Single Variable Calculus

Differential

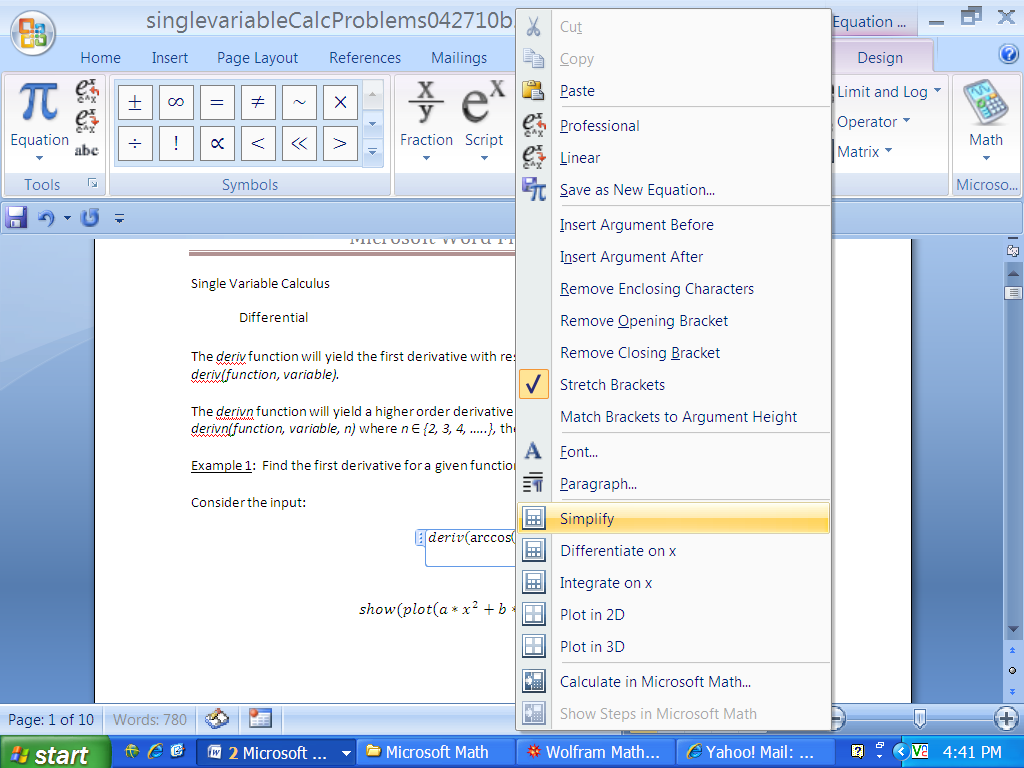
The *deriv* function will yield the first derivative with respect to the variable indicated. The syntax is *deriv(function, variable).* The deriv function may be omitted. There is an alternate way to find the first derivative with respect to the particular variable, *x*. Enter the function as an expression in the variable *x.* Right-click and select *Differentiate on x* from the menu.

The *derivn* function will yield a higher order derivative for a given A function derived from another function so that at each point of the original function, the derivative represents the slope of the original function at that poin function. The syntax is *derivn(function, variable, n)* where *n {2, 3, 4, …..},* the order. Three arguments are required. There is an alternate way to find the *nth* derivative with respect to the particular variable, *x*. Enter the function as an expression in the variable *x.* Right-click and select *Differentiate on x* from the menu *n* times using the previous input lines.

Example 1: Find the first derivative for a given function.

Consider the input:

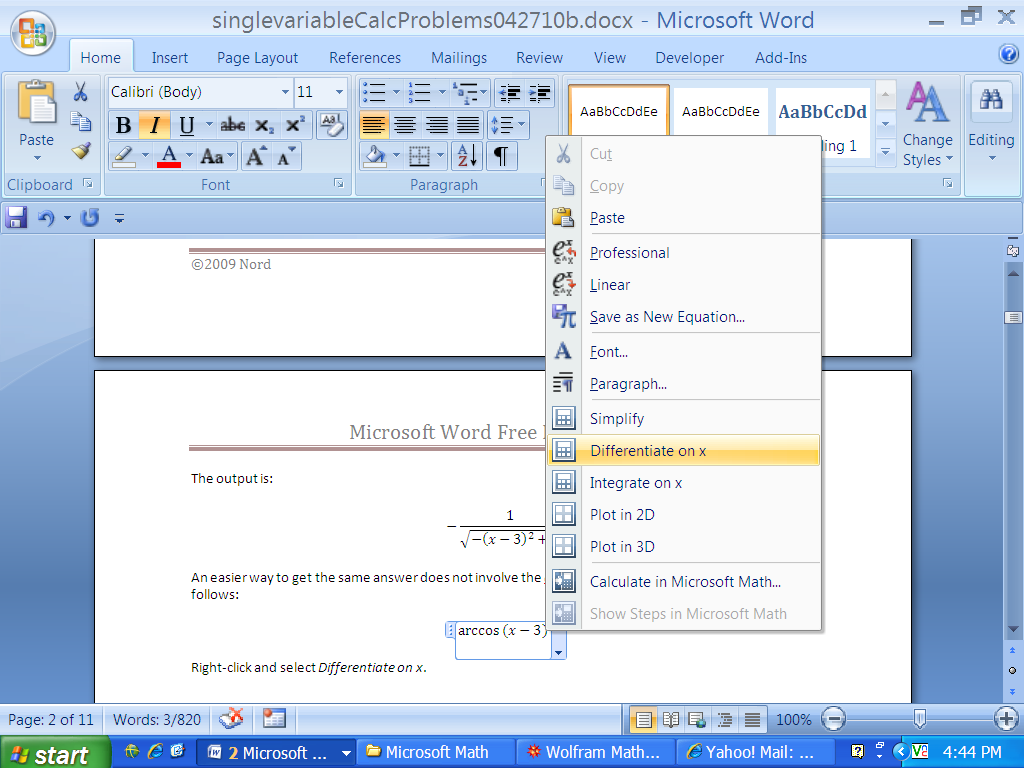
Right-click on the input line and select *Simplify*.



The output is:

An easier way to get the same answer does not involve the *deriv* command. Type in the expression as follows:

Right-click and select *Differentiate on x*.

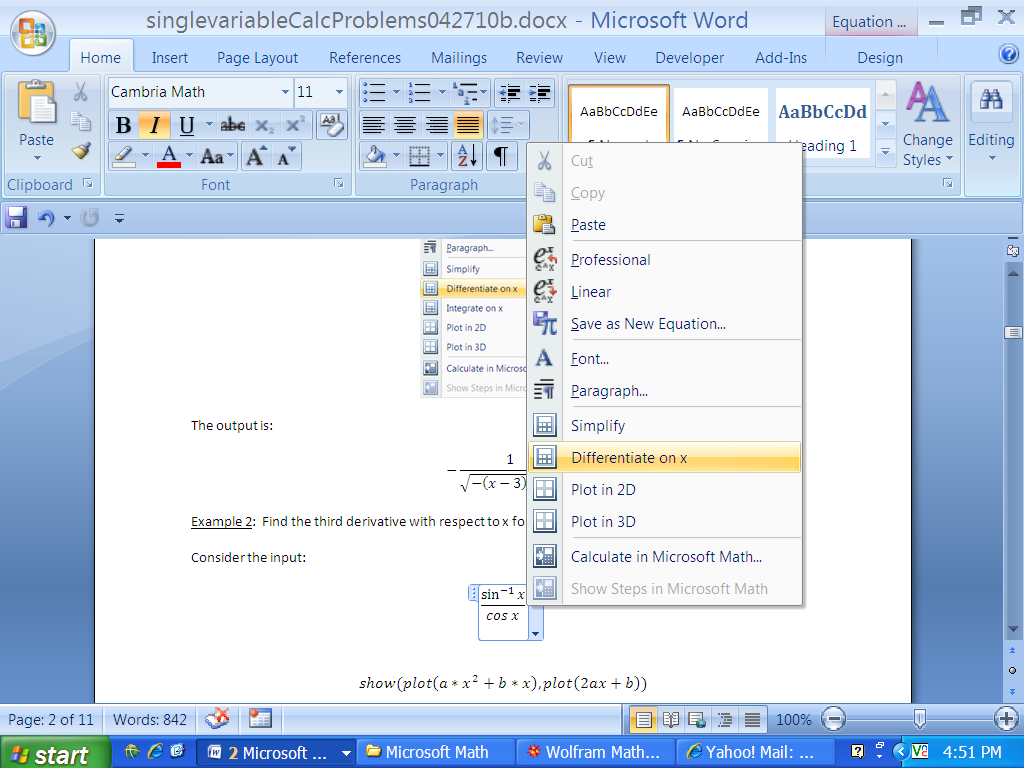


The output is:

Example 2: Find the third derivative with respect to x for a given function.

Consider the input:

Right-click and select *Differentiate on x*.



