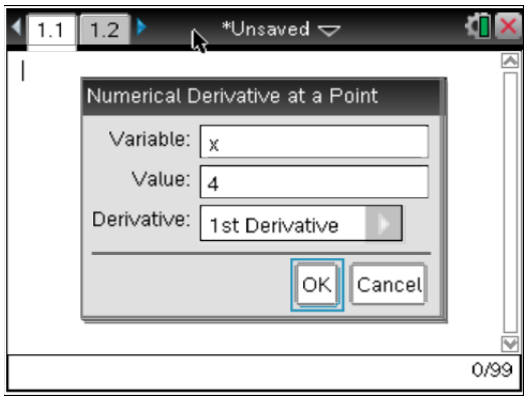
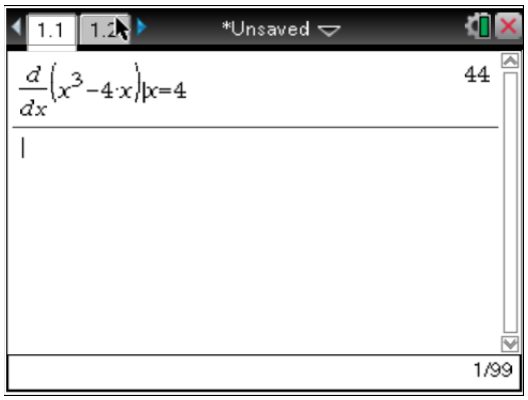
TI LAB 2: Derivatives

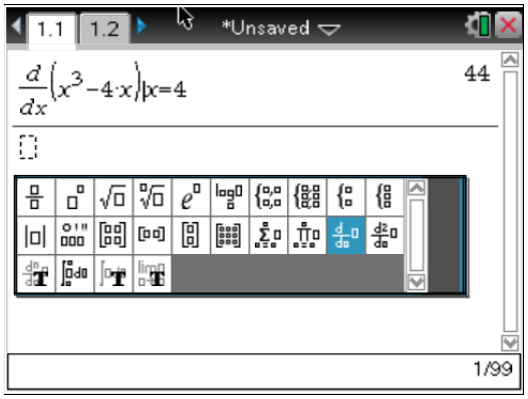
IN THIS LAB, YOU WILL: CALCULATE THE DERIVATIVE OF A FUNCTION AT A POINT FROM THE CALCULATOR SCREEN;
CALCULATE THE DERIVATIVE OF A FUNCTION AT A POINT FROM THE GRAPH SCREEN;
GRAPH THE DERIVATIVE OF A FUNCTION; AND
GRAPH TANGENT LINES AND USE THEM TO INVESTIGATE THE SLOPE OF A FUNCTION

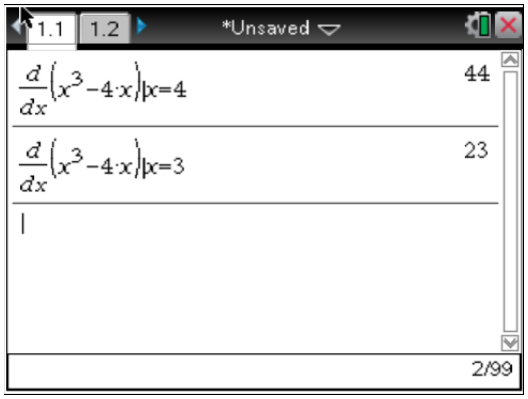
1. The command for the derivative is in the Calculus Menu as choice 1. Using this method, you are prompted to input the variable you are "respecting", the value of the variable where you want the numerical derivative calculated, and the order of the derivative you want calculated. Once you return to the calculator screen, you will need to enter the function you want to take the numerical derivative of.
a) Evaluate the derivative of $f(x) = x^3 - 4x$ at the point $x = 4$.





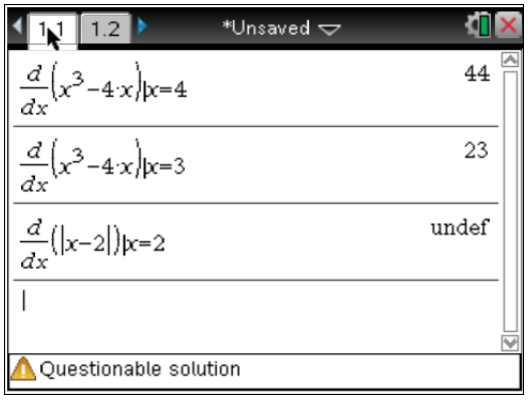
2. You can also calculate a derivative using a template. The templates key is located next to the number 9 key. The template for a derivative is second from the right on the second row. You will need to input the variable you are "respecting" as well as the function you are taking the derivative of. You must also indicate the value of x where you want the numerical derivative calculated. This can be kind of tricky. After your function, you will need to enter "|x=#". The "|" symbol can be found by pressing CTRL, =.
a) Evaluate the derivative of $f(x) = x^3 - 4x$ at the point $x = 3$.





