Quiz 30   Name:_____ Key_____

You must show your work to get full credit.

An aquarium is in the sun and has algae growing in it. To keep this under control some water fleas, which eat algae, are added to the tank. Let

$x(t) =$ number of grams of algae in tank after t days.

$y(t) =$ number of grams of water fleas in tank after t days.

Assume this satisfy the predator-prey equations

$$\frac{dx}{dt} = .1x\left(1 - \frac{x}{500}\right) - 5xy \quad = x\left(.1\left(1 - \frac{x}{500}\right) - 5y\right)$$

$$\frac{dy}{dt} = -.2y + .0005xy \quad = y\left(-.2 + .0005x\right)$$

1. What is the carrying capacity of the algae before the water fleas are added?

Carrying capacity is _____ 500 _____

when $y(t) = 0$ the first equation becomes

$\frac{dx}{dt} = .1x\left(1 - \frac{x}{500}\right)$ which is logistic with $K = 500$

2. What are the equilibrium points?   Equilibrium points are $(0,0), (400, .004)$

From $\frac{dx}{dt} = 0$ we have $x = 0$ or $.1\left(1 - \frac{x}{500}\right) - 5y = 0$

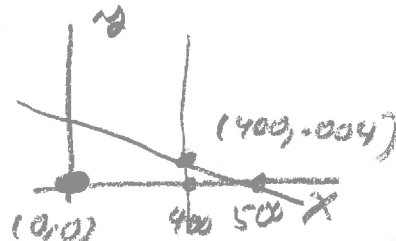From $\frac{dy}{dt} = 0$ we have $y = 0$ or $-.2 + .0005x = 0$

So one eqm. pt. is $(0,0)$. For the other

$-.2 + .0005x = 0$ gives $x = \frac{.2}{.0005} = 400$.

use this in $-.1\left(1 - \frac{x}{500}\right)$ to get

$y = .1\left(1 - \frac{400}{500}\right)/5 = .004$

So $(400, .004)$ is the other eqm pt

3. What is the stable population size of the algae after the water fleas are added?

Stable population size is _____ 400 _____