

CSE 330: Summer 2024
Assignment-3
Total Marks: 20

1. Consider the function $f(x) = x \tan(x)$. Now answer the following:

- (a) (2 marks) Evaluate the numerical derivative of $f(x)$ at $x = 1.0$ with step size $h = 0.2$ using the **forward and central difference** methods up to 4 significant figures.
- (b) (4 marks) Compute the upper bound of the truncation error of $f(x)$ at $x = 1.0$ using $h = 0.2$ for the **backward and central difference** methods up to 7 significant figures.
- (c) (4 marks) **Deduce** an expression for D_h^1 from D_h by replacing h with $(4h/3)$ using the Richardson extrapolation method.

2. (3+2 marks) The following Data set is generated by the function $f(x) = 2\cos(x) - x + x^2\sin(x)$.

x	2.4	2.5	2.6
f(x)	0.015880	-0.36184	-0.82899

Based on the above data, compute $f(2.5)$ using the **Central Difference** method, and also calculate the **relative error**. Use 5 significant figures.

3. Consider the function $f(x) = 7x^4 - 4e^{-5x}$ Now answer the following:

- a) (3 marks) Compute $D_{0.2}^{(1)}$ at $x = 3.4$ using **Richardson extrapolation** method up to 4 significant figures.
- b) (2 marks) Compute $D_{0.2}^{(2)}$ at $x = 3.4$ using **Richardson extrapolation** method up to 4 significant figures.