Math 150, Section 4.5

Lec: Naushad Pasha Puliyambalath

October 30, 2009

Purpose of This Section

In this section we learn how to model using exponential functions. We also learn Richter scale and how logarithm is used to define it.

Exponential Growth Model

A population that grows exponentially has the model

$$n(t) = n_0 e^{rt}$$

where

$$\begin{aligned} n(t) &= \text{population at time } t \\ n_0 &= \text{initial size of the population} \\ r &= \text{relative rate of growth} \\ t &= \text{time} \end{aligned}$$

This is the model you should use for any situation where it says the population is **growing exponentially** or has an **exponential growth**.

Half Life and Radioactive Decay

For a population which is decreasing or decaying exponentially we define the **half-life** to be the time taken for the population to become half and is denoted by h.

If m_0 is the initial mass of a radioactive substance with half-life h, then the mass remaining at time t is modeled by the function

$$m(t) = m_0 e^{-rt}$$

where $r = \dfrac{\ln 2}{h}$.

Newton's Law of Cooling

If D_0 is the initial temperature difference between an object and its surroundings, and if its surroundings have temperature T_s, then the temperature of the object at time t is modeled by the function

$$T(t) = T_s + D_0 e^{-kt}$$

where k is a positive constant that depends on the type of the object.

The Richter Scale

Let I be the intensity of an earthquake and S be the intensity of a standard earthquake. Then the magnitude M of the earthquake is defined as

$$M = \log \frac{I}{S}$$

Try problems 34 and 35 on Richter scale.