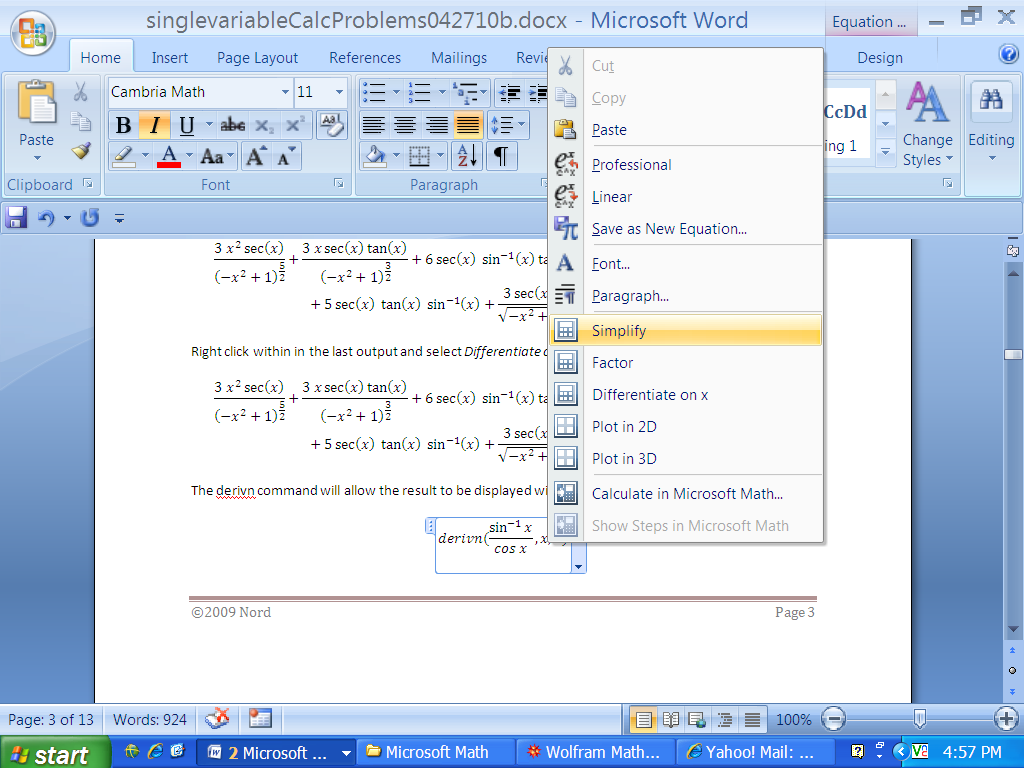
The answer for the first derivative is:

Right click within the last output and select *Differentiate on x* . The answer is:

Right click within in the last output and select *Differentiate on x* a last time. The answer is:

The *derivn* command will allow the result to be displayed after one input line. Consider the input:

Right click and select *Simplify*.



The output is:

Example 3: Given a polynomial, find the 3rd derivative with respect to *x*.

Consider the input:

The output is:

The same output can be obtained with an initial input of an expression:

Right click and select *Differentiate on x*. Repeat two more times with right-clicking on the previous outputs. The first and second and third derivatives are:

Single Variable Calculus

Integrals

There are three ways to evaluate an indefinite integral.

* Type an expression and select *Integrate on x*.
* Use the integral symbol in the top ribbon and select *Simplify*.
* Use the command, *integral,* and input *integral(input, variable)* and select *Simplify*.

I have seen that the third approach execute when involving a radical, here as the first two approaches may not evaluate and simply follow a return of the original input. The software appears to be cautious when working with a radical and requiring that the radical does not take on a value that is zero (or negative). The first approach is the easiest to input.

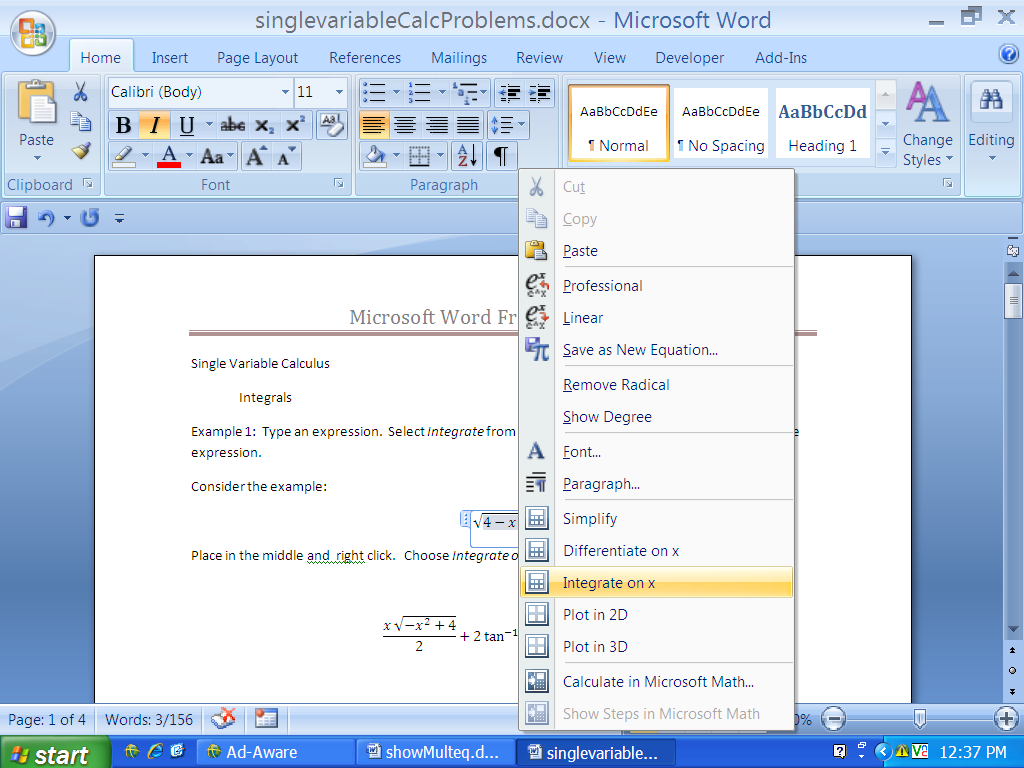
There are two ways to evaluate a definite integral.

* Use the integral symbol in the top ribbon and select *Simplify*.
* Use the command, *integral*, and input *integral(input, variable, lowervalue, uppervalue).*

Example 1: Type an expression. Select *Integrate* *on x* from the drop-down menu to integrate on *x* with the expression.

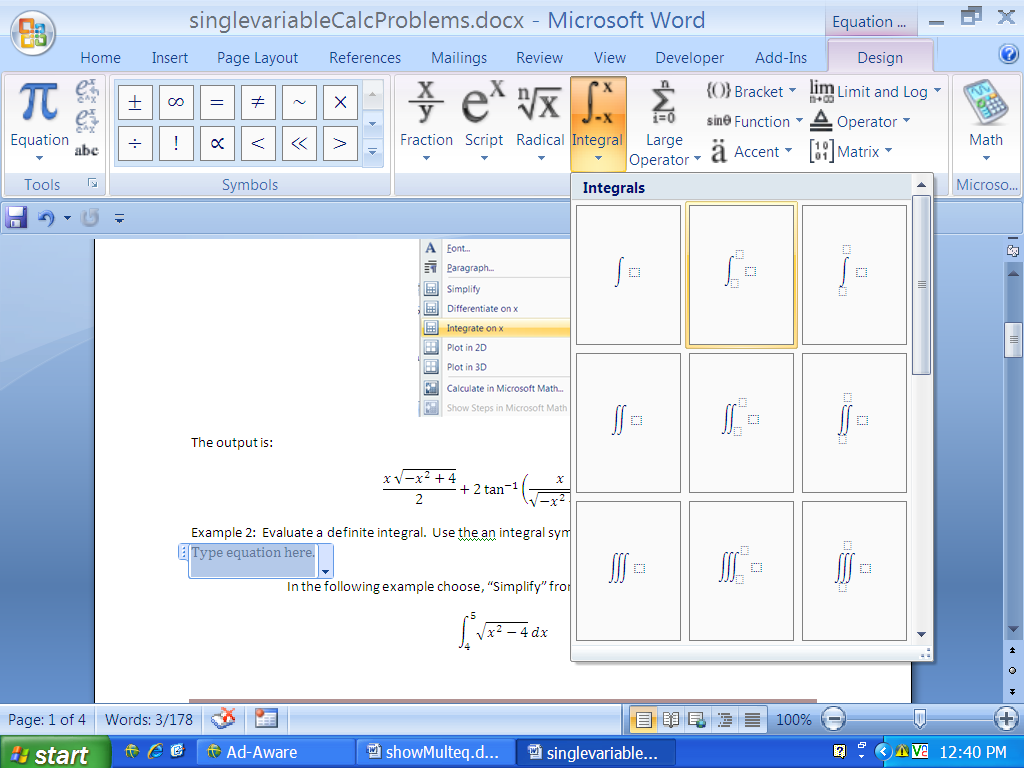
Consider the example:

Place the cursor in the middle and right click. Choose *Integrate on x*.



