Section 4.6: Exponential Growth and Decay

Video 1

Exponential Growth & Decay Model

The amount *y* present at any time *t* is given by $y = y_0 e^{k \cdot t}$, where y_0 is the amount present initially and *k* is a constant.

1a) In 1974, the total world population reached 4 billion people. In 1999, the population reached 6 billion people. Find an exponential function that gives the world population (in billions) where *t* is the number of years after 1974.

1b) Use the function to predict the world population in 2047.

1c) Use the function to determine then the world population will reach 11.5 billion.

Video 2

2) If someone invests money in an account that pays 4% interest, compounded continuously, how long will it take for their investment to double?

Video 3

3a) The average annual income of a person with an advanced degree can be approximated by $f(t) = 18000 \cdot e^{0.04 \cdot t}$, where *t* represents the number of years after 1975.

a) Use the function to predict the average annual income of a person with an advanced degree in 2030.

b) Use the function to estimate the year that the average annual salary of a person with an advanced degree will reach $200,000.

Video 4: Exponential Decay

4) In 1940 there were 1878 daily newspapers in the US.

By 2002, this had dropped to 1457 daily newspapers.

a) Determine an exponential function of the form $y = y_0 e^{k \cdot t}$ that models this decay.

b) Use the function to determine when there will only be 500 daily newspapers in the US.

Video 5: Radioactive Decay & Half-Life

5) Carbon-14 is used to determine how much time since a living thing has died, by measuring what percentage of its original Carbon-14 remains.

a) The half-life of Carbon-14 is 5730 years. Determine its exponential decay constant, *k*.

b) If a bone is found that contains 40% of its original Carbon-14, how old is the bone?

Video 6: Newton's Law of Cooling

The rate at which a body cools is proportional to the difference in temperature between the body and the environment around it. The temperature at time *t* after being put into an environment with temperature T_0 is $f(t) = T_0 + Ce^{-k \cdot t}$ where *C* and *k* are constants.

6a) A dead human body is found inside a walk-in refrigerator at a restaurant, which is kept at 35°F. The temperature of the body when it is discovered is 96°F. Find a function to model the temperature of the body. One hour later, the temperature of the body had dropped to 95°F.

b) If the body is left in the refrigerator, what will the temperature be in 6 hours?

c) How long before the discovery was the body's temperature 98.6°F?
(This is an estimate of how long before discovery that the death occurred.)