

Task for lecture 11

Consider the following system of differential equations

$$\begin{cases} x'(t) = xy, & x(0) = 1 \\ y'(t) = -x^2, & y(0) = 1 \end{cases} \quad (1)$$

Approximate the solution using the:

- "Euler" method. (Program by yourself)
- "4th order Runge Kutta" method. (Use NR3 implementation)

For

- $0 \leq t \leq 10$
- $h^{-1} = 5, 10, 20, 40 \dots$

Then

- Evaluate the error and order (Using Richardson)

Note that

- $x^2 + y^2$ remains constant for the exact solution.

Implement the remaining methods and perform the same analysis, that is.

- Leap-frog
- Midpoint
- Trapezoidal