CMPT-439 Numerical Computation
Project 10

1. (**50 points**) Design two functions (use the m-language in Matlab or any high-level language) GoldenSection utilizing the golden section method and NewtonMinMax utilizing the Newton method for finding both minimum and maximum of a function.

   Take into consideration that the GlodenSection method employs different criteria for finding min and max (see slides 13 and 14 of the Lecture 11 class notes - this should be taken care of).

   At the same time the Newton's method is simply looking for an extremal value of a function regardless of min or max it is (see slide 23 of the Lecture 11 class notes).

   Both functions should return a value of x where min(max) was found, a value of $f(x)$ at the point of min(max) and the number of iterations.

2. (**30 points**) The function $f(x) = x^3 - 4x$ has both minimum and maximum on the interval [-3,3].

   a) Plot a graph of the function $f(x)$ to estimate the initial interval [a, b] for finding minimum and maximum of the function.
   b) Find $\min f(x)$ and $\max f(x)$ using the golden section method and the Newton method. Use functions, which you designed.

3. (**15 points**) Ask a generative AI tool (ChatGPT or any other) to create two functions utilizing the golden section and Newton optimization methods using the same programming language, which you used. Test functions designed by AI using the same function whose min and max you found in # 2. **Is AI-generated code correct? Is it usable? Does it return correct results?**

4. (E**xtra credit, 15 points**) The function $f(x) = -\sin x + \cos(x^2)$ has both minimum and maximum on the interval [-3,-1].
   Find $\min f(x)$ and $\max f(x)$ using the golden section method and the Newton method. Use functions, which you designed.

5. (**5 points**) Write a brief report presenting your solution. Compare the number of iterations needed for the convergence of the golden section and Newton's algorithms.

Turn in your source code and report.