MATH 221 - DIFFERENTIAL EQUATIONS

Lecture 14 Activities

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§A. In-class Practice Problems

■ Question 1.

Consider the two Predator-Prey systems as follows:

$$\frac{dx}{dt} = 0.3x - 0.1xy, \quad \frac{dy}{dt} = -0.1y + 2xy$$

$$\frac{dx}{dt} = 0.3x - 3xy, \quad \frac{dy}{dt} = -2y + 0.1xy$$

- 1. First identify which variable corresponds to prey and which one is predator.
- 2. One of these systems refers to a predator-prey system with very lethargic predators those who seldom catch prey but who can live for a long time on a single prey (for example, boa constrictors). The other system refers to a very active predator that requires many prey to stay healthy (such as a small cat). The prey in each case is the same. Identify which system is which and justify your answer.

■ Question 2.

Consider two brine tanks connected as shown in figure 1 below. Tank 1 contains x(t) pounds of salt in 100 gal of brine and tank 2 contains y(t) pounds of salt in 200 gal of brine. The brine in each tank is kept uniform by stirring, and brine is pumped from each tank to the other at the rates indicated in figure 1. In addition, fresh water flows into tank 1 at 20 gal/min, and the brine in tank 2 flows out at 20 gal/min (so the total volume of brine in each of the two tanks remains constant over time).

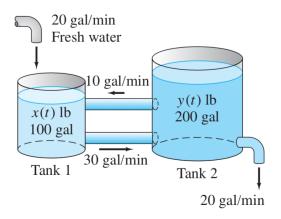


Figure 1: Two Brine Tanks

Write down a system of first order linear differential equations that models the amount of salt x(t) and y(t) in the two tanks. Do not solve it.