

PROPORTION TYPE DIFFERENTIAL EQUATIONS

1. Due to a curse imposed by a neighboring town, the members of a particular town are driven away. The rate at which the population is declining is approximately $2\sqrt{P}$ people per month when the population is P . Suppose the population initially has 1600 members.

- A. Write an initial value problem for the population at time t .
- B. Solve the initial value problem.
- C. Use your solution to determine when everyone will have left the town.
- D. Would Euler's method generate an under estimate or over estimate of the actual population values?

2. Suppose the interest rate for a particular type of bank account has been decreasing linearly as indicated in the table below. Write a differential equation satisfied by M , the amount of money in the account at time t , measured in years since 2006.

Year	2006	2007	2008
Interest rate	3.2%	2.8%	2.4%

3. The rate at which ice forms on a lake is inversely proportional to the thickness of the ice at time t . Suppose the ice is initially 1 inch thick.

- A. Set up an initial value problem.
- B. Solve the initial value problem.
- C. If the ice is initially forming at the rate of 3 inches per day, find the thickness of the ice as a function of time measured in days.
- D. When will the ice be 2.5 inches thick?

4. Linguists use language to help determine the age of a civilization by making a list of basic words in the original language (house, man, etc.) and then determining how many words are still in use. They assume the rate at which words leave the list is proportional to the number words still in use. If the basic list for classical Latin has 210 words with 144 still in use in modern Italian, how long did it take for modern Italian to develop? An estimate of the proportionality constant is $k = 0.22$ and t is measured in thousands of years.