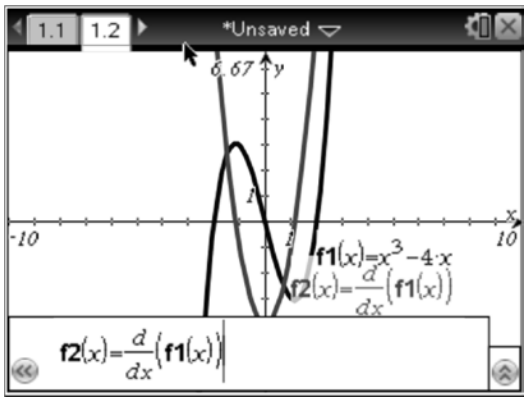
WARNING: The numerical derivative command will not give good results if you mistakenly attempt to evaluate the derivative of a function where the derivative is not defined! For instance $f(x) = |x - 2|$, is not differentiable at $x = 2$, and so the derivative there is undefined.

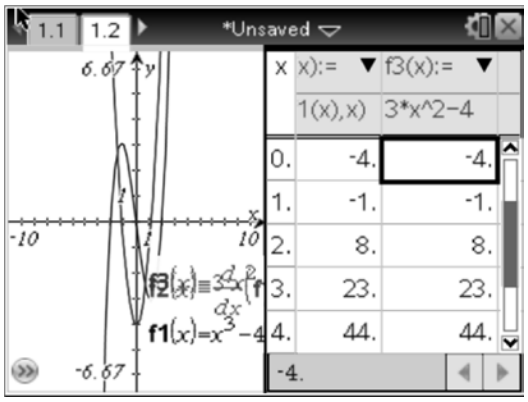
b) Attempt to calculate the derivative of $f(x) = |x - 2|$ when $x = 2$ using the numerical derivative command on the calculator. What did you get?



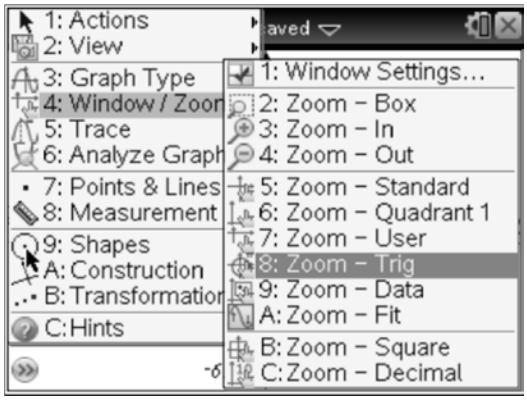
3. You can use the derivative template to graph the derivative of a function without finding the expression for the derivative.

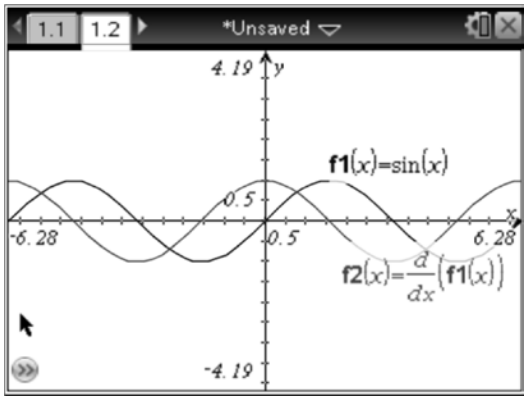
a) Enter $f(x) = x^3 - 4x$ into $f1$. Enter $f2(x) = \frac{d}{dx}(f1(x))$. Obviously the derivative of $f1$ is $3x^2 - 4$. Enter this on $f3$ and compare with $f2$ using the table. How accurate is the derivative approximation?





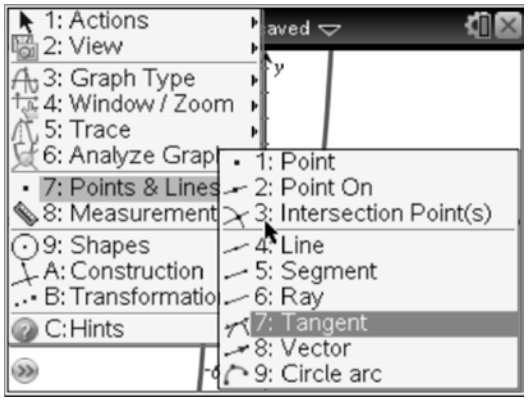
b) Clear $f3$. Enter $f1(x) = \sin x$. Make sure the mode is radians and then select Zoom – Trig. What function does the derivative resemble?

