

**Homework 1: Warm Up!**

DUE: Soon

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I Consider the function

$$f(x) = x \sin(3x) - \exp(x)$$

and solve for the x-value near  $x \approx -0.5$  that satisfies  $f(x) = 0$ . In the first part, use the Newton-Raphson method with the initial guess  $x(1) = -1.6$  to converge (in absolute value) to the solution to  $10^{-6}$ . Keep track of the number of iterations until convergence is achieved (NOTE: please check convergence with  $f(x_n)$  not  $f(x_{n+1})$ ). In the second part, use bisection with the initial end points  $x = -0.7$  and  $x = -0.4$ . Keep track of the mid point values and number of iterations until an accuracy of  $10^{-6}$  is achieved.

**ANSWERS:** Should be written out as A1.npy, A2.npy, and A3.npy. Specifically, A1.npy is the vector of x-values in the Newton method starting with the initial guess  $x(1) = -1.6$ , and A2.npy is the mid point ( $x_{mid}$ ) values in the bisection method for successive iterations. A3.npy is a 1x2 vector with the number of iterations for the Newton and bisection respectively as the two components.

II Let the following be defined:

$$\mathbf{A} = \begin{bmatrix} 1 & 2 \\ -1 & 1 \end{bmatrix}, \mathbf{B} = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}, \mathbf{C} = \begin{bmatrix} 2 & 0 & -3 \\ 0 & 0 & -1 \end{bmatrix}, \mathbf{D} = \begin{bmatrix} 1 & 2 \\ 2 & 3 \\ -1 & 0 \end{bmatrix} \mathbf{x} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}, \mathbf{y} = \begin{bmatrix} 0 \\ 1 \end{bmatrix}, \mathbf{z} = \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix},$$

Calculate the following:

(a)  $\mathbf{A} + \mathbf{B}$ , (b)  $3\mathbf{x} - 4\mathbf{y}$ , (c)  $\mathbf{Ax}$ , (d)  $\mathbf{B(x-y)}$ , (e)  $\mathbf{Dx}$ , (f)  $\mathbf{Dy} + \mathbf{z}$ , (g)  $\mathbf{AB}$ , (h)  $\mathbf{BC}$ , (i)  $\mathbf{CD}$ **ANSWERS:** Should be written out as A4.npy–A12.npy