Before Starting:

- Plan on experimenting, and make extensive use of the Help menu. You can learn all sorts of cool things just by doing "topic searches". **Give Maple a chance!**
- In the beginning, using Maple's palettes and contextual (shortcut) menus is easy and helpful, so the *Getting Started* section focuses mainly on those.
- You may eventually decide it's easier to enter some expressions using the keyboard. Some are mentioned in *Getting Started* section; included in the on-line version of this is the section *Further Exploring Maple*, which contains additional tips and the most relevant commands for Calc 2.
- Always check Maple's output to make sure you entered what you meant to.

What You'll See:

- There are two interfaces for Maple, *Worksheet* and *Document*. *Document* mode is probably easiest to learn with (although I don't use it). Go to **File - New - Document Mode.**
- There are also two types of input – *Math* and *Text*. *Math* is the default; click the *Text* button if you want to enter text.

Getting Started

- The many palettes on the left are handy templates for Maple's syntax, especially the **Expression** and **Common Symbols** palettes. Open a palette by clicking on the triangle next to its name.
- The templates will allow you to enter all the operations ($+$, $-$, $\times$, $\div$) as well as square roots, exponents, sines and cosines, logarithms, functions, derivatives, integrals, and summations. Enter specific values or variables by tabbing from one entry to the next.
- Some expressions you may find easier to enter using the keyboard :
  - $+$, $-$, $*$, / for addition, subtraction, multiplication, and division.
    Don't omit the $*$ when typing in something like $5x$ or $5x\cos(x)$. Sometimes, Maple knows what you mean, but other times it won't – and it won't give you an error, it will just ignore part of what you type (treating it as a long variable).
  - `^` for exponents
  - *Pi* for π.
    Maple is case-sensitive! `pi` is **not** the same as `Pi` ! In Maple, `pi` represents the Greek letter, while `Pi` is the number.
  - `exp(x)` for e^x; In Maple, `e` is a variable variable not a number.
  - `sqrt(x)` for $\sqrt{x}$.
- Contextual, or shortcut, menus are accessed by right-clicking (control-clicking, on a Mac) on an item you've entered. Different options will appear in the pop-up menu, depending on the context. For example, if you control-click on an expression like $exp(x)$, Maple will give you to options to:

  Differentiate, Integrate, 2-D Plot, Evaluate at a point, Approximate, etc

  Experiment!
- When we get to numeric integration, you may want to quickly calculate a left sum, right sum, or midpoint sum. For this, you'll need to load the calculus student package that contains the necessary commands (as well as many others!).

- To load this package, from the menu bar across the top of your screen, choose `Tools-Load Package - Student Calculus 1`.
- The Maple function that will calculate or plot the approximation is `RiemannSum( )`. For example,

  RiemannSum(exp(x)*sin(x),x=0..2*Pi, partition=30, method=left, output=sum)

  will output the summation notation for the left hand sum with 30 subdivisions for $\int_0^{2\pi} e^x \sin(x)\, dx$. You can then control-click on your entry (or the output) and select `Approximate` to find the numeric value.
- The other options we will use for `method` are `right` and `midpoint`.
- The other option we will use for `output` is `plot`. (`animation` is also an option; feel free to explore it).

Further Exploring Maple:

On the course website is a link to some Maple tutorials; although developed for an older version of Maple, you still might find them helpful.

Here are many of the commands we'll use, roughly organized by type.

