

Math 302 Final Project
Section IV 2024
Duke Kunshan University

Problem 1 (Coding Problem). *Consider the predator-prey models*

$$\frac{dx}{dt} = x - \alpha xy, \tag{1}$$

$$\frac{dy}{dt} = -y + \beta xy, \tag{2}$$

where $\alpha = 0.01$, $\beta = 0.02$, and $\begin{bmatrix} x_0 \\ y_0 \end{bmatrix} = \begin{bmatrix} 20 \\ 20 \end{bmatrix}$. We want to simulate the ODE system from $t = 0$ to $T = 15$. We split the interval into 100 subintervals for the implementation of numerical methods. Compare your simulation results with an existing numerical solver or refined calculations to check errors. Plot the trajectory of your solutions.

1. Implement the RK4.
2. Implement the Trapezoidal's rule.