Quiz #10

You must show your work to get full credit.

A population of roaches in a house grows logistically with a carrying capacity of 1000 bugs and an intrinsic growth rate of .8 (bugs/week)bug.

A treatment is started that removes the roaches at rate of 50% of the current population size.

(1) What is the new rate equation?

$$\frac{dN}{dt} = .8N\left(1 - \frac{N}{1000}\right) - .5N$$

$\underbrace{\phantom{.8N\left(1 - \frac{N}{1000}\right)}}$ logistic growth

$\underbrace{}$ 50% of current population

(2) What is the new stable population size?

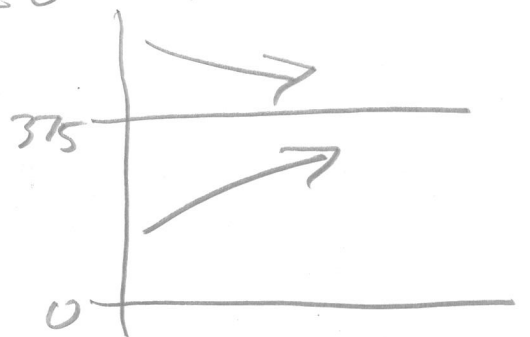First find the equilibrum points by setting $\frac{dN}{dt} = 0$

$$\frac{dN}{dt} = .8N\left(1 - \frac{N}{1000}\right) - .5N = 0$$

$$N\left(.8\left(1 - \frac{N}{1000}\right) - .5\right) = 0$$

$$N\left(.3 - \frac{.8N}{1000}\right) = 0$$

so equm. pts are

$$N = 0, \quad N = \frac{(.3)(1000)}{.8} = 375$$

we see that $N = 375$ is the stable on

$$\boxed{N = 375}$$