Inspiring Excellence

Department of Mathematics and Natural Sciences

MAT120 Lab - Integral Calculus and Differential Equations

Lab Assignment

*Copying codes from any websites or from other classmates will not be tolerated. Plagiarized submissions will receive zero points, regardless of the circumstances. Please create a Google Colab file and rename it as nickname_id_section.ipynb. Insert a text cell at the top of your notebook and include your name, ID, and section. Download your notebook file and submit it via the provided Google Form. (**Total marks = 20**)*
Submission deadline: December 04, 2023 (11:59 pm)

1. Consider the following function

$$f(x) = \begin{cases} 2sin(x + \frac{\pi}{6}), & x \geq 0 \\ e^{x\sqrt{3}}, & x \leq 0 \end{cases}$$

   (a) Plot both $f(x)$ and $f'(x)$ for $x \in [-1, 1]$.Include enough points so that the curve you plot appears smooth. Use different colors and separate label to represent the function and its derivative respectively. Label the axes x and y, and use grid. **You must use Sympy and Matplotlib. Manual differentiation is not allowed**. **(5)**

   (b) Using numerical method (trapezoid or rectangular rule), evaluate the following integral accurate upto 3 decimal points. (**You cannot use SymPy or SciPy**)

$$\int_{-1}^{1} f(x)dx$$

(5)

2. Consider the differential equation:

$$\frac{d^3y}{dx^3} + \frac{d^2y}{dx^2} - \frac{dy}{dx} - y = 0$$

   Initial condition: $y''(0) = -1, y'(0) = -3, y(0) = 7$.

   (a) Solve this differential equation using Euler's method and plot x vs y. (**Use of SymPy or SciPy is prohibited. You can use Matplotlib and Numpy**) **(7)**

   (b) Using **SymPy** solve the differential equation. **(3)**