

## Home work 4: Due Tuesday March 1, 2016 Math 2335 Spring 2016

Name: \_\_\_\_\_

The polynomial

$$f(x) = x^5 - 5.4x^4 + 10.1x^3 - 7.436x^2 + 1.1253x + 0.61226$$

has three real zeros. Your task is to find all three of these zeros to within an error of  $\epsilon = 10^{-5}$  using any combination of the three methods: bisection, Newton's, and secant. You may wish to use different methods for different roots. **Your final report for this assignment must be typed with embedded table(s) and figure(s) as appropriate. It must be printed, stapled, and turned in at the beginning of class on Tuesday March 1, 2016.**

Your report must contain the following elements.

- (a) Produce a plot of  $f$  over an interval that shows each of the three roots. You may wish to produce multiple plots that show all of the roots and that focus on one or more of the roots. If you choose an appropriate interval  $[a, b]$  containing one or more roots, you can produce a plot using Matlab by typing the following commands into the command window:

```
>> x = linspace(a,b,1000);  
>> y = x.^5-5.4*x.^4+10.1*x.^3-7.436*x.^2+1.1253*x+0.61226;  
>> plot(x,y)  
>> grid on
```

Plots should have labels either directly embedded or contained in a clear caption. (Don't assume the reader understands your figure just because you know what you've plotted. You can save Matlab plots as jpeg files and edit them using paint or other software. They can be inserted into word documents where captions can be added. Matlab is NOT required, you can use an alternative software for plotting.)

- (b) Decide on the general location of the smallest (left most) root. Choose a method for finding it (bisection, Newton's, secant). Implement your chosen method. (You can write

your own code or modify the Matlab code that is available on D2L.) Include the following in your report:

- (b.1) A brief discussion of which method you chose and your reason for choosing it. Consider the nature of the root (is it simple, multiple, very close to another root, etc.). State which software and or program you used for the implementation.
  - (b.2) A table of iterates appropriate to the method (e.g.  $n, x_n, |x_n - x_{n-1}|$  for Newton's or secant, or  $n, a_n, b_n, c_n, b_n - c_n$  for bisection) Tables should have clearly labeled columns and a caption describing the contents of the table.
  - (b.3) Your final conclusion as to the root's value within the stated tolerance of  $10^{-5}$ .
  - (b.4) A brief discussion of your experience with the method. (How did you start your method? How many iterations were needed? Did the number of iterations meet your expectations? Did you try more than one method or change your mind about which would be best suited to this root?)
- (c) Repeat step (b) for the middle root.
- (d) Repeat step (b) for the right most root.

Note that the final turned in homework will contain at least one plot and at least three tables. The text that you add should be standard English in complete sentences with correct spelling and grammar. You are welcome to use Matlab or any other programming language that you are familiar with and MSWord or any word processor that you prefer.