Mathematics 172

Quiz 11 Name: Key

You must show your work to get full credit.

1. Write the discrete logistic equation with natural per capita growth rate r and carrying capacity K both in the form $P_{t+1} = \cdots$ and $\Delta P = \cdots$

$P_{t+1} =$ $P_t + rP_t(1 - \frac{P_t}{K})$

$\Delta P =$ $rP(1 - \frac{P}{K})$

2. Write the logistic differential equation with natural per capita growth rate r and carrying capacity K.

$\frac{dP}{dt} =$ $rP(1 - \frac{P}{K})$

3. If you were modeling the growth of a population of annual cicada which would be the better model the discrete logistic equation or the continuous logistic equation (which is the same thing as the logistic differential equation). Write a sentence or two to explain your answer.

The discrete equation because the population changes at discrete time intervals (once a year).

4. If we have a model for a population size of the form

$$N_{t+1} = f(N_t)$$

(a) what is the equation to find the equilibrium points?

Equation is $f(N) = N$

(b) If $N = N_*$ is an equilibrium point what is the condition that this point be stable?

Condition is $|f'(N_*)| < 1$

(c) If $N = N_*$ is an equilibrium point what is the condition that this point be unstable?

Condition is $|f'(N_*)| > 1$

5. If a population size is modeled by

$$\frac{dN}{dt} = .1N(N-2)(10-N)$$

(a) If $N(0) = 1$ estimate $N(65)$. $N(65) \approx$ 0

(b) If $N(0) = 12$ estimate $N(65)$. $N(65) \approx$ 10

Make a graph

equilibrium points $N = 0, 2, 10$