MATH-411 Numerical Analysis—Homework 3
Rochester Institute of Technology, Fall 2022

Due: Friday September 16, 2022 at 11.59pm EST.
Instructor: Blessing Emerenini
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Remark:
- All assignments are uploaded on MyCourses as pdf.
- For this assignment your can handwrite your solution **or** you can type your solution in Microsoft word and then convert to pdf **or** you can use Latex and automatically generate your pdf.
- Figure out how to upload your files on MyCourses before the due dates. Late homeworks are **not** accepted.
- You can discuss ideas on how to tackle the problems on **Piazza** but do not post solutions. Thanks.

Please show all your work clearly. If the assignment involves MATLAB, please turn in your code and figures as well.

Important Note: The answers to the following questions are in the textbook, so you do not get any point for the answers, you are expected to provide solutions with detailed explanations to get your points.

1. Let $f(x) = x^4 - 7x^3 + 18x^2 - 20x + 8$. Does Newton's Method converge quadratically to the root $r = 2$?. Find $\lim_{i \to \infty} e_{i+1}/e_i$, where e_i denotes the error at step i

2. Each equation has one root. Use Newton's method to approximate the root to eight correct decimal places.

    (a) $x^3 = 2x + 2$
    (b) $e^x + x = 7$
    (c) $e^x + \sin x = 4$

3. Apply Newton's Method to find the only root to as much accuracy as possible and find the root's multiplicity. Then use Modified Newton's Method to converge to the root quadratically. Report the forward and backward error of the best approximation obtained from each method.

    (a) $f(x) = 27x^3 + 54^2 + 36x + 8$
    (b) $f(x) = 36x^4 - 12x^3 + 37x^2 - 12x + 1$

4. Consider the function $f(x) = e^{\sin^3 x} + x^6 - 2x^4 - x^3 - 1$ on the interval $[-2, 2]$. Plot the function on the interval, and find all three roots to six correct decimal places. Determine which roots converge quadratically, and find the multiplicity of the roots that converge linearly.