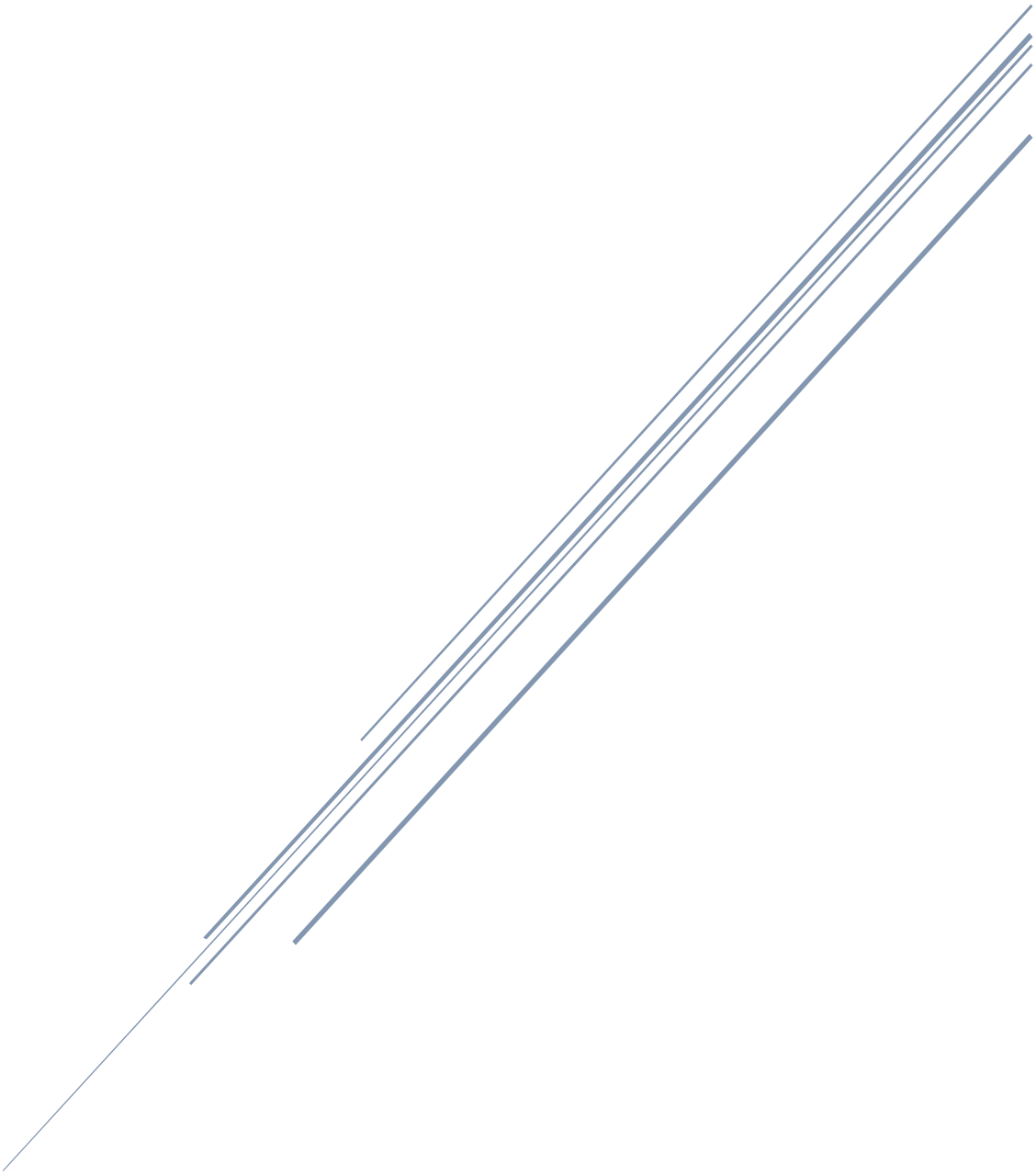
LAB# 12 NUMERICAL DIFFERENTIATION

CST8233 W2021



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LAB OBJECTIVE

The objective of this lab is to get familiar with the following:

1- Numerical Differentiation

Earning

To earn your mark for this lab, each student should finish the lab's requirements within the lab session and demonstrate the working code to the instructor.

STATEMENT OF THE PROBLEM

Write C /C++ Program that use the forward, backward and centered finite difference scheme to approximate the first derivative of the function

$$f(x) = x\sin(x^2) + 1$$

Where x started with x=0 till x=4 with h= 0.25.
your code must evaluate the function for each value of x to generate y data.

The exact solution is given by the following equation:

$$f'(x) = \sin(x^2) + 2x^2\cos(x^2)$$

Write your results of a numerical evaluation for various value of x and compare between exact and approximate solution in a table format.

Your output should be like the following format

x	*y*	*Exact derivative*	*Centered*	*forward*	*backward*
0	*1*	*0*	-	*0.06245*	-
0.25	*1.0156*	*0.18721*	*0.2474*		*0.06245*
0.5					
0.75					
1					
1.25					
1.5					
1.75					
2					
2.25					
2.5					
2.75					
3					
3.25					
3.5					
3.75					
4			-	-	

Your output should complete all the value inside the table, - means you are not able to compute these values.