Lecture 8.3: Predator–prey models

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Math 2080, Differential Equations

Lotka–Volterra equations

Example 1

Consider the following system: $\begin{cases} X' = X(1 - \frac{1}{2}Y) \\ Y' = Y(-\frac{3}{4} + \frac{1}{4}X) \end{cases}$

Lotka–Volterra equations

Example 1 (cont.)

There are two fixed points of the following system, $(X^*, Y^*) = (0,0)$ and $(3,2)$:

$$\begin{cases} X' = X(1 - \frac{1}{2}Y) \\ Y' = Y(-\frac{3}{4} + \frac{1}{4}X) \end{cases}$$

Lotka–Volterra equations

With logistic growth

Consider the following system: $\begin{cases} X' = rX(1 - X/M) - sXY \\ Y' = Y(-u + vX) \end{cases}$

Linearization and steady-state analysis

Example 2

Consider the following system: $\begin{cases} X' = 1.3X(1-X) - .5XY \\ Y' = Y(-.7+1.6X) \end{cases}$