MATH 131: Numerical Methods for scientists and engineers – Discussion 3: Coding

The goals of this discussion section are:

- Get a deeper understanding of using root-finding algorithms.
  Use the codes you developed for Assignment 1.
- Get familiar with Interpolation.

1. **Pair-up with a classmate and** write a `MATLAB` function, called `Secant_method` that inputs a function, f, an initial guess x_0, an error tolerance, `tol`, and a maximum number of iterations, N, and outputs the root of f obtained using the Secant method (denoted by c), starting with x_0.
2. Consider the function $f(x) = 2x\cos(x) + x$ over $[1, 10]$. We want to solve $f(x) = 0$ within 10^{-10} accuracy.
   (a) Use your bisection method code and call c_1 the solution.
   (b) Use your fixed-point iteration code and call c_2 the solution.
   (c) Use your Newton's method code and call c_3 the solution.
   (d) Use your Secant method code and call c_4 the solution.
   (e) Plot on the same graph the function and c_1, c_2, c_3, c_4 the four solutions. Comment.
   (f) **Swap your function codes with your neighbor. Do you find the same solutions ?**
3. Consider the function $f(x) = 2x\cos(x) + x$ over $[0, 2]$, and consider $x_0 = 0$, $x_1 = 1$, $x_2 = 2$. Write the Lagrange polynomial interpolant of f.
4. *If there is still time:* create a MAtlab function that computes the Lagrange polynomial interpolant of a function f.