Hwmk 9

Math 528 Summer Session 1

Due 6/2 (Wednesday at 11:59 pm)

1 Running with the wolves

You have a wolf and deer population that is modeled effectively with the Lotka-Volterra Population Model:

$$\begin{cases} \dfrac{dp_1}{dt} = ap_1 - bp_1p_2 \\ \dfrac{dp_2}{dt} = kp_1p_2 - lp_2 \end{cases}$$

In particular, you have observed that $a = 5$, $b = 3$, $k = 3$, and $l = 6$

(a) 2 points Where are the critical points?

(b) 2 points Linearize the system.

(c) 2 points Using their eigenvalues, classify the critical points.

2 Cool Plots

Suppose you have the system of DEs:

$$\begin{cases} \dfrac{dx_1}{dt} = -2x_1^2 + 3x_1 - x_1x_2 \\ \dfrac{dx_2}{dt} = -2x_2^2 + 3x_2 - x_1x_2 \end{cases}$$

(a) 2 points Where are the critical points?

(b) 1 point Use a plotter tool and draw a few trajectories below to show the behavior of the phase field.

(c) 1 point Using the picture, to what point does everything in $x_1 \in (0, \infty)$ and $x_2 \in (0, \infty)$ go to?