Mathematics 172

Quiz #31 Name: Key

You must show your work to get full credit.

1. A population of fleas starts in a barn with 70 fleas. Two months later there are 520 fleas. Assume the population has continuous exponential growth.

(a) What is the intrinsic growth rate of the flea? Given units on your answer.

If $P(t)$ = number of fleas after t months, then

$P(t) = P(0)e^{rt} = 70e^{rt}$

$r =$ 1.0027

Then $P(2) = 70e^{2r} = 520$

$e^{2r} = 520/70$

$2r = \ln(520/70)$

$r = \ln(520/70)/2 = 1.0027$

(b) How long until there are 100,000 fleas?

Solve

$P(t) = 70e^{1.0027t} = 100{,}000$

$e^{1.0027t} = 100{,}000/70$

$t = \ln(100000/70)/1.0027$

$= 7.245$ months

2. A tank has algae growing it it with an intrinsic growth rate of $r = -.85$ lbs/wk. At what rate should it be stocked so that there is a stable population of 16 lbs of algae.

Let $P(t)$ = mass of algae.

S = stocking rate.

Stocking rate is 13.6 lbs/wk.

Then $\frac{dP}{dt} = -.85P + S$

when $P = 16$, $\frac{dP}{dt} = 0$ which gives

$0 = -.85(16) + S$

$S = (.85)(16) = 13.6$