Homework 2 Due: 23:59 19 December 2022

Problem 1

Consider the financial function defined over the interval $x \in [1, 5]$ by

$$F(x) = 2x^2 \sin(x) + 0.8x^3.$$

(a) Compare various numerical differentiation methods for calculating the rate of change of the financial function (i.e., the gradient) with step sizes $\Delta x = 0.02$, $\Delta x = 0.2$, and $\Delta x = 0.5$. Utilize forward difference, backward difference, and central difference. Plot the curves of $F(x)$ and the financial function gradients obtained using these methods in a figure, and include it in your report (Note: Ensure proper labeling of the x- and y-axes and include a legend in your plot).

(b) The derivative of the financial function gradient is referred to as the financial flux. Derive the mathematical formula in your report for computing the financial flux from $F(x)$ (Hint: Start with the Taylor series expansion, paying extra attention to the computation at the first and last points). Implement your algorithm in MATLAB to compute the financial flux.