

Mathematics 172

Quiz #26

Name: Key

You must show your work to get full credit.

A bats (the predator) feeds on mosquitoes (victims). The numbers of victims, V , and predators, P , satisfy a Lotka-Volterra predator-prey system of equations

$$\frac{dV}{dt} = .2V - .005VP = V(.2 - .005P)$$

$$\frac{dP}{dt} = -.3P + .0001VP = P(-.3 + .0001V)$$

where time t is measured in months.

1. What is the intrinsic growth rate of the victim population?

Intrinsic growth rate is .2

2. What is the intrinsic death rate of the predator population?

Intrinsic death rate is .3

3. If we start with $V(0) = 2,500$ mosquitoes and $P(0) = 50$ bats, then compute $V'(0)$ and $P'(0)$. (Recall that $V' = \frac{dV}{dt}$ and $P' = \frac{dP}{dt}$.)

$$V'(0) = \underline{-125} \quad P'(0) = \underline{-2.5}$$

$$V'(0) = 2500(.2 - .005(50)) = -125$$

$$P'(0) = 50(-.3 + .0001(2500)) = -2.5$$

4. Use your answer to the last problem to describe initial behavior of the system in a sentence or two: V is decreasing by 2500 bugs/month
 P is decreasing by 2.5 bats/month.

5. What is the average number of victims and predators.

$$\hat{V} = \underline{3000} \quad \hat{P} = \underline{40}$$

solve $.2 - .005P = 0$ to get $\hat{P} = \frac{.2}{.005} = 40$
 and $-.3 + .0001V = 0$ to get $\hat{V} = \frac{.3}{.0001} = 3000$