

Math 2250 Lab 1

Name/Unid: _____

Due Date: 1/16/2014

Class ID: _____

1. (50 points) **Natural Growth Equation**

Suppose the amount $A(t)$ of atmospheric pollutants in a mountain valley grows naturally and is doubling every 8 years.

- (a) If the initial amount is 20 pu (pollutant units), find a formula for $A(t)$ which gives the amount (in pu) present after t years.
- (b) What amount (in pu) of pollutants will be present in the valley atmosphere after 16 years?
- (c) If it is hazardous to stay in the valley once the amount of pollutant reaches 200 pu, how long will this take?

References: Edwards & Penney Section 1.4

To learn more about Air Quality Modeling, explore the US EPA website on the subject:
<http://www.epa.gov/oar/oaqps/modeling.html>

To find out about the use of air quality models in Utah, consult
<http://www.airquality.utah.gov/Planning/Modeling/Index.htm>

2. (50 points) **Mixture Problem**

Suppose that a reservoir with volume 6 billion cubic feet (ft^3) has an initial pollutant concentration of 0.3%. There is a daily inflow of 300 million $\frac{ft^3}{day}$ of water with a pollutant concentration of 0.1% and an equal daily outflow of well-mixed water from the reservoir.

- (a) Find a formula for $x(t)$ which gives the quantity of pollutant (in millions of cubic feet) in the reservoir after t days.
- (b) How many days will it take to reduce the pollutant concentration in the reservoir to 0.2%?
- (c) If it is unsafe to drink the water if the pollutant concentration is greater than or equal to 0.15%, how many days must residents wait before they can drink the water?

References: Edwards & Penney Section 1.5

Note: We made a number of simplifying assumptions to model how pollutant concentration would change over time in a reservoir with equal rates of inflow and outflow. To see a more detailed model which considers salinity water balance of reservoirs and outflow, consider reading the article by S. Miyamoto, F. Yuan, and Shilpa Anand (2009) entitled "A Simple Model for Estimating Water Balance and Salinity of Reservoirs and Outflow" -Texas Water Resources Institute Technical Report No. 363. Retrieved on January 8, 2014 at <http://twri.tamu.edu/reports/2010/tr363.pdf>