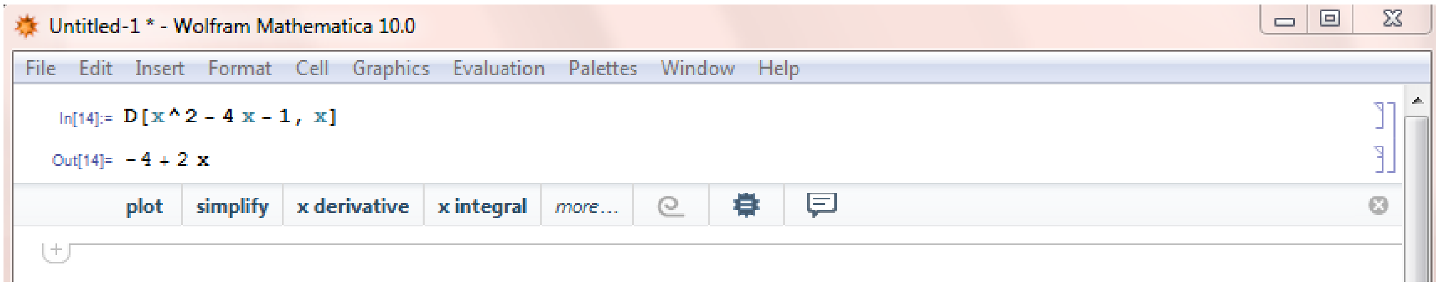
Technology Project #2—Derivatives

Taking the derivative with the D command

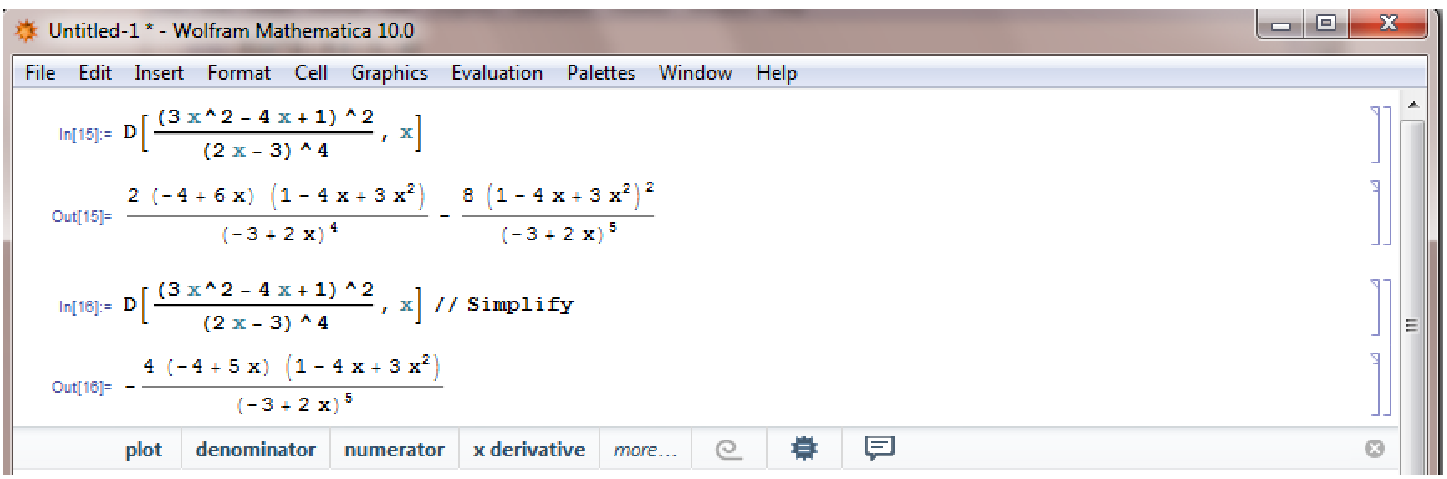
You can take the derivative in Mathematica using the command D[function , x].

