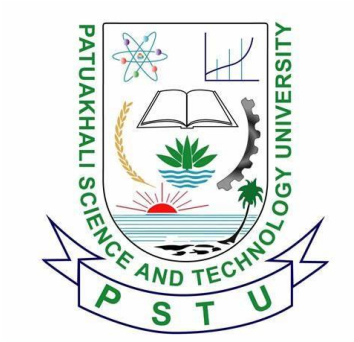

PATUAKHALI SCIENCE AND TECHNOLOGY UNIVERSITY

COURSE CODE CCE 312
Numerical Methods Sessional

SUBMITTED TO:

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Assignment 14
Assignment title: Milnes Method
Date of submission: 30 Tue, Sep 2025

Problem Statement

A long metal rod is placed inside a furnace, and its temperature (y) (in °C) changes over time (x) (in hours) according to the following law:

$$\frac{dy}{dx} = \frac{x + y}{2}$$

Time (x) (hours)	Temperature (y) (°C)
0.0	2.000
0.5	2.636
1.0	3.595
1.5	4.968

Where:

- (y) = temperature of the rod (°C)
- (x) = time elapsed since the rod was placed in the furnace (hours)

Code

```
import matplotlib.pyplot as plt

def fun_avg(x, y):
    return (x + y) * 0.5

def milnes_method(f, x0, x1, x2, x3, y0, y1, y2, y3, x4):
    x = [x0, x1, x2, x3, x4]
    y = [y0, y1, y2, y3, None]
    h = x[1] - x[0]

    y1_value = f(x[1], y[1])
    y2_value = f(x[2], y[2])
    y3_value = f(x[3], y[3])

    y[4] = y[0] + (4 * h / 3) * (2 * y3_value - y2_value + 2 * y1_value)
    y4_value = f(x[4], y[4])

    return y[2] + (h / 3) * (y2_value + 4 * y3_value + y4_value)

x0, x1, x2, x3 = 0, 0.5, 1.0, 1.5
y0, y1, y2, y3 = 2, 2.636, 3.595, 4.968

final_y = milnes_method(fun_avg, x0, x1, x2, x3, y0, y1, y2, y3, x4=2)

# Now let's plot it...
plt.plot([x0, x1, x2, x3, 2], [y0, y1, y2, y3, final_y], marker='o', label="Milne's Method",
color='green')
plt.title("Milne's Method for Solving ODE")
plt.show()
```

Visualization