

MATH-411 Numerical Analysis—Homework 2
Rochester Institute of Technology, Fall 2022

Due: Friday September 09, 2022 at 11.59pm EST.

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Remark:

- All assignments are uploaded on MyCourses as pdf.
- For this assignment you 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.

1. Suppose that you were to run the bisection method on the function $f(x) = \frac{1}{x}$ with starting interval $[-1, 2]$. Will the method converge to a real number? If so, is this a root? Give some explanation of why you will see this behavior.
 2. Apply two steps of Newton's method with initial guess $x_0 = 1$ to find the roots of $f(x)$ where (a) $f(x) = x^3 + x^2 - 1$ and (b) $f(x) = x^2 + (x + 1)^{-1} - 3x$.
 3. Consider the following 5 methods for calculating $2^{\frac{1}{4}}$.
 - (a) Bisection methods applied to $f(x) = x^4 - 2$.
 - (b) Secant Method applied to $f(x) = x^4 - 2$.
 - (c) Fixed point iteration applied to $g(x) = \frac{x}{2} + \frac{1}{x^3}$.
 - (d) Fixed point iteration applied to $g(x) = \frac{2x}{3} + \frac{2}{3x^3}$.
 - (e) Fixed point iteration applied to $g(x) = x - \frac{2}{5}(x^4 - 2)$.
 - (f) Newton's Method applied to $f(x) = x^4 - 2$Rank them in order of speed of convergence from fastest to slowest. Give the reasons for your ranking.
 4. Let $f(x) = x^2 - 6$. With $p_0 = 3$ and $p_1 = 2$, find p_3 using the Secant method.
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