For example, the following screen shot shows how to find the derivative of $y = -x^2 + 4x - 1$



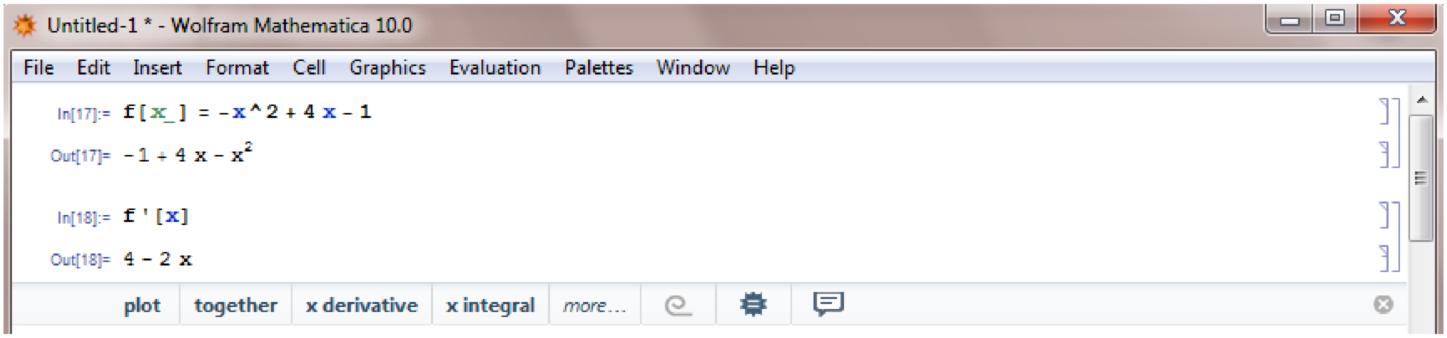
Simplifying your answer

Sometimes the derivative is quite complicated. Mathematica can be used to simplify the function using the //Simplify command. The following screenshot shows the derivative of $y = \frac{(3x^2-4x+1)^2}{(2x-3)^4}$ both with and without the //Simplify command.



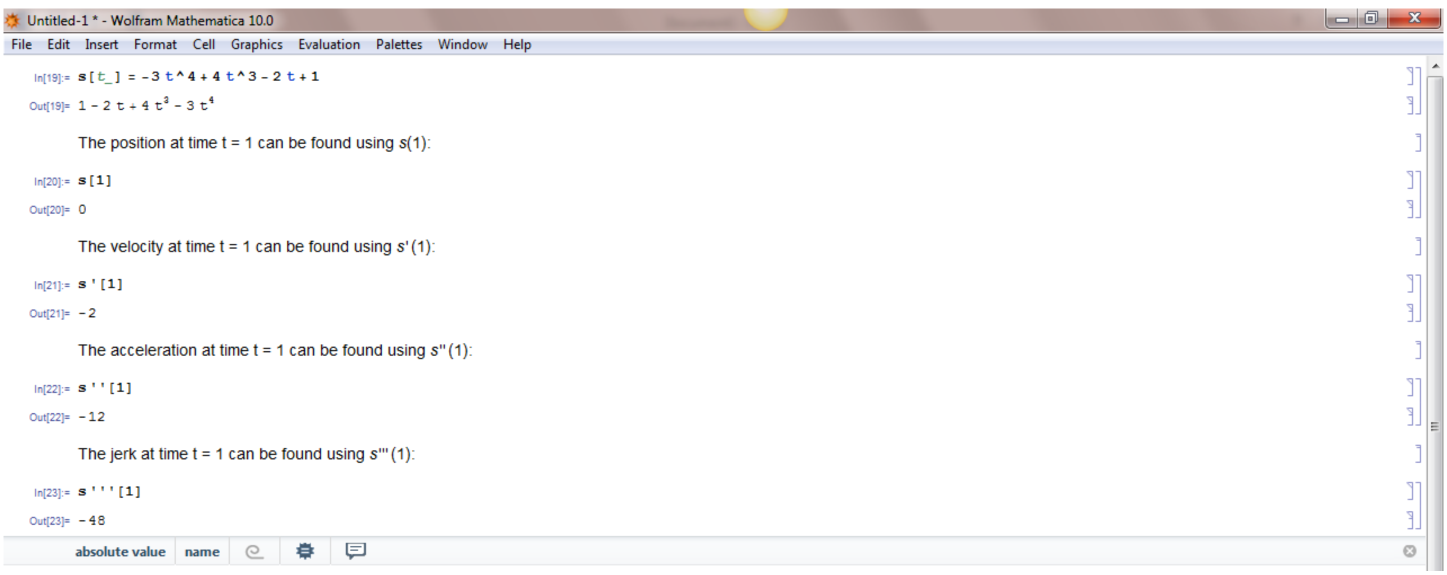
Taking the derivative by defining a function

You can define a function in Mathematica and then use function notation. For example, to take the derivative of $f(x) = -x^2 + 4x - 1$, we would first define the function and then find the derivative by typing f'[x].

