
Problem 5: (The Lorenz system)

- (a) Write a program that uses Euler's method to approximate solutions of the initial value problem

$$y' = \begin{pmatrix} \sigma(y_2 - y_1) \\ y_1(\rho - y_3) - y_2 \\ y_1y_2 - \beta y_3 \end{pmatrix} \quad y(0) = \begin{pmatrix} 12 \\ 17 \\ 25 \end{pmatrix},$$

with coefficients $\beta = 8/3$, $\rho = 28$, and $\sigma = 10$.

- (b) Plot the approximate solutions on the interval $[0, 30]$ for $h = 1/10, 2/20, 1/40, 1/80, \dots$. What do you think about the convergence?
- (c) For the more interested: compare the results to a Runge-Kutta method of order 4.