Homework assigned Wednesday, January 11.

We saw today that if a population under goes unrestrained growth, then the the population size $N(t)$ at time t satisfies the rate equation

$$\frac{dN}{dt} = rN$$

where r is constant called the ***intrinsic growth rate***. The solution to this equation is

$$N(t) = N(0)e^{rt}.$$

Problem 1. Let $N(t)$ is the size of a population of rabbits on an island t years after they were introduced. Thus the units of N is "number of rabbits" and the units of t are "years".

(a) What are the units of $\dfrac{dN}{dt}$?

(b) What are the units of the intrinsic growth rate r? *Hint:* $r = \dfrac{1}{N}\dfrac{dN}{dt}$.

Problem 2. Twenty guppies are released in a pond. After three months there are 75 guppies. Let $N(t)$ be the number of guppies t months after the first release.

(a) Write down the rate equation for the growth of the population guppies. This equation will involve the intrinsic growth rate r, which we have yet to determine.

(b) Use the condition that there are 75 guppies after three months to find r.

(c) Give a formula for $N(t)$.

(d) What is the doubling time for the population of guppies?

(e) How long does it take for the population to reach a size of a million?

Problem 3. Due to over fishing a population of trout in a lake has a higher death rate than birth rate. That is the intrinsic growth rate, r is negative. Assume that $r = -.06$. If the lake starts with 10,000 trout, then how long before there are only a 100 trout?