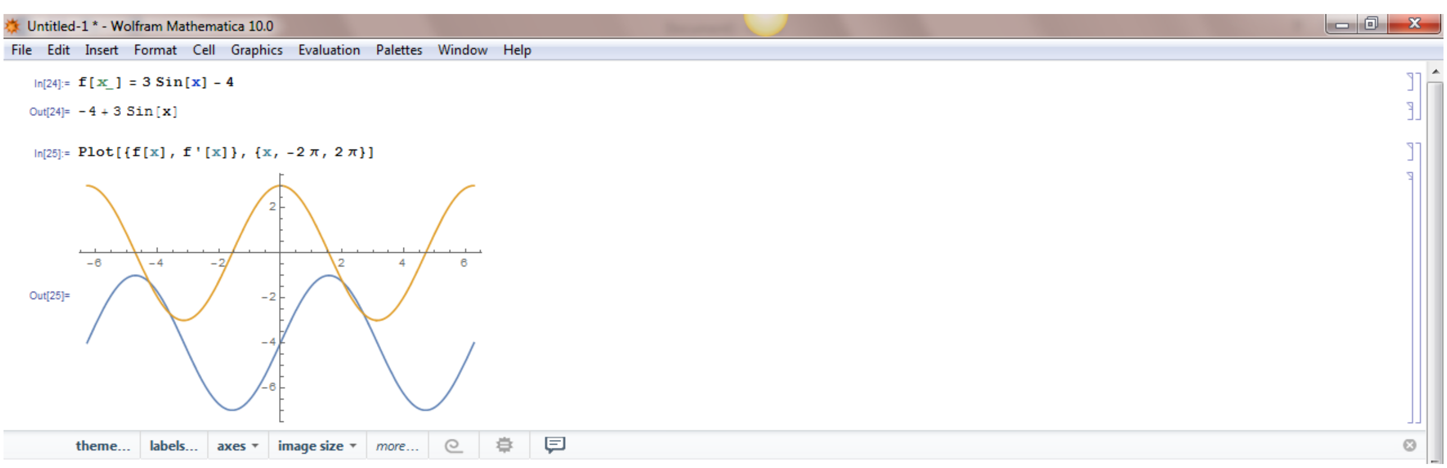


Evaluating a function or a derivative at a point

One of the advantages of using function notation is that you can then evaluate the function and its derivative at a given point. For example, if $s(t) = -3t^4 + 4t^3 - 2t + 1$ represents the position of a particle at time t, we can find the position, velocity, acceleration, and jerk at time $t = 1$ as shown in the following screenshot:



Once you have defined a function, you can also easily graph the function and/or its derivative.



Assignment Instructions

Directions: Please create a new Mathematica file and complete the following problems. Please do each problem in a separate Section Cell.

1. Find the derivative of $y = \sqrt{3\cos(4x^2 + 4x - 7)}$.
2. Find the derivative of $y = \frac{3x^2 - 4x + 14}{\sqrt{x - 5}}$ and use Mathematica to simplify your answer.
3. Find the derivative of $y = 8.3\sin x - 4.2\cos x$ and evaluate the derivative at the point $x = \frac{5\pi}{8}$.
4. Use the technique shown above to graph $y = x^2 - \ln(x - 1)$ and its derivative on the same coordinate axes.
5. When we learned about implicit differentiation (section 3.7) I introduced how to do the implicit differentiation using Mathematica. The command was $Solve[D[equation, x], y'[x]]$. Remember that with the equation for each y we have to put in $y[x]$ to represent that y is a function of x. Also remember that the equation must have an $==$ instead of just a single $=$. Using this command (do not copy it into Mathematica), find the derivative of $x^2\cos^2(y) - \sin(y) = e^{5x} + 6y\sqrt{x}$.