

## 9.2.3

EE24BTECH11050 - Pothuri Rahul

### Question:

What is the solution for the differential equation  $y' + \sin x = 0$  **Solution:**

### Theoretical solution :

by rearranging the given differential equation

$$\frac{dy}{dx} = -\sin x \quad (0.1)$$

On integrating both sides w.r.to x,

$$\int \frac{dy}{dx} dx = \int (-\sin x) dx \quad (0.2)$$

$$y = \cos x + C \quad (0.3)$$

### Solution using Trapezoidal rule :

Consider the equation (0.1),

$$\frac{dy}{dx} = -\sin x \quad (0.4)$$

$$dy = -\sin x dx \quad (0.5)$$

To apply the Trapezoidal rule, we need to convert it into definite integration. For that let us take two points on x-axis  $x_n$  and  $x_{n+1}$ , which are at a small separation  $h$  and  $y_n, y_{n+1}$  be the values of respectively.

$$\int_{y_n}^{y_{n+1}} dy = \int_{x_n}^{x_{n+1}} \sin x dx \quad (0.6)$$

By Trapezoidal rule, We can approximate it as,

$$y_{n+1} - y_n = \frac{1}{2} \times h (\sin x_n + \sin x_{n+1}) \quad (0.7)$$

Where,

$$h = x_{n+1} - x_n \quad (0.8)$$

By taking initial conditions as  $x_0 = 0, y_0 = 1$  and plotting the points resulted in this algorithm will give the approximate graph for the given differential equation (0.1)

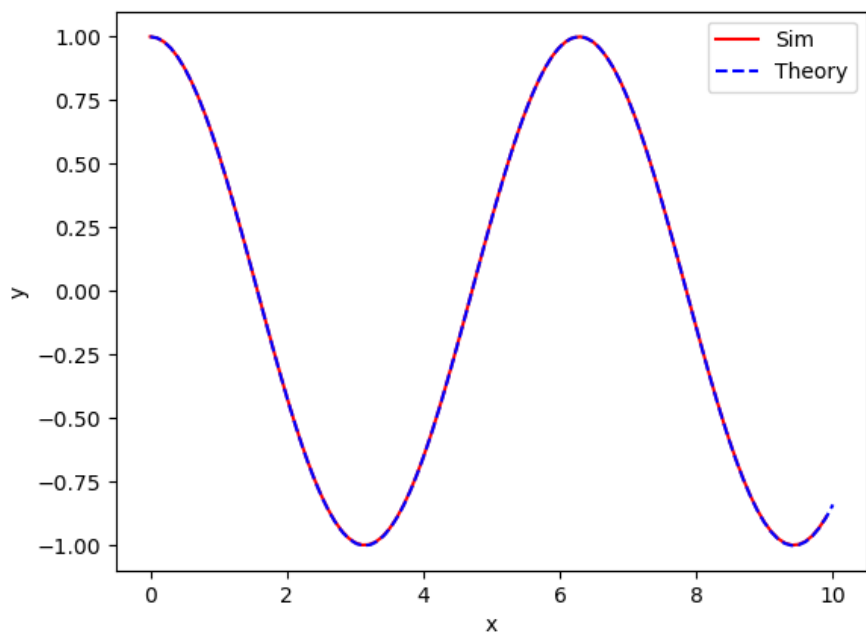


Fig. 0.1: Plot