

NMA – homework from week 5

1. Explicit and implicit Euler's method

Consider Cauchy problem

$$y' = -y + x, \quad y(0) = 1.$$

- Find an interval of the maximal solution.
- Choose step-size $h = 0.5$ and using explicit Euler method compute approximate value of $y(1)$.
- Choose step-size $h = 1$ and using implicit Euler method compute approximate value of $y(1)$.

2. Euler's and Collatz method, nonlinear problem

Consider Cauchy problem

$$Y' = \begin{bmatrix} y_1 + y_2 \\ -\ln\left(\frac{x}{y_2}\right) - 2\sqrt{x+4} \end{bmatrix} \quad Y(-2) = \begin{bmatrix} 1 \\ -3 \end{bmatrix}.$$

- Find a domain G where the conditions of existence and uniqueness of the solution are satisfied.
- Choose step-size $h = 0.5$ and using explicit Euler method compute approximate value of $Y(-1.5)$.
- Choose step-size $h = 0.5$ and using Collatz method compute approximate value of $Y(-1.5)$.
- Which one of these two methods should give more precise result?