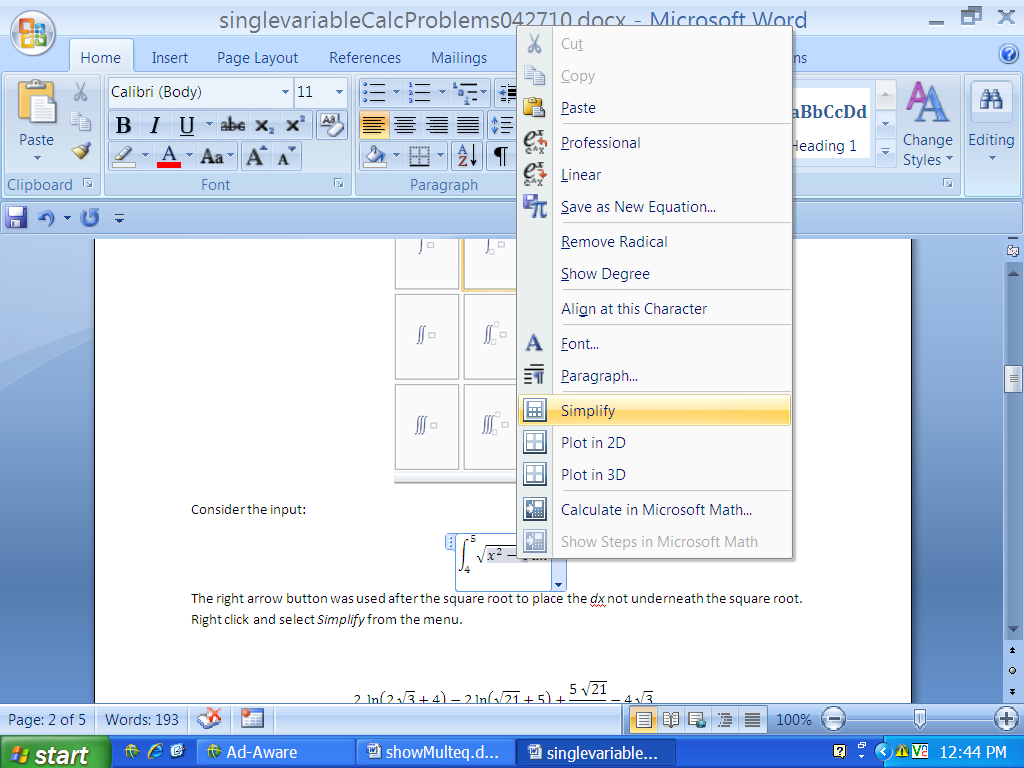
The output is:

Example 2: Evaluate a definite integral. Use the integral symbol from the top ribbon.



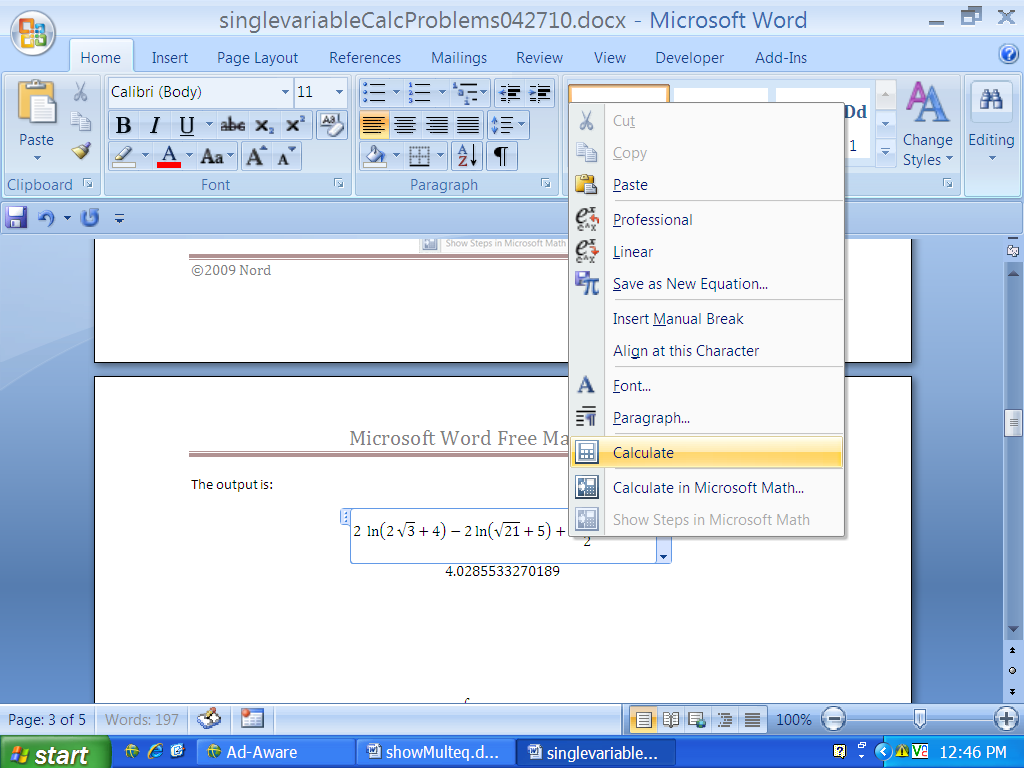
Consider the input:

The right arrow button was used after the square root not place the *dx* underneath the square root. Right click and select *Simplify* from the menu.



The output is:

Right click within this output and select *Calculate*.



The output is:

Example 3: Evaluate an indefinite integral that would involve a substitution.

The input is:

Right click and select *Simplify* to yield the output:

The output does not include the integration constant. This will occur when evaluating some indefinite integrals.

Consider another example where the input is only an expression:

Right click and select *Integrate on x* to give:

The command *integral* would have yielded the same answer. The right arrow button should be used before inputting the comma. This will ensure that the comma and dx are not under the radical. The input is:

Select *Simplify* to give the answer:

Example 4: Evaluate the definite integral:

Using the integral symbol in the top ribbon and selecting *Simplify* gives the output:

The definite integral is not evaluated. Consider trying this another way using the integral command and inputting:

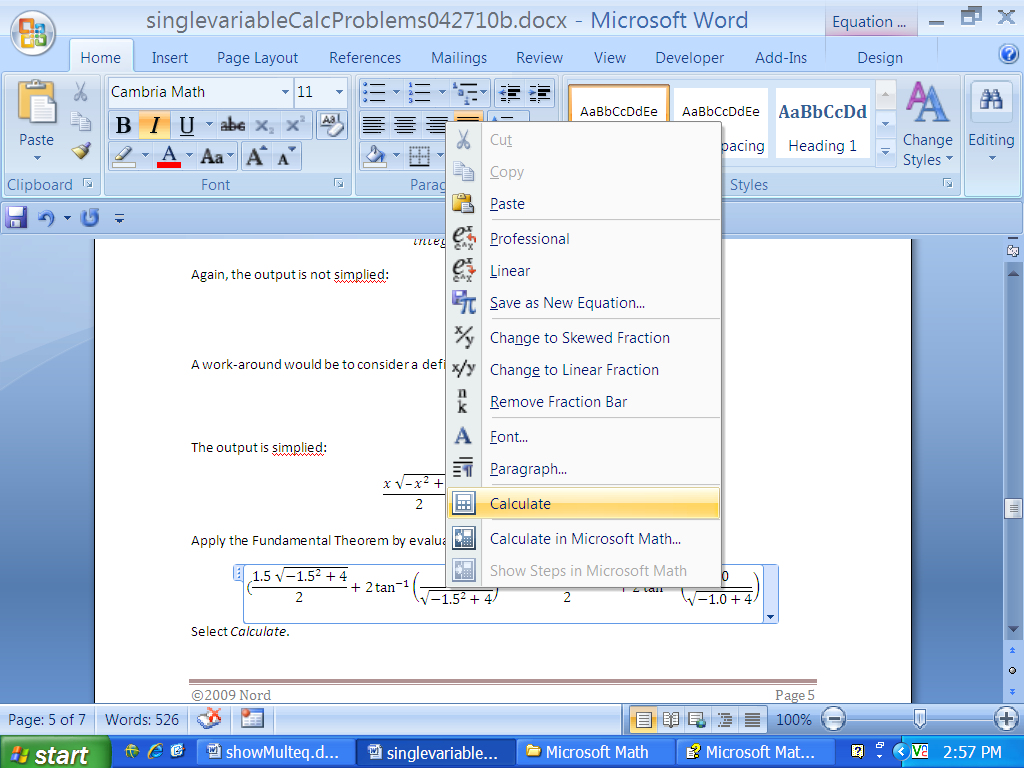
Again, the output is not simplified:

A work-around would be to consider an indefinite integral:

The output is simplified:

Apply the Fundamental Theorem by evaluating *F(1.5)*  *F(1)* and cut and paste from the previous output. Consider the new input:

