ESO 208A: Computational Methods in Engineering

Tutorial 10

ODE: Initial value problem

1. Consider the following differential equation with initial condition $y(0)=1$.

$$\frac{dy}{dx} = yx^3 - 1.5y$$

Determine the solution over the interval $x=0$ to 1 by the following methods. Estimate the true error in the numerical results by comparing them against the analytical result.

a. Euler's method with $h=0.5$

b. Heun's method with no iterations and $h=0.5$

c. Midpoint method with $h=0.5$

d. Classical 4^{th} order RK method with $h=0.5$

2. Solve the following problem by using the 4^{th} order RK method, where $y(0)=4$ and $y'(0)=0$. Solve from $x=0$ to 1 using $h=0.5$

$$\frac{d^2y}{dx^2} + 0.5\frac{dy}{dx} + 7y = 0$$