Assignment 1

MAS365 Introduction to Numerical Analysis   **Fall 2023**
Prof. Chang-Ock Lee   **Due date: Sep. 14 (Thu), 2023**

Note: Put your homework in KLMS before the beginning of the class. If you did computer programming work, hand in your code and results in KLMS before the beginning of the class, too. For the plotting work, you may use any plotting tool, but I recommend to use MATLAB.

1. Rearrange the following expressions so as to avoid loss of significance.

   (a) $y - \sqrt{y^2 - 1}$ for y large

   (b) $1 - \cos^3 \theta$ for θ near 0 Hint: Use half-angle formulas.

   (c) $z^2 - 200z + 10001$ for z near 100

2. Write a program to use the bisection method to solve for the root of $\tan \theta = e^\theta$ in the interval $[0, \pi/2]$. Terminate the program when the relative difference between two consecutive iteration is less than 10^{-3}.

3. (a) Apply the fixed point iteration to the function $x - f(x)$ to attempt to find approximate zeros of $f(x)$, starting at $p_0 = 11.6$ and performing 4 iterations in each case:

      (i) $f(x) = 2552 - 30x^2 + x^3$

      (ii) $f(x) = (2552 - 30x^2 + x^3)/(-300)$

   (b) In each of the preceding two cases, explain, based on the theory of fixed point iteration, why the method "works" or "fails".

4. Do the problem 2 using Newton's method.