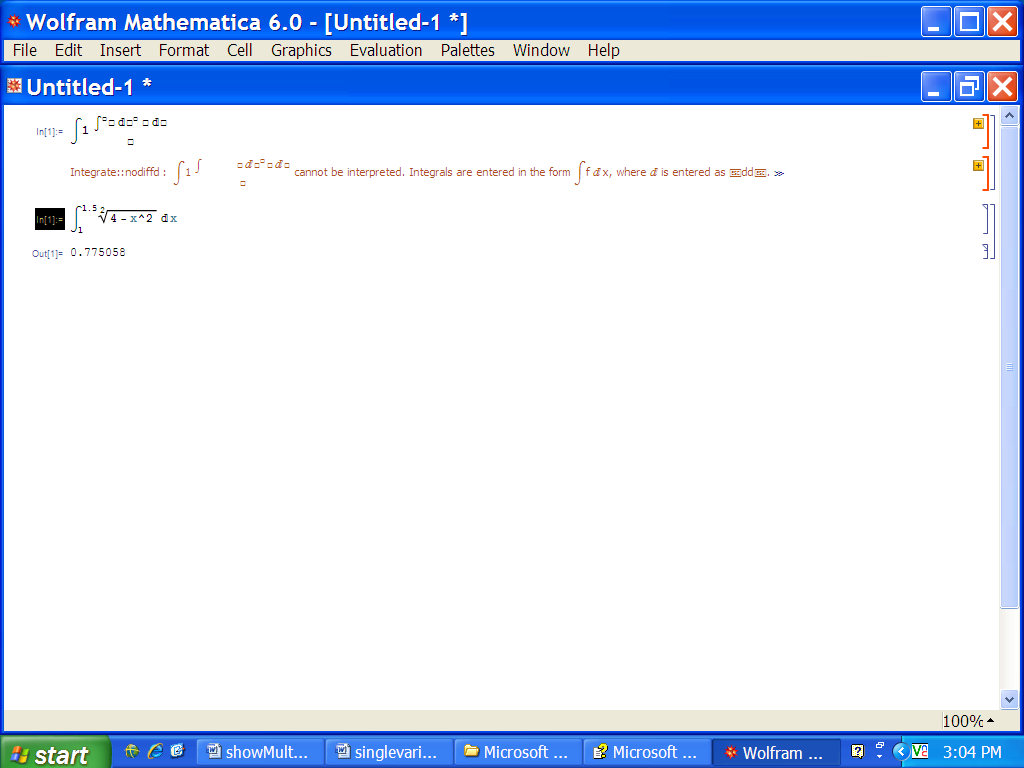
Select *Calculate*.



The output is:

Select *Calculate* again to give:

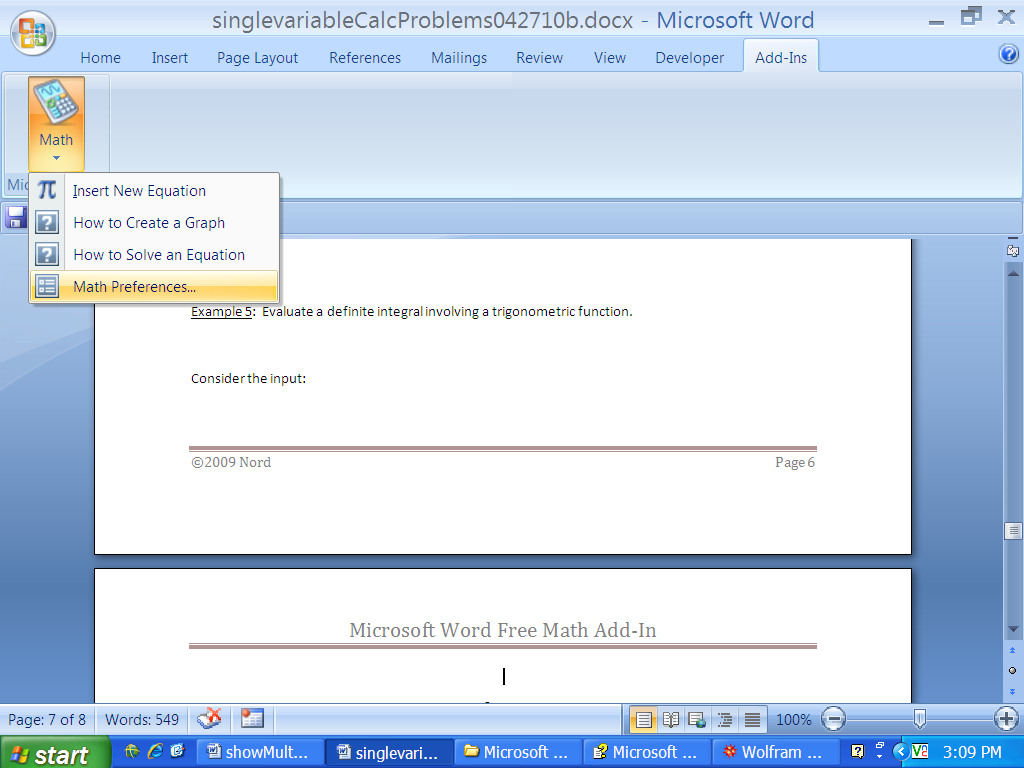
*Mathematica* gives the same answer and evaluates the definite integral directly as shown below:



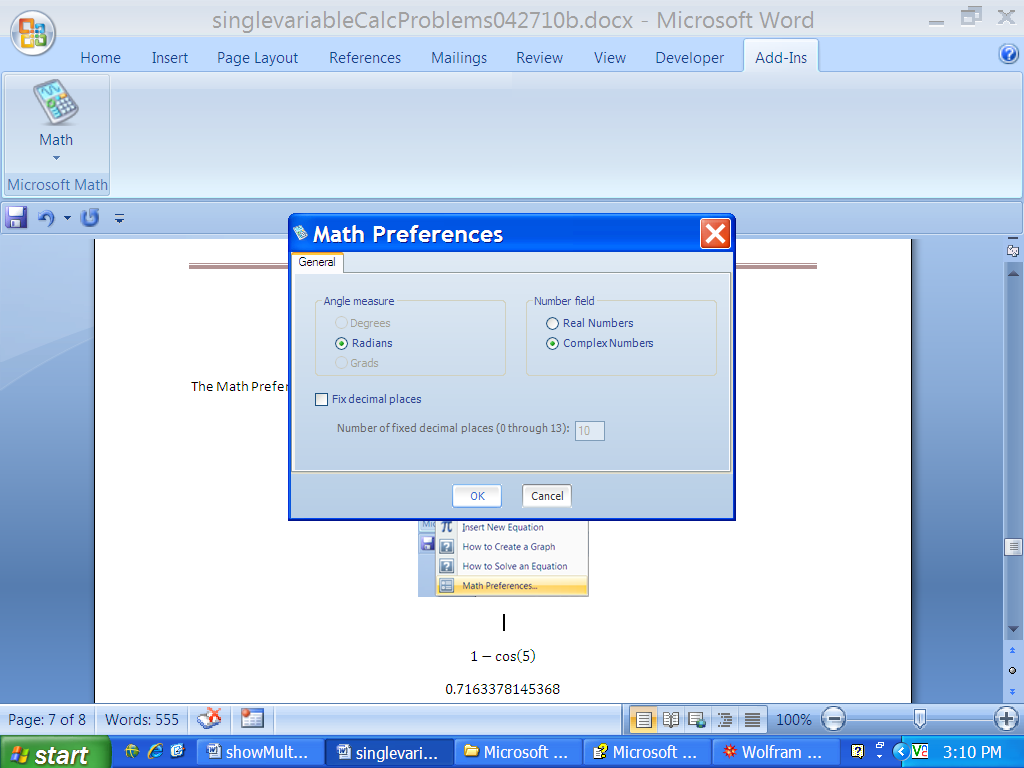
Example 5: Evaluate a definite integral involving a trigonometric function.

Consider the input:

The *Math Preferences* needs to be set.



The angle measure should be in radian mode as shown below:



The output from our example is:

Right-click and select *Calculate* from the menu to give:

Example 6: Evaluate an indefinite integral involving a trigonometric function.

