APMA 0350 – HOMEWORK 10

Problem 1: (5 points) Find the (real) equilibrium points of

$$\begin{cases} x' = y - x^2 y \\ y' = y^2 x - 4x^2 \end{cases}$$

Problem 2: (5 points) Find and classify the equilibrium points of

$$\begin{cases} x' = x - y + x^2 \\ y' = x + y \end{cases}$$

Problem 3: (5 points) Find and classify the equilibrium points of

$$\begin{cases} x' = x\,(3 - x - 2y) \\ y' = y\,(2 - x - y) \end{cases}$$

Problem 4: ($5 = 2 + 3$ points, Application)

You work as a consultant for PeyAlamo, a car rental company that has distributors in Atlanta and Boston. Travelers may rent a car in one city and return it either at the same location or the other city.

Suppose 40% of the cars rented in Atlanta are returned in Boston per day, and 20% of cars rented in Boston are returned in Atlanta per day. Let $x(t)$ and $y(t)$ be the number of cars in Atlanta and Boston respectively, where t is in days. Assume no other cars go in and out of the two cities.

(a) Set up a system of ODE model for $x(t)$ and $y(t)$

(b) Find the equilibrium points of the system in (a) and their stability. Do not solve the system