ME 5400 Homework Assignment #3

1. Using the Golden-Search method, the parabolic interpolation method and Newton's method, find the maximum values of the following functions:

   a. $f(x) = -x^2 + 8x - 1$
   b. $f(x) = -1.5x^6 - 2x^4 + 12x + 15$
   c. $f(x) = 18 + 4.2x - 1.8x^2 + 1.2x^3 - 0.3x^4$
   d. $f(x) = -x^4 - 2x^3 - 8x^2 - 5x + 12$

2. Using the Golden-Search method, the parabolic interpolation method and Newton's method, find the *minimum* values of the following functions:

   a. $f(x) = 4 + 3x + (4/x)$; x>0
   b. $f(x) = 10 + 5x + 5x^2 + 3x^3 + 4x^4$

3. Implement Newton's method, but with the following finite difference approximations for the derivatives. Validate your implementation by solving problems 1b and 2b above.

$$f'(x) = \frac{f(x_i + \delta x_i) - f(x_i - \delta x_i)}{2\delta x_i}$$

$$f''(x) = \frac{f(x_i + \delta x_i) - 2f(x_i) + f(x_i - \delta x_i)}{(\delta x_i)^2}$$

4. Using the random search method, and using a range from 0 to 3 in *x* and -1 to 1 in *y*, find the maximum of

$$f(x) = -x^4 + 5x^3 + 4x^2 + 5x - 6y^2 + xy + 18$$

5. The *grid search* is another brute force approach to optimization. In the two-dimensional version, *x* and *y* are divided into increments to create a rectangular grid. The function is then evaluated at each node of the grid. The more dense the grid, the more likely it is to locate the optimum.

   Implement the grid search as an Excel VBA macro. Design the program so that it will locate a maximum, and allow the user to easily refine the search to "zoom in" on a region of interest. Test it by solving problem 4 above.