

AMATH 481 / 581 Fall 2021
Homework Gradescope Submission Practice

Submission open until 11:59:59pm Monday October 11, 2021

This assignment is for **practice** and **will not be included in your grade calculation**. Make sure to upload to Gradescope your main homework **m-file** (solution.m) as well as any **auxiliary** files (function files or data files). Do not put any unnecessary marks, e.g. “!”, “\$”, in your code (even if you are extremely excited about the assignment). Please do not change the overall struction of the solution.m file and treat it as your ”main” file.

Exercise 1 Building a Matrix

Define the following matrix:

$$\mathbf{A} = \begin{bmatrix} 34 & 45 \\ 17 & 6 \end{bmatrix}$$

Answers: Assign the matrix **A** as A1 variable, i.e. A1=A.

Exercise 2 Matrix Operations

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) **A+B**, (b) **3x - 4y**, (c) **Ax**, (d) **B(x-y)**, (e) **D x**, (f) **D y + z**, (g) **AB**, (h) **BC**, (i) **CD**

ANSWERS: Assign these variables as variables named A2–A10.

Exercise 3 Root Finding

Consider the function $f(x) = -x - \cos(x)$ and solve to find the root near $x \approx -0.74$, i.e., x-value that satisfies $f(x) = 0$. In the first part, use the Newton-Raphson method with the initial guess $x(1) = -3$ to converge (in absolute value) to the solution within 10^{-6} . Keep track of the number of iterations until convergence is achieved (NOTE: please check convergence with $f(x_{n+1})$). In the second part, use bisection with the interval end points $x_a = -3$ and $x_b = 1$. 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 A11–A13. A11 is the *column* vector of x-values in the Newton method starting with the initial guess $x(1) = -3$. A12 is the *column* vector of midpoint (x_{mid}) values in the bisection method for successive iterations. A13 is a 1x2 vector with the number of iterations for the Newton and bisection respectively as the two components.