ME 549 Homework Assignment 1

1. Compare, contrast and comment on the solutions of all the real roots of the following equations using (a) bisection, (b) false position, (c) modified false position, (d) fixed-point iteration, (e) Newton-Raphson, (f) secant and (g) modified secant methods:

   1.1 $f(x) = x^3 - 9x^2 - 5x + 6$
   1.2 $f(x) = 24 - 50x + 35x^2 - 10x^3 + x^4$
   1.3 $f(x) = \sin(3x) - \cos(x/2)$; $0 < x < 3.2$
   1.4 $f(x) = (0.8 - 0.3x) / x$; $x > 0$
   1.5 $f(x) = x \cos(x) e^{x/5}$; $-3 < x < 3$

2. Find the *maximum* of $f(x) = x^4 - 6x^3 + 5x^2 + 12x$ between $x=0$ and $x=3$ using (a) interval halving and (b) the modified secant method. Describe your solution methods and comment on the results.

3. Find the smallest positive root of $f(x) = 8\sin(x)e^{-x} - 1$ by (a) Newton-Raphson, (b) secant and (c) modified secant methods. Comment on your results.

4. The function $f(x) = x^4 - 6x^3 + 13x^2 - 12x + 4$ has two double roots, at $x = 1, 2$. Solve for the root at $x = 2$ using the standard Newton-Raphson method and the two modifications to N-R discussed in class, using an initial guess of $x_o = 1.7$. Comment on your results.

5. Use and comment on Müller's method to find all of the real roots of
   a. $f(x) = x^4 - 16x^3 + 86x^2 - 176x + 105$
   b. $f(x) = x^4 - 5x^2 + 4$

6. Use and comment on Bairstow's method to find all of the real and complex roots of
   a. $f(x) = -2 + 6.2x - 4x^2 + 0.7x^3$
   b. $f(x) = 9.34 - 21.97x + 16.3x^2 - 3.704x^3$
   c. $f(x) = x^4 - 3x^3 + 5x^2 - x - 10$
   d. $f(x) = x^3 - x^2 + 3x - 2$
   e. $f(x) = 2x^4 + 6x^2 + 10$