

MATH 103 200710 Problem Set 8

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The following problems may appear on the quiz on Tuesday, April 10, 2007.

1. Let $P(t)$ be the population (in millions) of a certain city t years after 2000. Suppose that $P(t)$ satisfies the differential equation $P'(t) = 0.03P(t)$, $P(0) = 2.5$. Find a formula for $P(t)$; use that formula to find the population in 2000, 2003, and 2006; and use the differential equation to determine how fast the population is growing when it reaches 4 million.
2. The world's population was 5.51 billion on January 1, 1993, and was 5.88 billion on January 1, 1998. Assuming that the population grows at a rate proportional to its size, determine in what year the world's population will reach (a) 6.5 billion, (b) 8 billion, (c) 10 billion.
3. Let $A(t)$ be the balance in a savings account after t years, and suppose that the account pays 4.5% interest and had an initial principal of \$3000, and no further deposits were made.
 - (a) What is the formula satisfied by $A(t)$?
 - (b) What is the differential equation satisfied by $A(t)$?
 - (c) What is $A(0)$?
 - (d) How much money will be in the account after 3 years?
 - (e) When will the balance reach \$7000?
 - (f) How fast is the balance growing when it reaches \$7000?
4. How long will it take an investment to double in value at 4% rate of return compounded continuously? To triple in value? What if the interest rate goes up to 10%?
5. Mike Holmes buys a house in Regina in spring 2004 for \$135,000. He has it appraised in spring 2007 for \$180,000. What is the annual rate of return he earned in that period, assuming continuous compounding?
6. One dollar invested in the S&P 500 in 1925 would have been worth \$517 in 1990. One dollar invested in small capitalization stocks in 1925 would be worth \$1,277 in 1990. Calculate the rates of return for those two types of investments. Now suppose you make an investment of \$5,000 when you are 25. Assuming similar rates of return, find the value of your \$5,000 investment when you retire at age 65 if you invest in the S&P 500 versus if you invest in small cap stocks.
7. Ten thousand dollars is deposited into a money market fund paying 8% interest compounded continuously. How much interest will be earned during the second year of the investment?
8. The decay constant for cesium-137 is 0.023 when time is measured in years. Find the half life of cesium-137.
9. In 1938, sandals woven from strands of tree bark were found in Fort Rock Creek Cave in Oregon. The bark contained 34% of the level of carbon-14 found in living bark. Approximately how old were the sandals? (The half life of carbon-14 is 5730 years.)

Please do the following problems from the textbook. They may appear on the final exam.

- 5.1 C-level: 1–12; B-level: 13–31.
- 5.2 C-level: 1–18; B-level: 19–25.