

Exercise: ODE solvers

Consider the following Cauchy problem

$$\begin{cases} y'(t) = -3y(t) + 2t - 2 & t \in [0, 1] \\ y(0) = -1. \end{cases} \quad (1)$$

- compute the approximation of $y(1)$ by applying two steps of IE
- implement in MATLAB the methods: EE, IE, CN (Crank-Nicolson) and Heun, for solving (1); after checking the answer of the previous question, use the four methods to compute the solution on $[0, 1]$; plot the results for $\Delta t = .5$, $\Delta t = .2$, $\Delta t = .1$ together with the exact solution

$$y(t) = (2t)/3 - 1/9 e^{-3t} - 8/9.$$