Homework #1 Due Friday Sept 7

1. Discuss the steps and approaches you might take to answer the following question: How far can a migrating bird fly?

2. Problem 8a,b,c on page 14 of Bender. (Include 1990 data, 248 million) Note that to fit this, you will have to use least squares. You probably have a calculator that does this. It is also in Excel and there are mny such calculators on the internet. Hint for this problem:

   - Approximate the derivative, dN/Dt by using centered difference, say for $t = 1810$,

     $$dN/dt(1810) \approx (N(1830) - N(1790))/(2(1830 - 1790))$$

     (Note that at the end points, just take $(N(1790) - N(1810))/(1790 - 1810)$ etc)
   - Note that $(1/N)dN/dt = r(1 - N/K)$ is linear, so transform the data to plot $y = (1/N)dN/dt$ vs N. Fit this with a least square
   - Solve the logistic equation, show:

     $$N(t) = A/(1 + Be^{Ct})$$

     where you have to find A, B, C.
   - Plot the solution using your fitted parameters and the actual data.

3. Problem 1 on page 29a,b Bender

4. Problem 4 on page 31, Bender. Hint:assume the following (a) Energy lost is through heat loss on the body surface (b) energy gained is proportional to the blood flowing through the lungs which provides the oxygen (c) energy lost = energy gained. Let m be mass, r be pulse rate, S be surface area, and H be volume of blood pumped in one stroke. Make any assumptions about geometric similarity that you need to get something along the lines of $r \propto m^d$. By taking logs of the data in the book, use least squares to approximation to fit the exponent.

5. Problem 5 page 33. (hint: see problem 4)