Mathematics 172

Quiz 17 Name: Key

You must show your work to get full credit.

Recall that the logistic equation is $\frac{dP}{dt} = rP\left(1 - \frac{P}{K}\right)$

where r is the intrinsic growth rate and K is the carry capacity. (You should memorize this as I am not always going to give you the formula.)

Picture of a skud 

Assume that a population of skuds (a type of small (< .5 in) fresh water crustaceans that look like miniature shrimp) is established a rain barrel. Assume that the population grows logistically with

$$r = .35 \text{ (skuds/week)/skud}$$
$$K = 250 \text{ skuds}$$

Let $P(t)$ be the size of the skud population after t weeks.

1. Write the rate equation for the growth of this population. (To anticipate some mistakes that are often made, a rate equation is an equation, so it has an equal sign in it, and it is a *rate* equation so a rate (= derivative) must occur in the equation.)

Rate equation is $\frac{dP}{dt} = .35P\left(1 - \frac{P}{250}\right)$

Assume that at some point some hydra are introduced and that they eat the skuds at rate of 20% of the skud population per week.

2. Write the new rate equation for the population size of the skud population.

New rate equation is $\frac{dP}{dt} = .35P\left(1 - \frac{P}{250}\right) - .2P$

3. What is the new stable population size for the skuds.

Find the equilibrium points

Stable population size is 107.14

$.35P\left(1 - \frac{P}{250}\right) - .2P = 0$

$P\left(.35\left(1 - \frac{P}{250}\right) - .2\right) = 0$

$P = 0$ or

$.35\left(1 - \frac{P}{250}\right) = .2$

$1 - \frac{P}{250} = \frac{.2}{.35} = \frac{20}{35} = \frac{4}{7}$

$-\frac{P}{250} = \frac{4}{7} - 1 = -\frac{3}{7}$

$P = \frac{3}{7}(250) = 107.14$

107.14 is stable