



Home Work: # 3 (due September 22, 2009)

1. Your parents are considering a 30-year mortgage that charges 0.5% interest each month. Formulate a model in terms of a monthly payment p that allows the mortgage (loan) to be paid off after 360 payments. Your parents can afford a monthly payment of \$1500. Experiment to determine the maximum amount of money they can borrow. *Hint:* If a_n represents the amount owed after n months, what are a_0 and a_{360} ?

2. Consider the spreading of a rumor through a company of 1000 employees, all working in the same building. We assume that the spreading of a rumor is similar to the spreading of a contagious disease (see Example 3, Section 1.2) in that the number of people hearing the rumor each day is proportional to the product of the number who have heard the rumor previously and the number who have not heard the rumor. This is given by

$$r_{n+1} = r_n + k r_n (1000 - r_n)$$

where k is a parameter that depends on how fast the rumor spreads and n is the number of days. Assume $k = 0.001$ and further assume that four people initially have heard the rumor. How soon will all 1000 employees have heard the rumor?

3. Suppose the spotted owls' primary food source is a single prey: mice. An ecologist wishes to predict the population levels of spotted owls and mice in a wildlife sanctuary. Letting M_n represent the mouse population after n years and O_n the predator owl population, the ecologist has suggested the model

$$M_{n+1} = 1.2M_n - 0.001O_nM_n$$

$$O_{n+1} = 0.7O_n + 0.002O_nM_n$$

The ecologist wants to know whether the two species can coexist in the habitat and whether the outcome is sensitive to the starting populations.

- Compare the signs of the coefficients of the preceding model with the signs of the coefficients of the owls-hawks model in Example 3. Explain the sign of each of the four coefficients 1.2, -0.001, 0.7, and 0.002 in terms of the predator-prey relationship being modeled.
- Test the initial populations in the following table and predict the long-term outcome.

	Owls	Mice
Case A	150	200
Case B	150	300
Case C	100	200
Case D	10	20

- Now experiment with different values for the coefficients using the starting values given. Then try different starting values. What is the long-term behavior? Do your experimental results indicate that the model is sensitive to the coefficients? Is it sensitive to the starting values?