Worksheet for the Volterra-Lotka Model

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Before the Lab

1 Read the notes *Vector Fields and Solutions to Ordinary Differential Equations with `MATLAB`/Octave* ☐

2 Examine carefully how the equation of a damped pendulum is solved. ☐

During the Lab

In the lecture notes for the class the Volterra Lotka model is examined

$$\dot{x}(t) = (c_1 - c_2\,y(t))\,x(t)$$
$$\dot{y}(t) = (c_3\,x(t) - c_4)\,y(t)$$

with the constants $c_1 = c_3 = c_4 = 1$ and $c_2 = 2$.

1 Generate the vector field for this problem. ☐

2 Find numerical solutions for the above problem for a few initial values. Plot the solutions. ☐

3 Estimate the period of the solution close to the critical point. Use graphical tools only. ☐

4 To take a limited supply into account we can modify the above model to ☐

$$\dot{x}(t) = (c_1 - c_2\,y(t) - c_5\,x(t))\,x(t)$$
$$\dot{y}(t) = (c_3\,x(t) - c_4)\,y(t)$$

with $c_5 = 0.1$. Visualize and solve this system.