Math 450
Exam 2 – Take Home Portion – Due: Tuesday, October 16th by 4:00pm

Instructions:

- You will have until 4:00pm on Tuesday, October 16th to complete this exam.
- The credit given on each problem will be proportional to the amount of correct work shown. Answers without supporting work will receive little credit.
- Work your exam on separate sheets of paper. Be sure to number each problem and put your name on each page. Include printouts of any supporting graphs and computations.
- The only resources that are allowed for this exam are your textbook, your course notes, Maple, your calculator, and programs that you have written yourself (include a printout of your code and all output if you use a program to complete a portion of an assigned problem). If you use Maple, you **may not** use pre-programmed algorithms such as Newton's Method, solve, or fsolve. You **may** use functions, expressions, simplification, symbolic differentiation, and graphing features.
- You should not work collaboratively with your classmates. You should not consult with other individuals or make use of additional print or online resources. Doing so will be considered an act of academic dishonesty and will be dealt with accordingly.

1. Let $g(x) = x^5 - 6x^3 + 3x^2 - 7x + 3$.
   (a) (4 points) Use Modified Newton's Method to approximate a real root of $g(x)$ to 7 decimal places of accuracy.
   (b) (2 points) Demonstrate that $i = \sqrt{-1}$ is a root of $g(x)$.
   (c) (5 points) Find (or approximate to 7 decimal places of accuracy) all roots of $g(x)$ (both real and complex). You will receive 1 bonus point if you make use of "deflation" at least once in your solution to this problem.

2. Given the following equally spaced data values:

x	0.0	0.1	0.2	0.3
$g(x)$	1.000	0.631	0.128	-0.503

   (a) (6 points) Use the Newton Forward Difference Method to find 3rd degree interpolating polynomial $P_3(s)$.
   (b) (6 points) Use the Newton Backward Difference Method to find a 3rd degree interpolating polynomial $P_3(s)$.
   (c) (2 points) Use both polynomials you found above to approximate $f(0.25)$. Comment on your results.

3. Given: $h(1) = -1$, $h(1.2) = -0.36528$, $h(1.4) = 1.01664$, $h'(1) = 2$, $h'(1.2) = 4.6560$, $h'(1.4) = 9.6320$
   (a) (6 points) Construct the Hermite interpolating polynomial based on this data, and use this polynomial to approximate $h(1.25)$.
   (b) (4 points) Use direct computation (you can do this in Maple if you would like) to verify that the polynomial that you found (and its first derivative) does fit all six initial data values.