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

CALCULATOR INSTRUCTIONS:

1. Under the $\text{Y}=\text{menu}, \text{input}$: $Y_1 = f(x)$ $Y_1 = 3 - 2x - e^x$
   $Y_2 = f'(x)$ $Y_2 = -2 - e^x$
2. Go back to the home window, and $\text{CLEAR}$ the screen.
3. Say our initial guess is $x_i = 1$. Store your initial guess into X by typing: 
   $1 \text{ STO} \rightarrow \text{X} \text{ ENTER}$
   The screen will look like: $1 \rightarrow \text{X}$
4. Now type in $\text{X} \rightarrow \text{Y}_1/\text{Y}_2 \text{ STO} \rightarrow \text{X} \text{ ENTER}$
   The screen will look like: $\text{X} \rightarrow \text{Y}_1/\text{Y}_2 \rightarrow \text{X}$

Reminder, to type in $\text{Y}_1$ the keystrokes are: $\text{VARS} \rightarrow \text{ENTER} \rightarrow 1$
   to type in $\text{Y}_2$ the keystrokes are: $\text{VARS} \rightarrow \text{ENTER} \rightarrow 2$
5. Continue to press $\text{ENTER}$ to get the next $x_2, x_3, x_4, x_5, \ldots$ Until you get the required number of decimal places.
   In this example: $x_i = 1$
   $x_2 = 0.6358246729$
   $x_3 = 0.5946198249$
   $x_4 = 0.5942049994$
   $x_5 = 0.5942049585$

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