Homework 07

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Work in groups of two. Include both of your names as a comment in the first line of each file. Then submit those files on canvas (once per group!).

1. Use the bisection algorithm (`bisect.m`) to find all (three) solutions x to the equation

$$e^x = \sin(x) + 5x^2$$

with an accuracy of 6 digits after the decimal point. Hint: You need to experiment with different values for a and b. The three roots are between -5 and 5.

Submit `hw07q1.m` that calls bisect and prints the solutions.

2. Submit: `secant.m` and `hw07q2.m`:

   (a) Use bisection and Newton's method (see `bisect` and `newt` on canvas) to find the smallest positive solution to

$$\sin(x) = 2\cos(x)$$

   using a tolerance of 10^{-12}, use a starting value $x = 0$ for Newton's and pick the interval [0,3] for bisection. Output the solutions and the number of iterations for each method.

   (b) Implement the secant method as `[x,numits] = secant(func,x0,x1,tol)` in Matlab.

   (c) Extend your program in a) to also test the secant method and output he number of iterations. Use $x_0 = 0$ and $x_1 = 0.1$.

3. Solve the following nonlinear system using Newton's method in Matlab (use `newton.m`):

$$\begin{aligned} 0 &= x^2 - y - \sin(z) + 1, \\ 0 &= x + 1 + \sin(10y) - y, \\ 0 &= (1-x)z - 2. \end{aligned}$$

Include a command to check that your solution is a root (or close to) by plugging the answer back into your function.

Hint: You need to find a suitable starting value for x, y, and z so that the method converges.

Bonus: Can you find more than one root?

Submit `hw07q3.m` and make sure the definitions of your functions f and ∇f are also included (if you create them in separate files).