

Quiz 6

Name: Key

You must show your work to get full credit.

A population of crayfish are kept in a pond to be sold as food. Initially the size,  $N(t)$ , of the population grows logistically with an intrinsic growth rate of  $r = .12$  (crayfish/mon)/mon and with a carrying capacity of  $K = 30,000$  crayfish.

- (1) Write down the rate equation satisfied by  $N(t)$ . (This question is just to see if you have the logistic equation memorized.)

Logistic eqn is  $\frac{dN}{dt} = rN(1 - \frac{N}{K})$  in our case this is

$$\boxed{\frac{dN}{dt} = .12N \left( 1 - \frac{N}{30,000} \right)}$$

- (2) Once the population is established, the crayfish are harvested at a continuous rate of 10% of the population per week.

(a) Write down a rate equation for size of the population once the harvesting starts.

$$\frac{dN}{dt} = .12N \left( 1 - \frac{N}{30,000} \right) - .1N$$

- (b) What is the stable population size after the harvesting begins?

Stable population size is 5,000

solve

$$\frac{dN}{dt} = .12N \left( 1 - \frac{N}{30,000} \right) - .1N = 0$$

$$\text{Factor } N \left( .12 \left( 1 - \frac{N}{30,000} \right) - .1 \right) = 0$$

$$\text{so } N = 0 \text{ or}$$

$$.12 \left( 1 - \frac{N}{30,000} \right) - .1 = 0$$

$$.12 - \frac{.12N}{30,000} = +.1$$

$$- \frac{.12N}{30,000} = -.02$$

$$N = (.02) \left( \frac{30,000}{.12} \right) = 5,000$$