**Mathematica in 400 Words or less**

*Enter text into Mathematica by typing* in commands - *execute* the input by *pressing SHIFT-ENTER* with the cursor located anywhere in the line you want to execute.

Mathematica is very particular about cases and brackets:

* Every Mathematica function starts with a capital letter, including familiar functions such as Sin or Cos
* Math constants are Pi, Infinity, E
* [ ] denotes arguments for a function
* ( ) is used for grouping
* { } denotes lists

Mathematica labels each input line as **In[#]** and each ouput line it produces as **Out[#],** where # is replaced by continuing numberings. You can refer to these objects in other calculations

**Example:**

Sin[Pi/4] SHIFT-ENTER should result in: Out[3] = N[Out[3]] SHIFT-ENTER should result in 0.707107

**Commonly used Functions**

* Simplify[expression] simplifies an expression
* Expand[expression] expands (FOIL) expression
* Factor[expression] factors an expression if possible
* Solve[expr1 == expr2, var] Solves the given equation for the specified variable if possible

NSolve[expr1 == expr2, var] Solves given equation for specified variable numerically

* N[expression] Provide numerical approximation of expression if possible
* Limit[expression, var -> c] computes limit as variable approaches value c

Limit[expression,var->c,Direction->1 or -1] finds limit as var goes to c from the left (1) or the right(-1)

* D[expression, var] differentiate expression with respect to variable var

D[expression, var1, var2] differentiate expression *twice* with respect to variables var1, var2

* Integrate[expression, var] indefinite integral of expression with respect to var

Integrate[expression, {var,lower,upper}] definite integral as var goes from lower to upper

* Plot[expression, {var,lower,upper}] Plots graph of the expression as var goes from lower to upper
* = Assignment operator (looks like the mathematical equal sign)
* == Equal sign (to be used in Solve and NSolve, for example)

**Defining Functions**

You can define your own function(s) in Mathematica so that you can reuse it as often as you like. Use the syntax:

f[var\_] = expression of var

Note that the input variable(s) used as argument(s) in the function f ends in an underscore, but the expression on the right of the assignment operator should use the variable *without* underscore.

**Example:** Define the function , then take the derivative and define that as another function . Finally, find at least one critical points.

f[x\_] = 3x^4 Sin[x^2] (SHIFT-ENTER)   
Simplify[D[f[x],x]] (SHIFT-ENTER)   
df[x\_] = Simplify[D[f[x],x]] (SHIFT-ENTER)  
NSolve[df[x] == 0,x] (SHIFT-ENTER)