Homework assigned Monday, January 23.

We have seen that a model for the size,N, of a population has a "carrying capacity" is

$$\frac{dN}{dt} = rN\left(1 - \frac{N}{K}\right)$$

where r is the intrinsic growth rate and K is the carry capacity. It is possible to solve this explicitly and here is the solution:

$$N(t) = \frac{K}{1 + \big((K - N_0)/K\big)e^{rt}}.$$

While this is nice to know, it will not be that useful to us. You should read the book's discussing of the logistic equation, pages 26–30.

(1) A population grows logistically with intrinsic growth rate $r = .1$ and carrying capacity $K = 900$.
   (a) What is the rate equation for the size, N, of the population as a function of time, t. *Answer:*

$$\frac{dN}{dt} = .1N\left(1 - \frac{N}{900}\right)$$

   (b) If $N(0) = 800$ what is the initial growth rate $N'(0)$? *Answer:* $N'(0) = .1(800)\left(1 - \frac{800}{900}\right) = 8.88888\ldots$.

(2) Let a population of fish in a pond grows logistically with $r = .15$ (fish/mon)/fish and has a carrying capacity of 1,000 fish. Assume that we start to harvest the by catching 10% of the current population. If N is the number of fish, then write a rate equation for the number of fish taking into account the harvesting. *Answer:*

$$\frac{dN}{dt} = .15N\left(1 - \frac{N}{1{,}000}\right) - .1N.$$

Use this rate equation to find the new stable population size. *Answer:* $N = 3.33333\ldots$.