Assignment 2

1. Find the all points at which $e^{-x/5} = \sin(x)$ on the interval $[0, 10]$.

   (a) **[Graphical Inspection]** Plot the functions $e^{-x/5}$ and $\sin(x)$. From this, make your first approximations to the points where they are equal.

   (b) **[Bisection Method]** Write a program which will implement the bisection method, given initial intervals $[a_k, b_k]$. Use the results from problem $1(a)$ to implement the program, and find the approximations to the points where $f(x) = e^{-x/5} - \sin(x) = 0$. Let the bisection method run until $|f(x)| < 10^{-7}$. Count the number of steps that the bisection method takes for each point.

   (c) **[Seant and Regula falsi]** Write a program which will implement Secant and Regula falsi method, given an initial intervals $[a_k, b_k]$, Again use the results from problem $1(a)$ to implement the program . Let these methods run until $|f(x)| < 10^{-7}$. Count the number of steps invlved in Secant/ Regula falsi method for each point. Compare the speed to Secant/Regula falsi method to that of the bisection method.

   (d) **[Newton's Method]** Write a program which will implement Newton's method, given an initial starting point, such as $b_k - a_k$ from above. Let the Newton's method run until $|f(x)| < 10^{-7}$. Count the number of steps that the Newton's method takes for each point. Compare the speed to Newton's method to that of the bisection method, Regula falsi method and Secant method.

2. Find the root of the following functions given below by using fixed point iteration method.

   (a) $x^3 - x - 1 = 0$ in $[1, 2]$

   (b) $x = \dfrac{2 - e^x + x^2}{3}$, in some $[a, b]$.

   Estimate the number of iterations necessary to obtain approximation with accuracy within 10^{-7}. Comment about the speed of convergence.

3. Repeat the Question no. 2 with initial another guess x_0. Have you observe any difference. Write your observation.

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