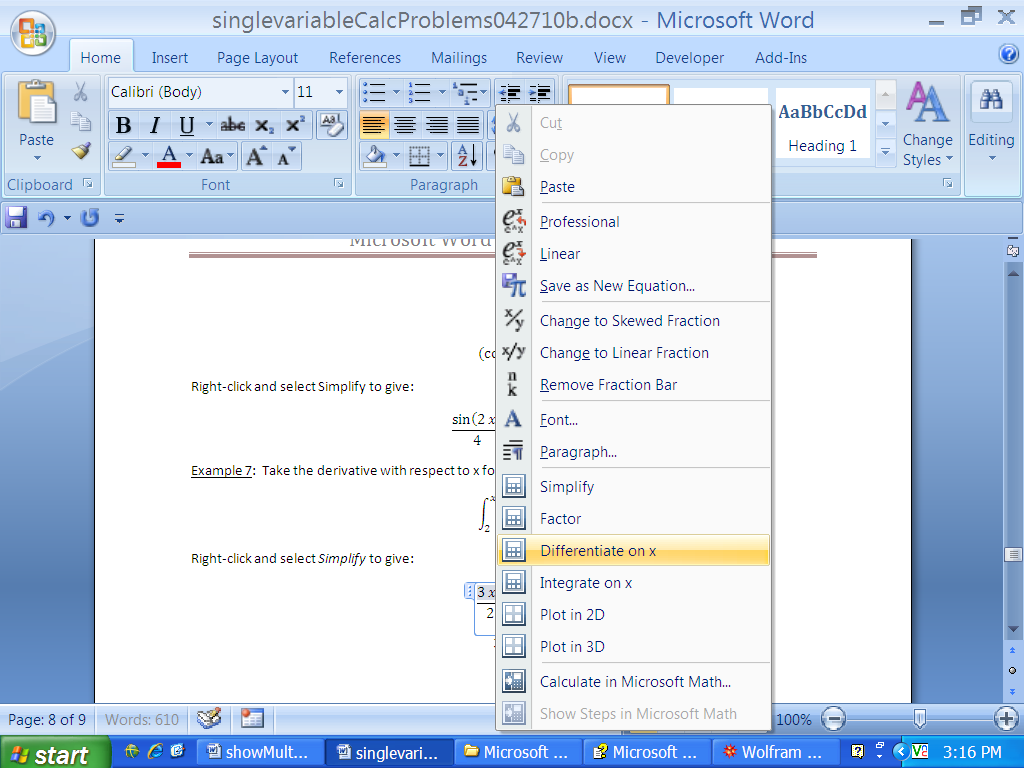
Consider the input:

Right-click and select *Simplify* to give:

Example 7: Take the derivative with respect to *x* for the following example involving an integral.

Right-click and select *Simplify* to give:

Right-click and select *Differentiate on x*.



The Fundamental Theorem tells us the answer is:

Example 8: Evaluate the following definite integral by using the *integral* command.

The input is:

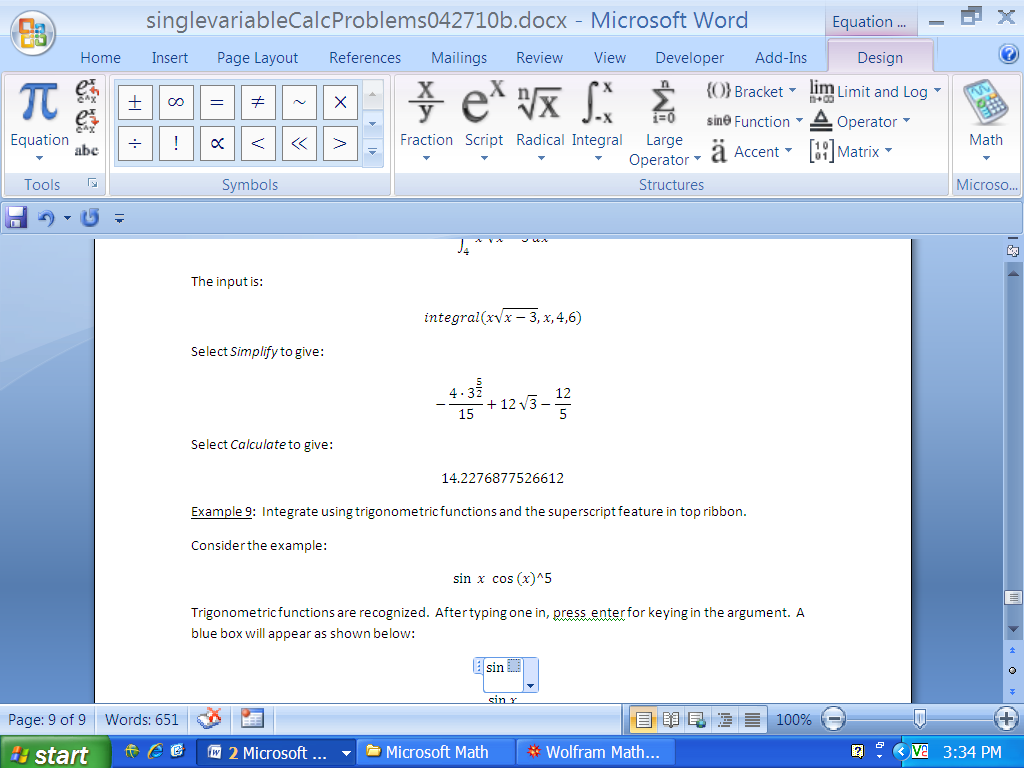
Select *Simplify* to give:

Select *Calculate* to give:

Example 9: Integrate using trigonometric functions and the superscript feature in the top ribbon.

Consider the example:

Trigonometric functions are recognized. After typing one in, press *enter* to key in the argument. A blue box will appear as shown below:



Parentheses are optional. As long as what is typed is within the blue box, the add-in will understand this as the argument. In the example below, typing *cos (x)* followed with a right arrow will ensure that the *cos(x)* is the base.

Select *Integrate on x* to give:

Single Variable Calculus

Graphing

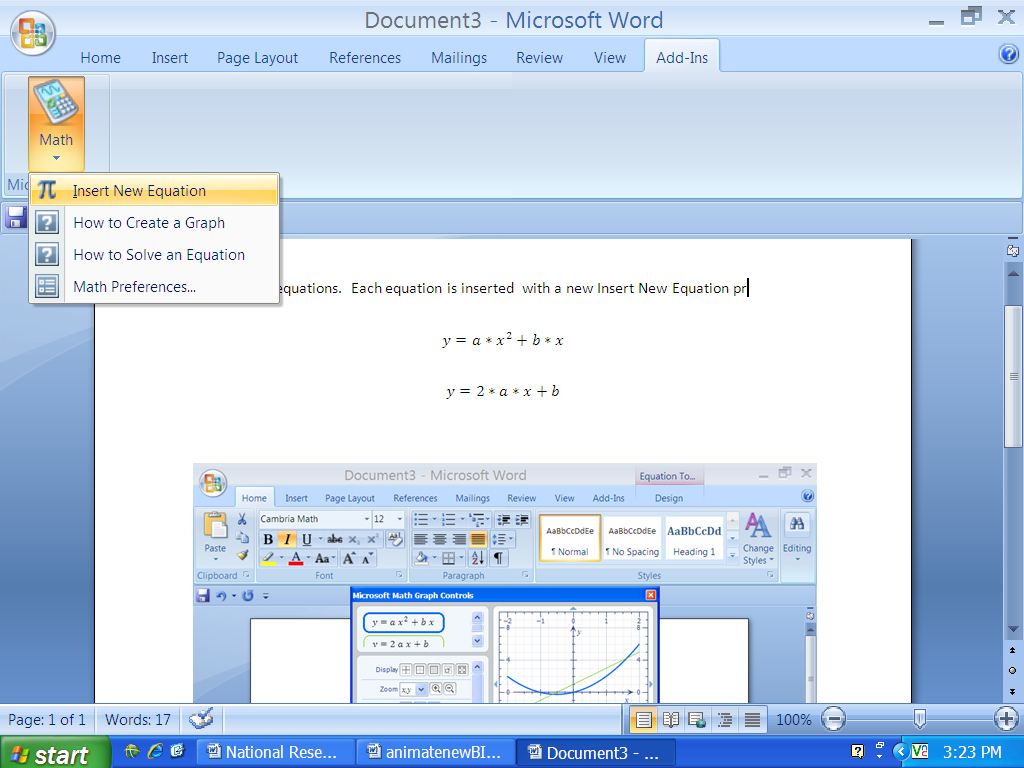
The table below describes some graphing commands. In most instances, the command may be absent. The exception is the *plotparam* command that is required. The commands are not case sensitive. That is, the use of capitalization is optional and will not change whether the line executes.

|  |  |  |  |
| --- | --- | --- | --- |
| Command | **Example** | **Notation Requirements** | **Drop- Down Menu Option to Execute** |
| *plot* |  | Input function, *f(x).* | *Simplify* |
| *plotDataSet* |  | Input point, {*x, y}.* | *Calculate* |
| *plotEq* |  | Input *f(x, y) = c.* | *Simplify* |
| *plotIneq* |  | Input inequality in *x* and *y.* | *Simplify* |
| *plotParam* |  | Input (*f(t), g(t))*where *x=f(t)* and *y=g(t).* | *Simplify* |
| *plotPolar* |  | Input | *Simplify* |
| *plotPolarDataSet* |  | Input point { | *Calculate* |

