Project 1
Matlab Project
Finite Difference and why you cannot take the limit $\Delta x \to 0$ on the computer.

Grading:

1. [80%] Complete assignment, input results in webcourses assignment Quiz as instructed.
2. [20%] Uploaded Matlab code files and output.

You must upload your codes and output to receive credit for this part of the assignment. Failure to upload your Matlab code will result in a loss of 50 points for the assignment.

You are to write a program in Matlab to evaluate the forward finite difference, backward finite difference, and central finite difference approximation of the first derivative of a one-dimensional normalized displacement given as:

$$u(x) = 2.5 - 1.25\cos(3.8x)$$

at the location $x_0 = 5.25$ using a step size of $\Delta x = 0.1, 0.01, 0.001 ... 10^{-20}$. Evaluate the exact derivative and compute the absolute error for each of the three finite difference methods.

1. Generate a table of results for the error for each finite difference at each value of Δx.
2. Generate a plot containing the log of the error for each method vs the log of Δx.
3. What is machine epsilon in the Matlab default real variable (double precision)?
4. Repeat this in single precision.
5. What is machine epsilon in the Matlab single precision real variable?

Instructions: your project files should have a comment that has

1. Your name.
2. Due date of the project.
3. Name of the project.
4. The course name and number: EML 3034C Modeling Methods in MAE

Submit your Matlab project files along with output generated for questions 1-3 on the Webcourses project 1 submission section. Complete the project 1 assignment quiz on webcourses. Report on the Webcourses project 1 assignment Quiz the values of the derivative estimated using each of the three finite differences using as step size of $\Delta x=10^{-2}$, $\Delta x=10^{-6}$, $\Delta x=10^{-10}$, and $\Delta x=10^{-20}$.