Mathematics 172

Quiz 32 Name: Key

You must show your work to get full credit.

Snails (the predator) in an aquariu feed on algae (the victims). If V is the amount of algae in grams and P is the number of snails we assume the following Lotka-Volterra system holds

$$\frac{dV}{dt} = .4V - .01VP \quad = V(.4 - .01P) = 0 \Rightarrow V = 0 \text{ or } P = \frac{.4}{.01} = 40$$

$$\frac{dP}{dt} = -.3P + .006VP = P(-.3 + .006V) = 0$$

$$\Rightarrow P = 0 \text{ or } V = \frac{.3}{.006} = 50$$

where t is measured in months.

1. If we start with 60 grams of algae and 20 snails, compute $V'(0)$ and $P'(0)$ and write a sentence or two to describe the initial behavior of the system.

$V'(0) =$ 12 $\qquad$ $P'(0) =$ 1.2

$V'(0) = 60(.4 - .01(20)) = 60(.4 - .2) = 60(.2) = 12$

$P'(0) = 20(-.3 + .006(60)) = 1.2$

2. Find the average amount, $\widehat{V}$, of algae, and the average number of snails, $\widehat{P}$ and these to draw the phase space complete with a couple of loops and arrows showing which way things are moving.

$\widehat{V} = 40$, $\widehat{P} = 50$ as above