Math 1151, Newton's Method Activity, Fall 2014 Name KEY

Instructions: Use Newton's Method $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$ to find the zeros of the specified function, or the intersection of functions. Sketch the graph of the functions to see how many you need to find.

You can set your calculator up to do this quickly by doing the following steps: 1) Put the original function into Y1. Put the derivative of the function into Y2. 2) Return to the main screen. Choose an x_1 value to start with. Enter it and press enter. 3) On the main screen write ANS –Y1(ANS)/Y2(ANS)). You can get the Y1 and Y2 commands from the VARS key, then select Y-VARS, FUNCTION and the appropriate function. The ANS command is 2ND and the Negative (-) key. 4) When you press enter, the value of x_2 will appear. Since the command uses the last answer, you only need to press ENTER again to get x_3 and so forth. Record each answer until you have 4 decimals places that remain fixed. You can repeat for a different starting value to find additional zeros.

1. Find all zeros of
   a. $f(x) = e^x - 5$

$f'(x) = e^x$

$x_0 = 2$ $x_1 = 1.676676\ldots$

$x_2 = 1.61169\ldots$ $x_3 = 1.60944\ldots$

$x_4 = 1.6094379$ $\boxed{x_5 = 1.609437912}$

   b. $f(x) = \tan(x) - 2x$ (if there is more than one, find at least 2)

$f'(x) = \sec^2 x - 2$

$x_0 = 2$ $x_1 = 3.63868$ $x_2 = -5.905$ $x_5 = 8.5855\ldots$

stop

$x_0 = 1$ $x_1 = 1.310478$ $x_2 = 1.2239$ $x_3 = 1.176$

$x_4 = 1.1659$ $x_5 = 1.16556$ $\boxed{x_6 = 1.16556185} = x_4$

$x_0 = 0$ $\boxed{x_1 = 0}$

$x_0 = -1$ $x_1 = -1.31047$, $x_2 = -1.2239\ldots$ $x_6 = -1.16556185$

2. Find the intersection of $f(x) = \ln(x)$ and $g(x) = x^3 - 2$. Do this by creating a function $f(x) - g(x) = h(x)$ and then find the zero of $h(x)$.

$h(x) = \ln x - x^3 + 2$

$h'(x) = \frac{1}{x} - 3x^2$

$x_0 = 2$ $x_1 = 1.5385$ $x_2 = 1.3508$ $x_3 = 1.3161\ldots$

$x_4 = 1.31498$ $x_5 = \boxed{1.31499872} = x_6$

$x_0 = 1$ $x_1 = 1.5$ $x_2 = 1.34\ldots$ same as before

$x_0 = -1/2$ $x_1 =$ undef

$x_0 = -1/4$ $x_1 = .09$ $x_2 = .128$ $x_3 = .1354$

$x_4 = .13567$ $\boxed{x_5 = .135673691 = x}$