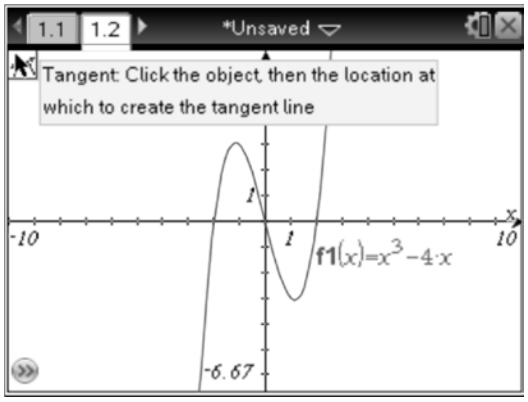


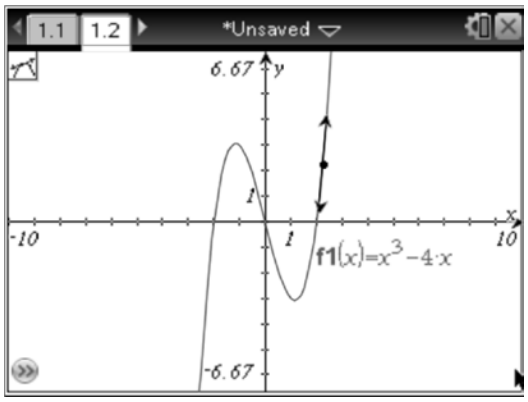


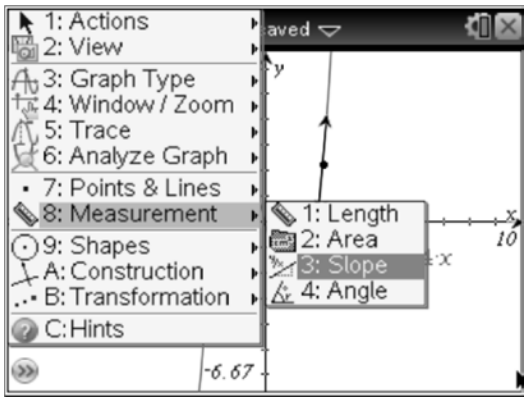
4. The Nspire can also graph the tangent line to a function at a point. The function is on the Graph menu as choice 7, then choice 7 again.

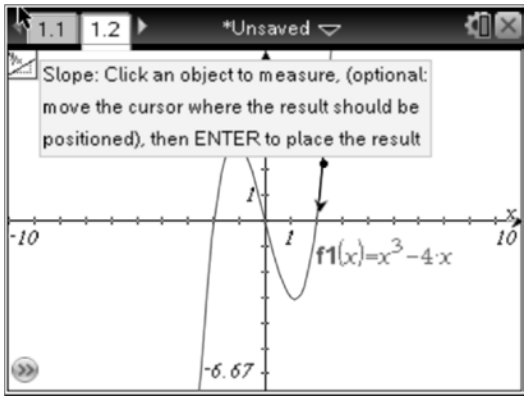
Clear $f2$. Enter $f1(x) = x^3 - 4x$ and choose Zoom: Standard. With the graph on the screen, press MENU, then 7: Points & Lines, then 7: Tangent. You will see a graphic in the top left corner of your screen. Click this graphic, then click your graph. The cursor should change to a pencil and the words "point on" should appear. Press ENTER. Now we're going to have the calculator find the slope of that line. Press MENU, then 8: Measurement, then 3: Slope. You will see a graphic in the top left corner of your screen. Click this graphic, then click your tangent line. You will see a number appear on your screen. This is the slope. Press ENTER and then place the slope somewhere on your screen and press ENTER again. Now go grab your tangent line and move it around on the graph. Note how the slope of the tangent line changes as it moves along the curve. When is the slope negative? When is it positive? When is it zero (or approximately zero)?

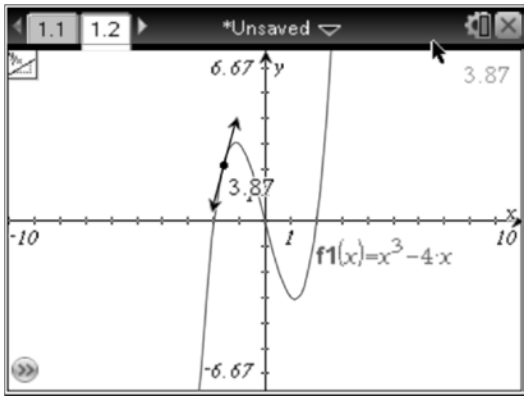












5. There is also a way to calculate the derivative directly on the graph by using the dy/dx function on the Analyze Graph menu. Press MENU, then 6: Analyze Graph, then 5: dy/dx. Move the cursor to the point at which you want to calculate the derivative (or simply enter the value) and press ENTER. (NOTE: to enter the value, you must open parentheses first). Remember that this is only an approximation.

a) Graph $y = x^3 + x^2 + e^{-\pi/2}$ on the standard window and find the derivative at the points $x = 1$, $x = 2$, and $x = -0.95$. What conclusion can you draw from the value of the derivative at $x = -0.95$?