Math 29
Worksheet 4
Environmental Analysis

1. Rivers presently carry about 10^{10}m^3 of soil and rock to the sea each year throughout the world. Roughly how long will it take at that rate for the continents to shrink by an average of 1 meter in elevation if all other processes (such as continental uplift) are ignored? You may use the fact that the total area of the continents is about $1.48 \times 10^{14}\text{m}^2$ and that their mean elevation is about 840 meters. Assume also that the total area of the continents remains constant.

2. In 1998 the world consumption rate of refined petroleum products was estimated to be 73.642 million barrels a day. As of January 1, 2000, the Oil & Gas Journal reported the world wide crude oil resources to be $1,016.8$ billion barrels. Assume that we continue to consume petroleum at the 1998 consumption rate, in what year will we use up the estimated worldwide resource of this fuel?

3. The world population in 1999 reached $5,996.17$ million people and was growing at a rate of about 84 million people per year. Given that the total area of the continents is about $1.48 \times 10^{14}\text{m}^2$ and assuming that the world population continues to grow at the 1999 rate, how long will it take for the population density to reach 10^4people/km^2 (this is a typical density of large cities).

4. The net primary productivity (npp) is the total amount of energy produced in a year as a result of photosynthesis in the entire world. It has been estimated that the npp is about 3.0×10^{21} joules/year (a joule is a unit of energy equivalent to 2.39×10^{-4} Calories). Given that the average person consumes about 2500 Calories per day and assuming that the human population continues to grow at the 1999 rate, in what year will humans be eating at the Earth's current rate of npp?

5. Experiments designed to estimate the evaporation rate of water in swimming pools have shown that, for an outdoor swimming pool if the wind speed is roughly 0.06 mph and temperature roughly 84°F, then the evaporation rate for each square foot of water surface is about 0.07 pounds of water per hour. Consider an outdoor swimming pool which has dimensions 25 meters by 12.5 meters, with an average depth of 1.40 meters. Assume that water lost through evaporation is not replenished, and that the conditions of temperature and wind speed mentioned above hold throughout the summer. Recall that water has a density of about 1.00 gram per cubic centimeter.

a) Determine the number of cubic meters of water which evaporates from the pool in a day.
b) Write a function representing the volume of water remaining in the pool t days after the pool was first filled.
c) How many days will it take until the pool contains half of its original volume?
d) How long will it take for all the water to evaporate from the pool?