

ENGR 6101: COMPUTATIONAL ENGINEERING

Problem Set 2 (due Friday in class, 9/04)

Questions:

The concentration of pollutant bacteria c in a lake decreases according to

$$c = 75e^{-1.5t} + 20e^{-0.075t}$$

Determine the time required for the bacteria concentration to be reduced to 15.

1. (3 pts.) Write a Matlab code to solve this problem using Newton's method with an initial guess of $t = 6$ and stopping criterion of 0.5% approximate relative error (equation 3.5 in textbook). At each iteration, your code should print (i) iteration number, (ii) approximated value of t , and (iii) estimated error¹. Print your code, and the output of your code, and include them in your solution. Name your code as `newton.m` and submit soft copy as an e-mail attachment to `caner@uga.edu`.
2. (3 pts.) Modify the code `bisection.m` given on the course website to solve the same problem using bisection method. Take your initial interval to be $[0, 6]$. Use the current interval length for error. At each iteration, your code should print (i) iteration number, (ii) approximated value of t , and (iii) the error. Print your code, and the output of your code, and include both in your solution. Name your code as `bisection.m` and submit soft copy as an e-mail attachment to `caner@uga.edu`.
3. (3 pts.) Write a Matlab code to solve the same problem using secant method with the same stopping criterion as in 1. Start at $x_1 = 6, x_2 = 5$. At each iteration, your code should print (i) iteration number, (ii) approximated value of t , and (iii) estimated error. Print your code, and the output of your code, and include both in your solution. Name your code as `secant.m` and submit soft copy as an e-mail attachment to `caner@uga.edu`.
4. (3 pts.) Write a Matlab code to solve the same problem using fixed point iterations with the same stopping criterion as in 1. Start at $x = 6$. At each iteration, your code should print (i) iteration number, (ii) approximated value of t , and (iii) estimated error. Print your code, and the output of your code, and include both in your solution. Name your code as `fixed_point.m` and submit soft copy as an e-mail attachment to `caner@uga.edu`.
5. (3 pts) Re-run your codes as follows:
 - Use $x = 0$ as the initial value for Newton.
 - Use $x = 0$ as the initial value for fixed point iteration.
 - Use $x = 0, 1$ as the initial values for the secant method.
 - Use $[0, 10]$ as the initial interval for bisection method.

Print the just the outputs (not the codes) and include them in your solution. How many iterations does each one take (with the same error)? Which one converges faster? Which method is easier to implement in Matlab? If you were given a choice, which method would you use?

¹You can use `disp` command to do this.