Assignment 2

MAS365 Introduction to Numerical Analysis **Fall 2023**
Prof. Chang-Ock Lee **Due date: Oct. 5 (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. (a) Write a program to use the method of false position 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}.

   (b) The problem in (a) is the same as Problems 2 and 4 of Assignment 1 using the bisection method and Newton's method, respectively. Compare the three methods and discuss efficiency in terms of the number of iterations, ease of programming, and anything else you think is pertinent.

2. Find approximations to within 10^{-5} for all zeros of

$$f(x) = x^4 - 4x^2 - 3x + 5$$

   by first finding the real zeros using Newton's method and then reducing to a polynomial of lower degree to determine the complex zeros by Müller's method.

3. By hand calculation, find the Lagrange interpolating polynomial and the Newton interpolating polynomial for the data:

x	-1	0	1/2	1	2	5/2
y	2	1	0	1	2	3

4. Write a program to find the Newton interpolating polynomial P that interpolates a function $f(x) = (x^2+1)^{-1}$ at 21 equally spaced nodes in the interval $[-5, 5]$. Use any graphic software to see the plots of $P(x) - f(x)$ at 51 equally spaced points on the interval $[-5, 5]$.