

7 Homework

You are given a first order Ordinary Differential Equation (ODE). You are going to find the general solution of this equation with Euler's Method for specific values of x . Furthermore, you are going to compare the performance of the method for different step size (h) values.

$$y' = e^{\cos x} - y \sin x. \quad (1)$$

- Solve and find the general solution of the ODE above where $y(0) = -2.5$. (Hint: You may solve the equation by hand or you may also use the online solver programs or programming languages such as Matlab, Mathematica, etc.)
- Use Euler's method to find the values of $y(x)$ where $x = \{0.1, 0.2, 0.3, 0.4, 0.5\}$. Here $y(0) = -2.5$ and $x(0) = 0$. You are going to use 3 different step sizes which is $h = \{0.01, 0.001, 0.0001\}$.
- Write the results to a file named "output.txt". When writing your results, you need to create a table in the file. An example is given below.

x	Exact Value	Euler Result(h = 0.01)	Euler Result(h = 0.001)	Euler Result(h = 0.0001)
0.10				
0.20				
0.30				
0.40				
0.50				

- Write a function to calculate the percentage error which is;

$$\text{Percentage Error} = \left| \frac{\text{Exact Value} - \text{Approximated Value}}{\text{Exact Value}} \right| \times 100 \quad (2)$$

- Calculate the percentage errors for the results you find in (c). Write this result into the same file with the form given below.

x	Percentage Error(h = 0.01)	Percentage Error(h = 0.001)	Percentage Error(h = 0.0001)
0.10			
0.20			
0.30			
0.40			
0.50			