? (If you have a problem, then your function **f** may not have been defined properly in Question **3a**.)

3c. Execute the command **f[2]** to try to calculate $f(2)$ and describe the result below. Explain why any attempt to calculate $f(2)$ in this case would cause an error message.

3d. Make *Mathematica* "forget" about our definition of **f** by executing the command **Clear[f]** . (You will not see any output from this command.) Then execute the command **f[x_] = Sqrt[x + 1]** and use *Mathematica* to do Exercise 49, Section 0.1 of your text by executing (one at a time!) the commands **f[0]** , **f[3]** , **f[-1]** , and **f[1/2]** . Neatly record the results below.