Math 180: Newton's Method, 4.8

Example: Use Newton's method to find all roots of the equation $e^x = 3 - 2x$, correct to 6 decimal places.

1. Get all terms to one side equal to 0: $\quad\quad 3 - 2x - e^x = 0$
2. Define $f(x)$: $\quad\quad\quad\quad\quad\quad\quad\quad f(x) = 3 - 2x - e^x$
3. Find the derivative, $f'(x)$: $\quad\quad\quad f'(x) = -2 - e^x$
4. Graph $f(x)$ on calculator to determine a reasonable first guess, x_1, $\quad\quad$ [$x_1 = 1$ looks good]
5. Follow calculator instructions below to find the root.
6. Round to 6 decimal places.

CALCULATOR INSTRUCTIONS:

1. Under the $\boxed{\text{Y=}}$ menu, input: $\quad\quad\quad\quad\quad\quad\quad\quad$ Example:

   $Y_1 = f(x)$ $\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad Y_1 = 3 - 2x - e^x$

   $Y_2 = f'(x)$ $\quad\quad\quad\quad\quad\quad\quad\quad\quad Y_2 = -2 - e^x$

2. Go back to the home window, and $\boxed{\text{CLEAR}}$ the screen.

3. Say our initial guess is $x_1 = 1$. Store your initial guess into X by typing: $\quad\quad$ 1 $\boxed{\text{STO►}}$ X $\boxed{\text{ENTER}}$

   The screen will look like: $\quad\quad$ 1→X

4. Now type in $\quad\quad$ X – Y_1/Y_2 $\boxed{\text{STO►}}$ X $\boxed{\text{ENTER}}$

   The screen will look like: $\quad\quad$ X – Y_1/Y_2 →X

   Reminder, to type in Y_1 the keystrokes are: $\boxed{\text{VARS}}$ $\boxed{\text{►}}$ $\boxed{\text{ENTER}}$ $\boxed{1}$

   to type in Y_2 the keystrokes are: $\boxed{\text{VARS}}$ $\boxed{\text{►}}$ $\boxed{\text{ENTER}}$ $\boxed{2}$

5. Continue to press $\boxed{\text{ENTER}}$ to get the next x_2, x_3, x_4, x_5, … Until you get the required number of decimal places.

   In this example: $\quad\quad x_1 = 1$

   $\quad\quad\quad\quad\quad\quad\quad x_2 = 0.6358246729$

   $\quad\quad\quad\quad\quad\quad\quad x_3 = 0.5946198249$

   $\quad\quad\quad\quad\quad\quad\quad x_4 = \underline{0.594204}9994$

   $\quad\quad\quad\quad\quad\quad\quad x_5 = \underline{0.594204}9585$

6. Round to the decimal place asked for. $\quad$ In this example: **To 6 decimal places, the root is 0.594205**