Mathematics 172

Quiz 12 Name: Key

You must show your work to get full credit.

(1) A population of trout in a lake is fished so that the population is reduced by 15% a year. At what rate, in trout/year, should lake be stocked to keep a stable population of 20,000 trout?

Stocking rate is 3,000

If N_t = number of trout in lake in year t and S = stocking rate

$N_{t+1} = N_t - .15N_t + S$

$= .85N_t + S$

If 20,000 is the stable population size, then

$N_{t+1} = N_t = 20{,}000$

$20{,}000 = (.85)(20{,}000) + S$

$S = 20{,}000 - (.85)(20{,}000) = 3000$

(2) A population of 20 rats colonizes an island. After 4 months there are 100 rats.

(a) What is the intrinsic growth rate, r, of the rat population?

This is continuous exponential growth

$r =$ .40236

$N(t) = N_0 e^{rt} = 20e^{rt}$

$N(4) = 20e^{4r} = 100$

$e^{4r} = 100/20$

$4r = \ln(100/20)$

$r = \ln(100/20)/4 = .40236$

(b) How long, in months, until there are 1,000 rats?

Time until 1,000 rats is 9.723 months

$N(t) = 20e^{.40236t} = 1000$

$e^{.40236t} = 1000/20$

$.40236t = \ln(1000/20)$

$t = \ln(1000/20)/.40236 = 9.723$