

Math 2080: Differential Equations

Worksheet 8.3: Predator-prey models

NAME:

In a predator-prey situation, it may happen that the species are valuable sources of food. In this case, we can introduce terms $-E_1X$ in the prey equation and $-E_2Y$ in the predator equation. Consider the following example of this:

$$\begin{cases} X' = rX(1 - X/M) - sY - E_1X \\ Y' = -uY + vX - E_2Y. \end{cases}$$

1. Without doing any math, think about the problem intuitively. How do you expect the populations and steady-state solutions to change if the prey alone is harvested? If the predator alone is harvested? If both are harvested?
2. How does the steady-state solution change if the prey is harvested but not the predator ($E_1 > 0$, $E_2 = 0$)?
3. How does the steady-state solution change if the predator is harvested but not the prey ($E_1 = 0$, $E_2 > 0$)?
4. How does the steady-state solution change if both are harvested? ($E_1 > 0$, $E_2 > 0$)?