Graphing in two dimensions

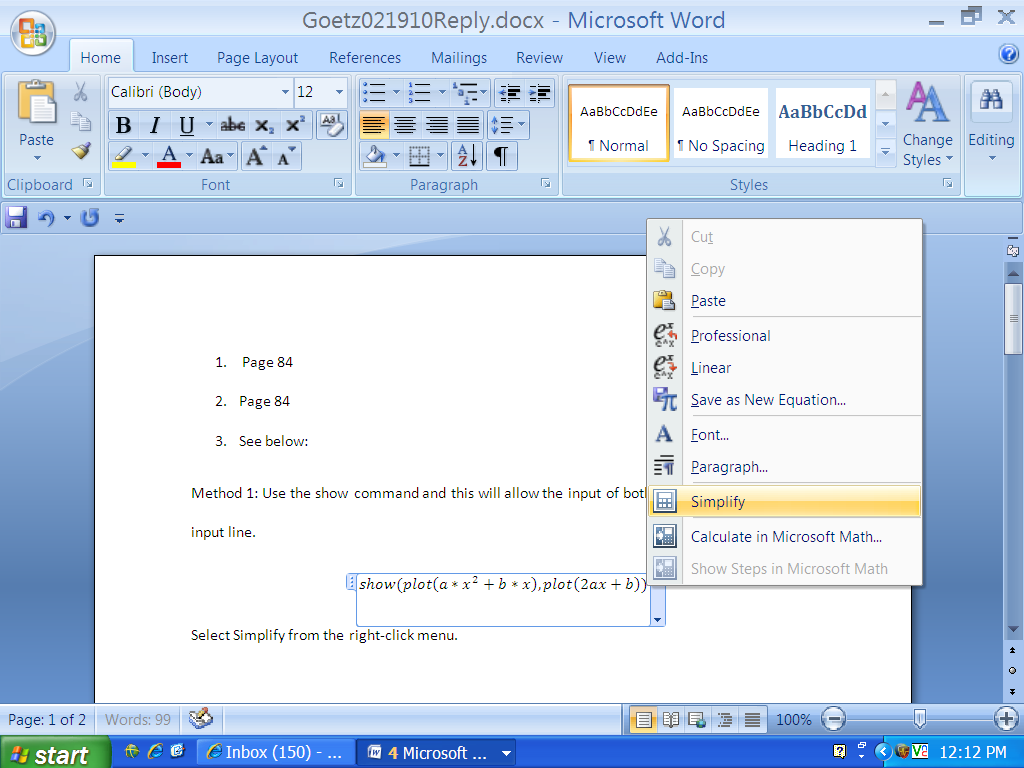
Here are a couple of options of how to input multiple equations.

**Method 1**: Use the *show* command and this will allow the input of both equations with a single application of the *Insert New Equation* command. *Insert New Equation* can be found here:



Input:

Select *Simplify* from the right-click menu. This will bring up the two graphs.

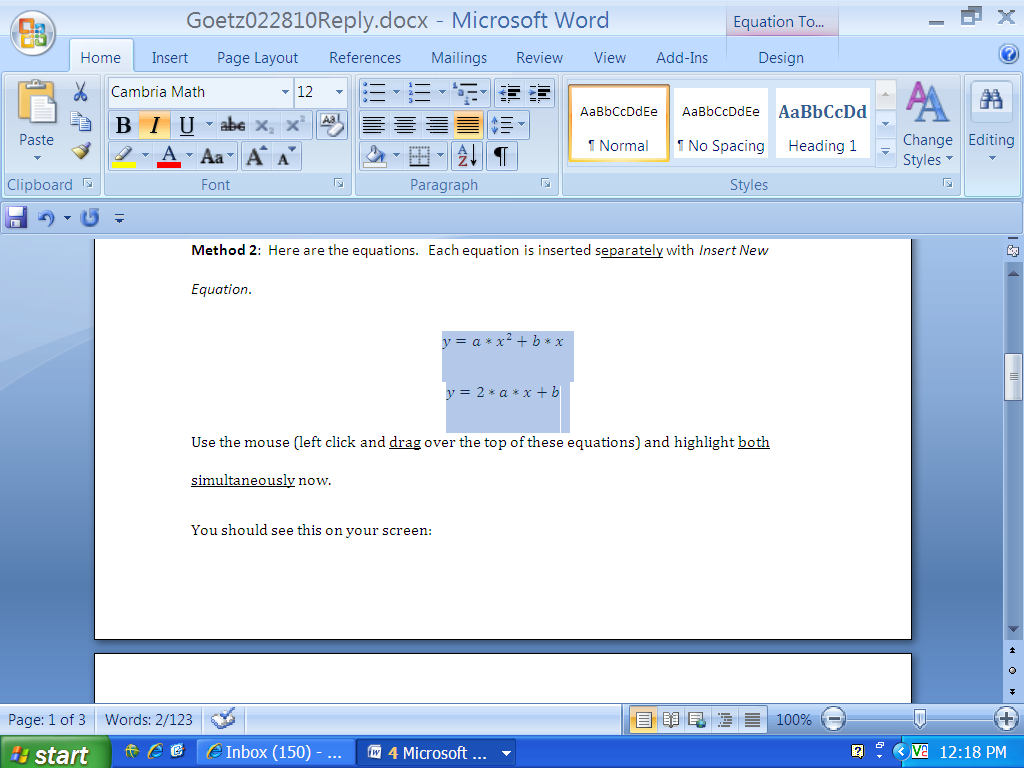


The *show* command needs the following syntax: *show(plot1example, plot2example)*

**Method 2**: Here are the equations. Each equation is inserted separately with *Insert New Equation*.

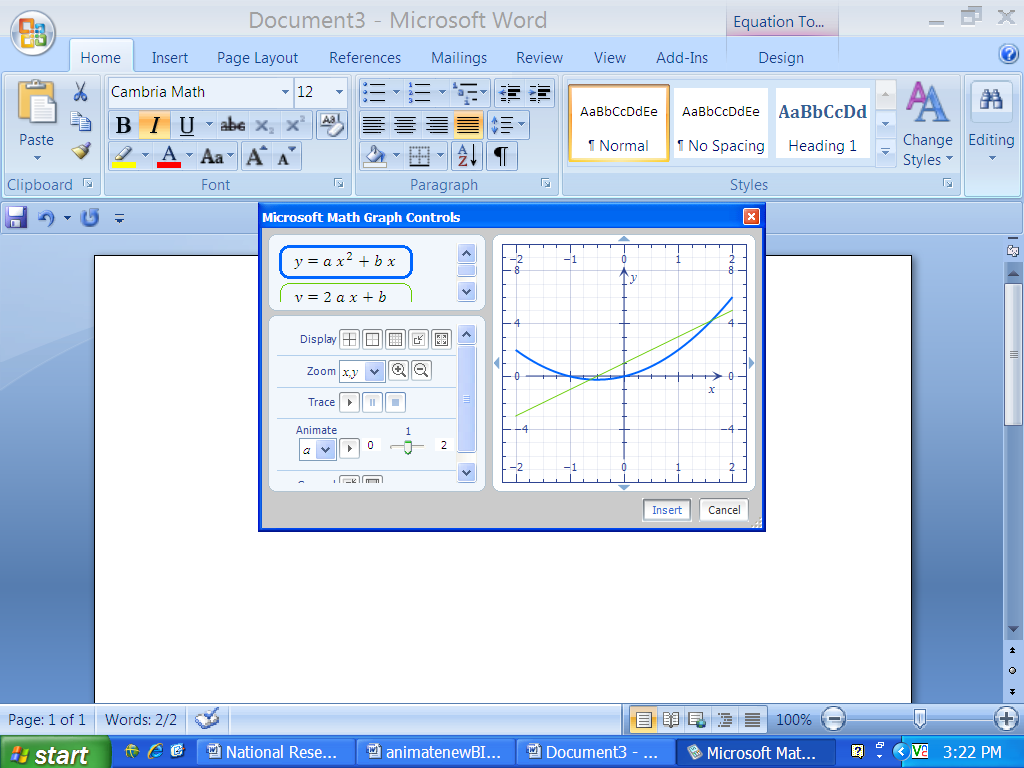
Use the mouse (left click and drag over the top of these equations with keeping the mouse pressed down) and highlight both simultaneously now. There cannot be any text between these equations. You only want the equations highlighted.

You should see this image on your screen:



After both are highlighted (in blue), right click to bring up the option, *Plot in 2D.* You need to right click and not left click. You are now working with both equations.

