Mathematics 172

Quiz 6 Name: Key

You must show your work to get full credit.

1. A population of roaches in a dorm grows exponentially. The original population has 12 roaches, and two weeks later there are 21. Let $N(t)$ be the number of roaches after t weeks.

(a) Give a formula for $N(t)$. $N(t) =$ $12(1.323)^t$ roaches

$N(t) = N(0)\lambda^t = 12\lambda^t$

To find λ not $N(2) = 12\lambda^2 = 21$

$\lambda^2 = 21/12$

$\lambda = (21/12)^{\frac{1}{2}} = (21/12)^{\wedge}(1/2)$

$= 1.323$

(b) What is the doubling time for the roaches population?

We want to find t Doubling time is 2.476 weeks

So that $N(t) = 2N(0)$

i.e $N(0)(1.323)^t = 2N(0)$

$(1.323)^t = 2$

$t \ln(1.323) = \ln(2)$

$t = \ln(2)/\ln(1.323) = 2.476$

(c) How long until there are 10,000 roaches? Time until 10,000 is 24.028 weeks.

Solve $N(t) = 12(1.323)^t = 10{,}000$

$(1.323)^t = \frac{10{,}000}{12}$

$t \ln(1.323) = \ln(10{,}000/12)$

$t = \ln(10{,}000/12)/\ln(1.323)$

$= 24.028$