

In-class exercise 10

In this exercise, you need to use the 4th-order Runge-Kutta method to solve the following initial value problem of:

$$\begin{cases} y' = x + y \\ y(0) = 1.0 \end{cases}$$

Use the spacing in x-direction as $h=1.0$, and find the solution at $x=1.0$.

4th-order Runge-Kutta method:

$$K_0 = hS(x_i, y_i)$$

$$K_1 = hS(x_i + \frac{1}{2}h, y_i + \frac{1}{2}K_0)$$

$$K_2 = hS(x_i + \frac{1}{2}h, y_i + \frac{1}{2}K_1)$$

$$K_3 = hS(x_i + h, y_i + K_2)$$

$$y_{i+1} = y_i + \frac{1}{6}(K_0 + 2K_1 + 2K_2 + K_3)$$

What is $y(1.0)$? The analytical solution is $y(1.0)=3.43656$. What I got using RK4 method is $y(1.0)=3.41667$.