Math 120: Elementary Functions
Exponential Modeling

Exponential equations "model" constant rate of growth; i.e.
amount of growth is a constant times current value
Finding exponential functions given two "data points"
Standard Applications:
  Population Growth
  Compound Interest
  Radioactive Decay
  Atmospheric Pressure
  Skip Logistic Functions

Exponential Functions – Growth or Decay

\[ y = a \cdot b^t \]

Growth Example: \[ y = 10(1.2)^t \] base \( b > 1 \)
Decay Example: \[ y = 10(0.8)^t \] base \( b < 1 \)

Given an initial value & growth rate
find the exponential equation
determine when it equals a certain value (use grapher)
Given two points (on a graph?) – find the exponential function

Population Growth

If a population \( P \) with initial population \( P_0 \) is changing at constant
rate \( r \) each time period (e.g. each year) then
\[ P = P_0(1 + r)^t \]

Example: Given an initial population of 7000 and a growth rate of
6% per year, what is the population after 8 years?

Example: If the population of a certain city was 60,000 in 2000
and it grew to 67,500 in 2010, find the population equation and
determine when the city will reach a population of 70,000.

Compound Interest (Annual Compounding)

If an initial amount \( PV \) (present value) is invested at \( r \) percent
interest the future value \( FV \) after \( n \) compounding periods is
given by
\[ FV = PV(1 + r)^t \]

Example: You invest $2000 at 4% interest compounded annually.
How much is it worth after 5 years?

Radioactive Decay

If an initial quantity \( Q_0 \) of a radioactive substance has a half life
of \( h \) hours/days/years the quantity \( Q \) remaining after \( t \)
hours/days/years is given by
\[ Q = Q_0 \left( \frac{1}{2} \right)^{\frac{t}{h}} \]

Given 50 grams of a radioactive substance with a half life of 15
days, how much remains after 40 days?

The half life of \(^{14}\text{C}\), Carbon-14, is 5730 years. If an object contains
80% of its remaining \(^{14}\text{C}\), approximately how old is it?

Atmospheric Pressure

Atmospheric pressure is reduced by half for every 3.6 mi. above sea
level. If the pressure at sea-level is 14.7 lbs/in\(^2\) then atmospheric
pressure at \( x \) miles is given by
\[ P = 14.7 \left( \frac{1}{2} \right)^{\frac{x}{3.6}} \]

At 29029 feet what is the atmospheric pressure on top of Mt.
Everest?

At 10350 feet what is the atmospheric pressure at the Visitors
Center at Cedar Breaks Nat. Monument in Utah?
Written Homework #23 – Due M 11/04/13

From page 270
1, 3, 5 (Counts as 1)
11, 13, 15, 17, 21
29, 33, 39, 41 (see Example 5 page 267)