Command	Description
Constants:	
`Pi`	The constant π
`exp(1)`	The constant e
`sqrt(5)`	$\sqrt{5}$
`cos(Pi/4)`	$\cos(\pi/4)$
Common Functions:	
`exp(x)`	The natural exponential e^x. For example, to get e^2, you would enter `exp(2)`.
`sqrt(45+sin(x))`	The expression $\sqrt{45+\sin(x)}$.
Defining functions and assigning values:	
`w := x^2 + 3*x`	Assigns w to be the *expression* x^2+3x. From that point on, whenever you use w, Maple will substitute x^2+3x.
`w:='w'`	Unassigns w. Now, w is just w.
`f := x -> x^3 + sin(x)`	Defines a *function* of one variable $f(x)=x^3+\sin(x)$.
`f := (x,y) -> 3*x^2 + 2*x*y`	Defines a function of *two* variables
`L:=[ [1,10], [2,5], [4,2]]`	Defines a list of points
`A:=matrix[ [2,3], [4,5] ]`	Defines a 2 x 2 matrix with top row consisting of 2 and 3, second row consisting of 4 and 5
`restart`	Clears all definitions and reinitializes Maple.
Various useful commands:	
`evalf(3*sqrt(Pi) )`	Returns a decimal approximation of $3\sqrt{\pi}$ using 10 significant digits. evalf stands for "evaluate to floating point".
`evalf(3*sqrt(Pi), 20)`	Returns a decimal approximation using 20 significant digits.
`%`	The output from the last executed statement.
`simplify( sin(x)^2 + cos(x)^2 )`	Simplifies the expression. In this case, the result is 1.
`solve(x^2+3*x+1)`	Solves the equation $x^2+3x+1=0$.
`solve(t*x^2+3*x*t+1, t)`	Solves the equation $tx^2+3xt+1=0$ for t.
Graphing:	
`plot(sin(x)+Pi/2, x=-2..Pi, color=blue)`	Generates a plot of $y=\sin(x)+\pi/2$ from $x=-2$ to $x=\pi$ in blue. You can leave out the color if you want.
`plot( [x^2, cos(x)], x=0..2*Pi, color=[blue,red])`	Plots the two functions $y=x^2$ and $y=\cos(x)$ on the same set of axes. The color is useful for distinguishing the plots.
`plot(L, x=0..5)`	If you have defined L to a list of points (see above) whose x coordinates are all between 0 and 5, this command will plot these points and draw lines connecting them.

Command	Description
Calculus Commands:	

`Diff(x^3+sin(x), x)`
 	
`value(%)`
	Returns the expression $\frac{\partial}{\partial x}(x^3+\sin(x))$. This allows you to check whether you've entered everything correctly.
	
	If you follow the command `Diff(x^3+sin(x),x)` immediately with this one, it will return the derivative of $x^3+\sin(x)$ with respect to x.

`diff( x^3 + sin(x), x)`	Returns the derivative of $x^3+\sin(x)$ with respect to x, $3x^2+\cos(x)$. Once you feel comfortable both with Maple and with differentiation, you can use this command rather than the previous one.
`diff(f(x),x)`	Returns the derivative of a function you have already entered, see top of page 2.
`diff(x^{3}+sin(x),x$2)`	Returns the second derivative of $x^3+\sin(x)$ with respect to x, $6x-\sin(x)$. You can also do second derivatives as above, where the expression is returned first, by simply capitalizing the "d" in `diff`.

`Int(x^3+sin(x),x)`
 	
`value(%)`
	Returns the expression $\int x^3+\sin(x)\,dx$.
	
	If you follow the above command with this one, Maple will return the indefinite integral (i.e. the antiderivative) of $x^3+\sin(x)$.

`int( x^3 + sin(x), x)`	Returns the indefinite integral, or antiderivative, of $x^3+\sin(x)$, $\frac{1}{4}x^4-\cos(x)$.
`int(f(x),x)`	Returns the antiderivative (indefinite integral) of a function you've already entered (see top of page 2).
`int(x^{3}+sin(x),x=2..5)`	Returns the definite integral of $x^3+\sin(x)$ from 2 to 5. If you capitalize the "i" in "into", it will return the expression $\int_2^5 x^3+\sin(x)\,dx$. To get the value, you would then enter `value(%)`.
`Sum( j^2, j=1..300)`	This creates the sum $\sum_{j=1}^{300} j^2$, but does not evaluate it. You'll need to use `value(%)` to get a numeric value.
`sum(j^{2}, j=1..300)`	This returns the value of the sum directly.

Command	Description
Calculus Graphing Commands:	
`Tools -Load Package-` `Student Calculus 1`	Loads the student package. You must load this package before you can use `RiemannSum( )`, command.

`RiemannSum(x^2, x=0..3,`
`partition=10, method=left,`
`output=sum)`
	Generates the leftsum approximation of $\int_0^3 x^2\,dx$ using 10 equal subintervals. You need to use `evalf( )` to get the decimal approximation.
	Replace "left" with "right" or "middle", and "sum" with "plot" or even "animation".

`Tools-Load Package- Plots`	Loads the plots package. You must load this package before you can use the `display` or `tubeplot()` command.
`tubeplot( [x, 0, 0], x=0..4*Pi,` `radius =sin(x)+ 2)`	This will draw the surface obtained by rotating the graph of $y = \sin(x) + 2$ about the x-axis from $x = 0$ to $x = 4\pi$. For all of our plots, you should not change the `[x,0,0]` part of the command.