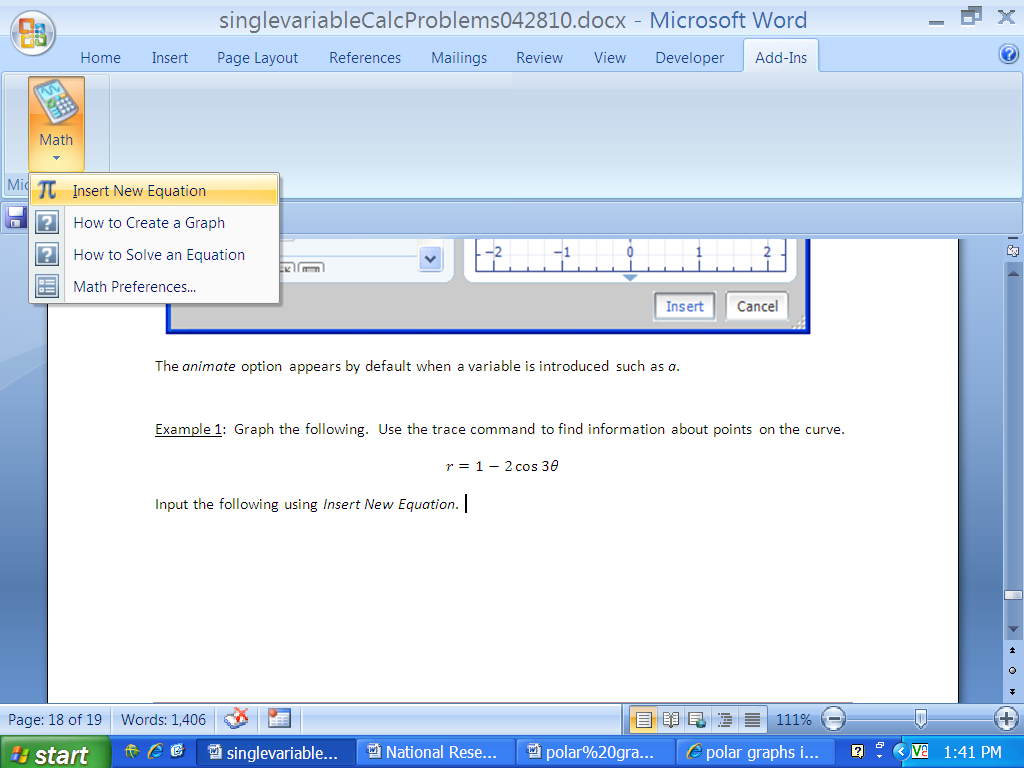
Either method should return this graph:



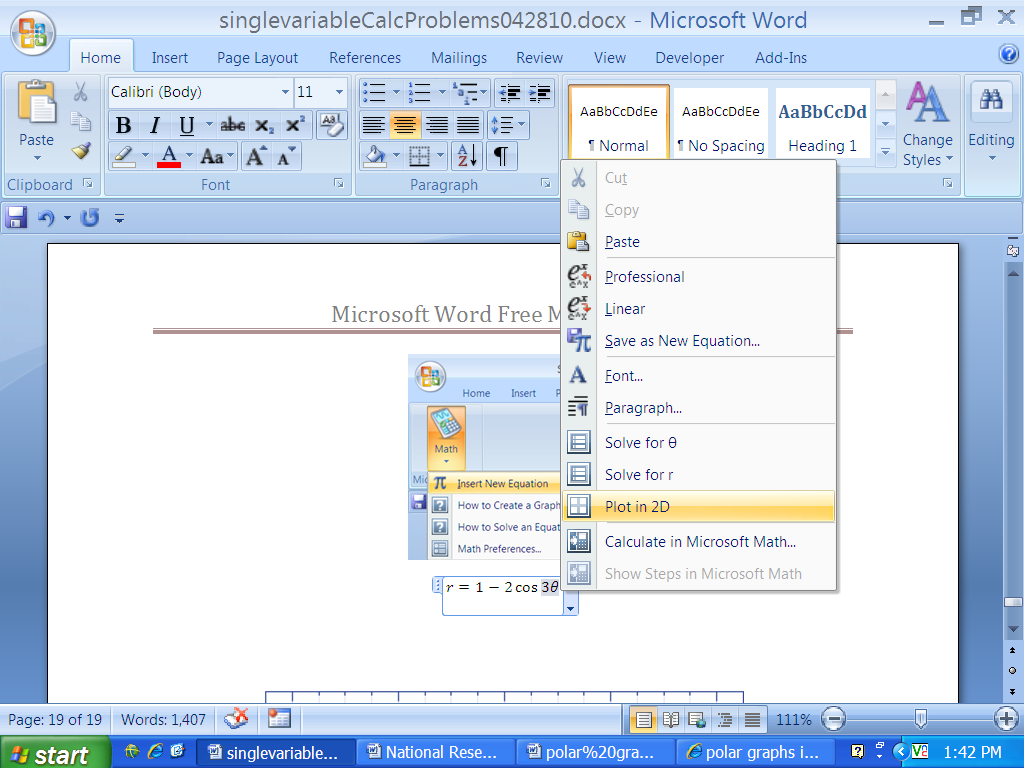
The *animate* option appears by default when a variable is introduced such as *a*.

Example 1: Graph the following. Use the *Trace* command to find information about points on the curve.

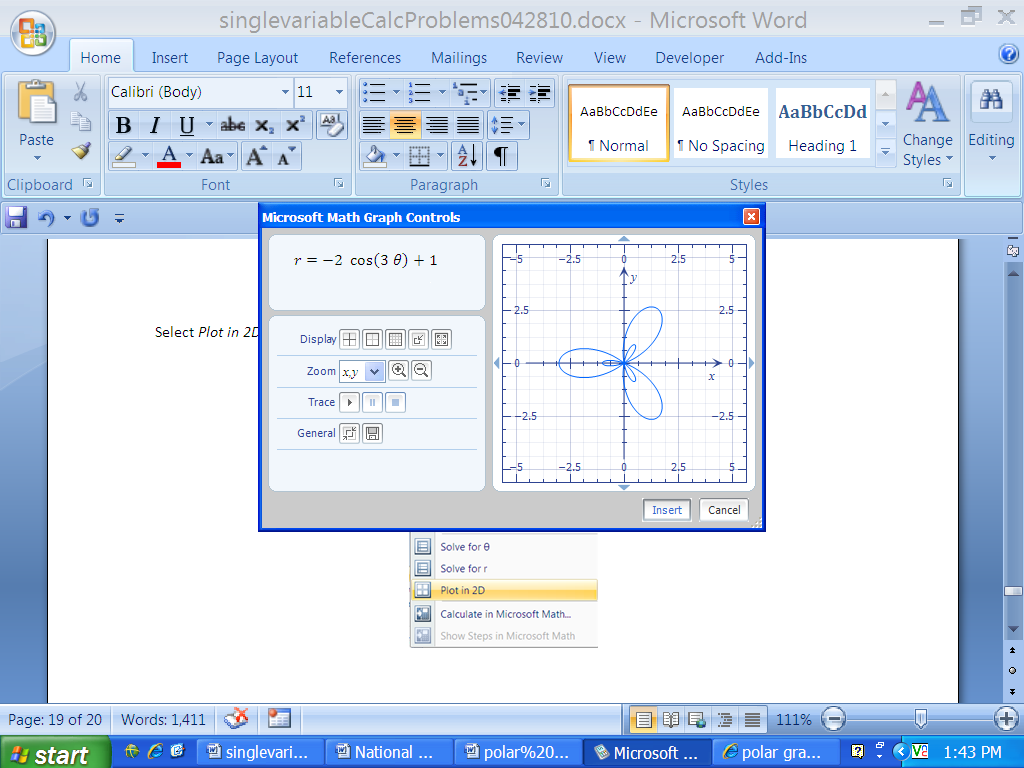
Input the following using *Insert New Equation*.



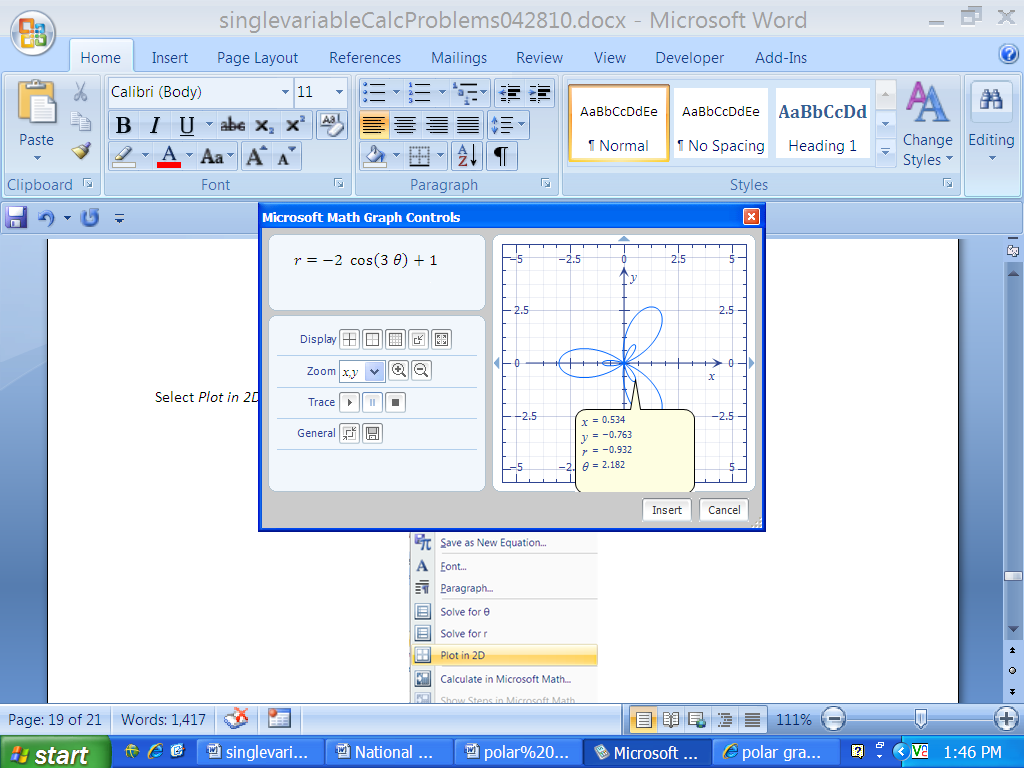
Select *Plot in 2D*.



