

Homework 1 due September 12th

Numerical Analysis, Fall 2016

Please show your work. Exercises in 1-5 should be done by hand. For the programming exercises in Chapter 4, hand in your Matlab codes and outputs. (You can use the matlab function *diary* to copy your command window output.) Page <http://academics.davidson.edu/math/chartier/Numerical/matlab.html> contains matlab M-files mentioned in the assignments, but you can (and are encouraged to) write your routines.

1. (*Intermediate Value Theorem.*) Show that the following equations have at least one solution in the given intervals.
 - (a) $2x \cos(2x) - (x - 2)^2 = 0$, intervals $[2, 3]$ and $[3, 4]$
 - (b) $x - (\ln x)^x = 0$, interval $[4, 5]$
2. Find $\max_{0 \leq x \leq 1} |f(x)|$ for $f(x) = (2 - e^x + 2x)/3$.
3. (*Rolle's Theorem.*) Given $f(x) = 1 - e^x + (e - 1) \sin((\pi/2)x)$, show that $f'(x)$ is 0 at least once in the interval $[0, 1]$.
4. Let $f(x) = x^3$.
 - (a) Find the second Taylor polynomial $P_2(x)$ about $x_0 = 0$.
 - (b) Find $R_2(0.5)$ and the error in using $P_2(x)$ to approximate $f(0.5)$.
 - (c) Repeat part (a) using $x_0 = 1$.
 - (d) Repeat part (b) using the polynomial from part (c).
5. Use three iterations of the Bisection method to find approximation of the root of $f(x) = \sqrt{x} - \cos x = 0$ on $[0, 1]$.

Programming part:

- Chapter 4, Exercise 2(a).
- Chapter 4, Exercise 18.