

Problem 1 Consider the predator prey model

$$\begin{aligned}\frac{dx}{dt} &= f(x, y), \\ \frac{dy}{dt} &= g(x, y).\end{aligned}$$

1. Verify that the functions

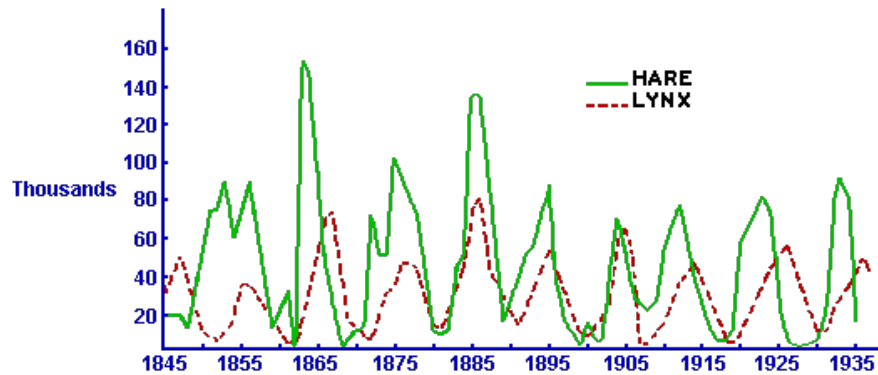
$$f(x, y) = ax - bxy - px^2 \text{ and } g(x, y) = -cy + dxy - qy^2,$$

satisfy all the six assumptions described in class.

2. Justify why when $p = q = 0$, the system admits periodic solutions.

Problem 2 1. Consider the case $a = .4$, $b = .0002$, $c = .08$, $d = .0004$ and $p = q = 0$. Using the MATLAB routine described in class, integrate the equations for $t = 0$ till $T = 300$ with initial conditions $x_0 = 200$ and $y_0 = 10$. Give a plot of both the hare population x and the lynx population y as functions of time (on the same axis). Give also a plot of x and y in the phase plane (y as a “function” of x). Comment.

2. Repeat with positive values of p and q (you choose them). Comment.
3. Consider the graph below representing the respective population of canadian lynx and snowshoe hare gathered by the Hudson Bay company over almost a century Give a thorough explanation of



how this data could be used to find appropriate values for the parameters of the model.