The following will appear:



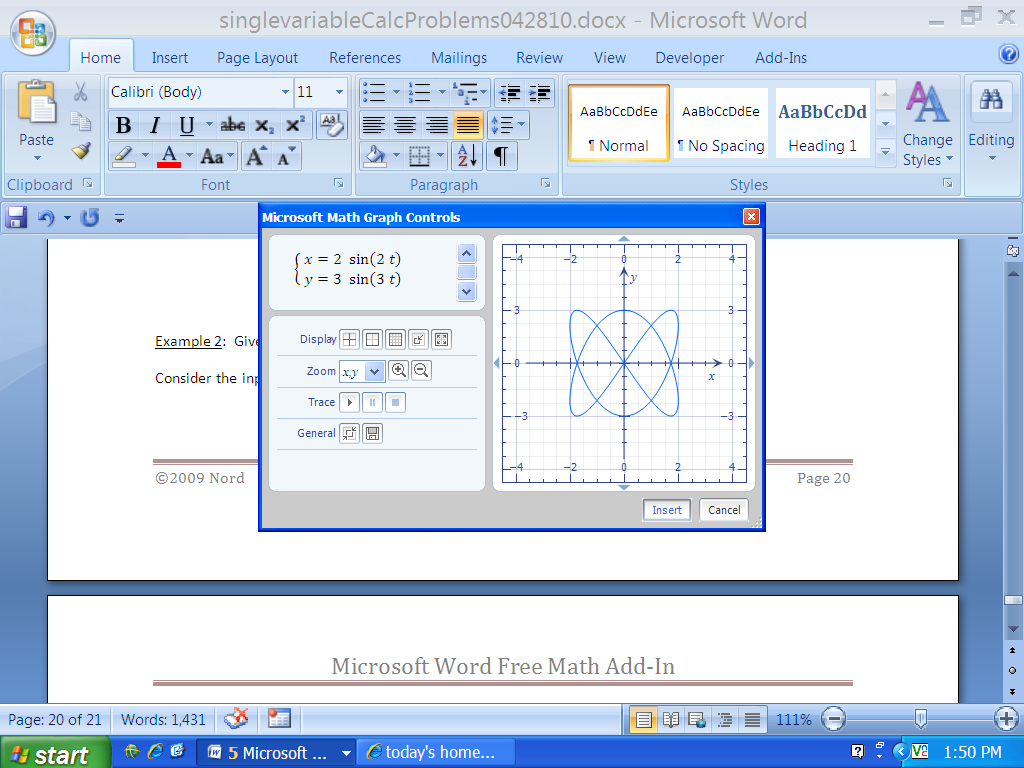
Select *Trace*.



Example 2: Give an example using the *plotparam* command.

Consider the input:

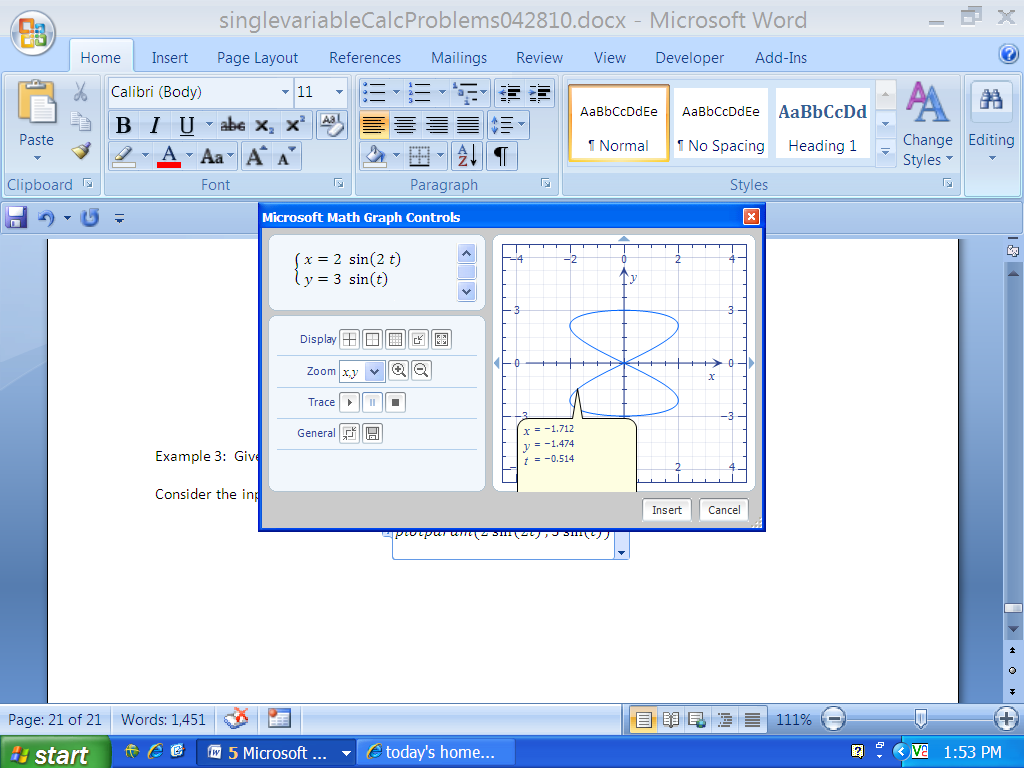
Select *Simplify* to get:



Example 3: Give an example using the *plotparam* command and the *Trace* feature.

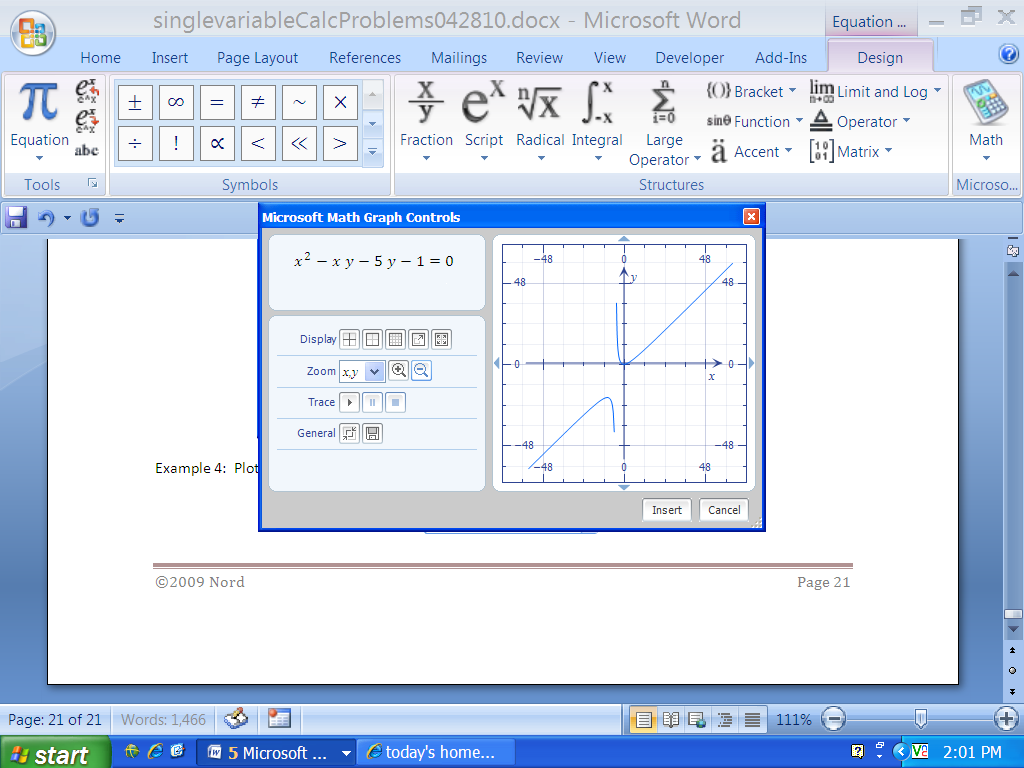
Consider the input:

Select *Simplify* and then apply the *Trace* feature.



Example 4: Plot the following equation.

Input the equation, right-click, and select *Plot in 2D*. Use the *Zoom* out feature to capture the hyperbola.



Zoom out using this button.