Mathematics 172

Quiz #12

You must show your work to get full credit.

A population grows of wolves with a discrete logistic groth rate a per capita groth rate of $r = 1.5$ (wolves/year)/wolf and and a carrying capacity of $K = 500$.

(a) If the population starts with 450 wolves, how many are the the next year?

Solution: The growth equation is

$$N_{t+1} = N_t + 1.5N_t\left(1 + \frac{N_t}{500}\right)$$

so letting $N_0 = 450$ we get

$$N_1 = 450 + 1.5450\left(1 - \frac{450}{500}\right) = 517.5$$

(b) Is the equilibrium point $N = 500$ stable?

Solution: If $0 < r < 2$, then the carrying capacity is stable. In our case $r = 1.5$, so it is ***stable***.

(c) Find the other zero of the equation.

Solution: The is set

$$N_t + 1.5N_t\left(1 - \frac{N_t}{500}\right) = 0$$

and solve. This factors as

$$N_t\left(1 + 1.5\left(1 - \frac{N_t}{500}\right)\right) = 0$$

so one zero is $N_t = 0$ and the other is when

$$1 + 1.5\left(1 - \frac{N_t}{500}\right) = 0$$

Distributing the 1.5

$$1 + 1.5 - \frac{1.5N_t}{500} = 0$$

So

$$-\frac{1.5N_t}{500} = -2.5$$

leading to

$$N_t = \frac{(2.5)(500)}{1.5} = 833.3333333\ldots$$