

## Math 464, Homework 1

1. Suppose that in a population of 100 animals the probabilities of death and birth are  $p_d = 0.02$  per day and  $p_b = 0.05$  per day. Choose a suitable time interval and then:
  - (a) Find the (expected) population at the end of each of the next five weeks.
  - (b) Find the (expected) population at the beginning of each of the previous five weeks.
  - (c) Graph your results. Be sure to label your axes clearly.
  - (d) Find a formula for (expected) population as a function of time,  $t$ , in days.
2. Using the same time interval and birth/death probabilities, repeat Exercise 1 with an initial population of 50 animals. Draw your graph on the same axes as in Exercise 1.
3. Using the same time interval and birth/death probabilities, repeat Exercise 2 with an initial population of 150 animals. Draw your graph on the same axes as in Exercise 1.
4. Assume an initial population of  $N$  animals with birth/death probabilities as above. Find a formula for population as a function of time with the time step set at  $1/n$  days.
5. Take the limit as  $n$  approaches infinity.
6. With  $N = 100$ , compute the population at times  $t = 35$  days and  $-35$  days. Compare to your answers from Exercise 1.