Mathematics 172

Quiz 27 **Name:** Key

You must show your work to get full credit.

For the predator-prey system

$$\frac{dx}{dt} = .1x\left(1 - \frac{x}{500}\right) - .01xy$$
$$\frac{dy}{dt} = -.2y + .002xy$$

where x is the size of the prey population, and y is size of the predator population.

1. What is per capita growth rate of then prey population. $r =$ .1

2. What is the carrying capacity of the prey population if there are no predators.
$K =$ 500

3. What is the per capita death rate of the predator population if there are no prey?

Rate is .2

4. Find the rest points of the system. Rest points are: (0,0), (500,0), (100,8)

(1) $\frac{dx}{dt} = x(.1(1-\frac{x}{500}) - .01y) = 0$

(2) $\frac{dy}{dt} = y(-.2 + .002x) = 0$

We know that (0,0), (500,0) are rest points for biological reasons. If $y \neq 0$ then (2) gives

$-.2 + .002x = 0$, $x^* = \frac{.2}{.002} = 100$

Use this in (1) to get

$.1(1-\frac{x}{500}) - .01y = 0$

$-.01y = -.1(1-\frac{100}{500})$

$y^* = \frac{.1}{.01}(1-\frac{1}{5}) = 10(\frac{4}{5}) = 8$