

Homework 1: Warm Up!

DUE: Friday, October 4 at midnight

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 (pages 25-30 of notes) 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, A2, and A3. Specifically, A1 is the vector of x-values in the Newton method starting with the initial guess $x(1) = -1.6$, and A2 is the mid point (x_{mid}) values in the bisection method for successive iterations. A3 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) $\mathbf{A}\mathbf{x}$, (d) $\mathbf{B}(\mathbf{x} - \mathbf{y})$, (e) $\mathbf{D}\mathbf{x}$, (f) $\mathbf{D}\mathbf{y} + \mathbf{z}$, (g) \mathbf{AB} , (h) \mathbf{BC} , (i) \mathbf{CD} **ANSWERS:** Should be written out as A4–A12