Mathematics 172

Quiz 28 Name: Key

You must show your work to get full credit.

In a small pond algae is being eaten by snails. Let

$V(t)$ = number of pounds of algae in the pond in week t.

$P(t)$ = number of snails in the pond in week t.

Assume these satisfy the predator-prey equations

$$\frac{dV}{dt} = .4V - .002VP \quad = V(.4 - .002P)$$

$$\frac{dP}{dt} = -.1P + .001VP \quad = P(-.1 + .001V)$$

1. What is the intrinsic growth rate of the algae when there are no predators?

The rate is .4(lbs/wk)/lb

2. What is the intrinsic death rate of the snails when there is no algae?

The rate is .1

3. What are the equilibrium points?

Solve the equations:

$V(.4 - .002P) = 0 \quad V = 0 \quad P = \frac{.4}{.002} = 200 = \overline{P}$

$P(-.1 + .001V) = 0 \quad P = 0 \quad V = \frac{.1}{.001} = 100 = \overline{V}$

The equilibrium points are (0,0) (100,200)

4. What are the average amount, $\widehat{V}$, of algae and the average number of snails, $\widehat{P}$, in the pond.

$\widehat{V} =$ 100 $\qquad$ $\widehat{N} =$ 200

5. What happen to $\widehat{V}$ and $\widehat{N}$ is the intrinsic growth rate of the algae is doubled but everything else stays the same?

$\widehat{V} =$ 100 $\qquad$ $\widehat{N} =$ 400

Then equations one

$\frac{dV}{dt} = .8V - .002VP = V(.8 - .002P)$ so $\widehat{P} = \frac{.8}{.002} = 400$

$\frac{dP}{dt} = -.1P + .001VP = P(-.1 + .001V)$ so $\widehat{V} = \frac{.1}{.001} = 100$

The same as before