Section 5.5 Applications of Exponential and Logarithmic Functions
(includes Section 5.1 objective 4)

Review of Converting Between Decimal and Percent Notation

To convert from a decimal to a percent, multiply by 100. Multiplying by 100 shifts the decimal point two places to the right.

To convert from a percent to a decimal, divide by 100. Dividing by 100 shifts the decimal point two places to the left.

Review of Approximating Exponential Expressions with the Calculator

See Section 5.1.

Review of Solving Exponential Equations of the Form $b^u = c$

To solve an exponential equation that can be written in the form $b^u = c$ where c is a constant not equal to any power of the base b:

1. Rewrite the equation in logarithmic form using the Definition of a Logarithmic Function.
2. Solve for the given variable and use the Change of Base Formula (base 10 or base *e*) to evaluate.

Alternatively,

1. Use the Logarithm Property of Equality to "take the log of both sides" (base 10 or base *e*).
2. Use the Power Rule of Logarithms to "bring down" any exponents. (If the base is *e*, remember that $\ln e^x = x$ for all x.
3. Solve for the given variable.

Objective 1: Solving Compound Interest Applications

The **Periodic Compound Interest Formula** is $A = P\left(1+\frac{r}{n}\right)^{nt}$, where A is the total amount in the account after t years, P is the principal (original investment amount), r is the annual interest rate as a decimal, and n is the number of times interest is compounded per year.

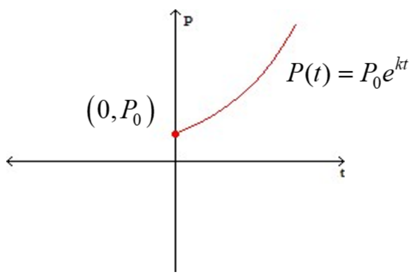
The **Continuous Compound Interest Formula** is $A = Pe^{rt}$, where A is the total amount in the account after t years, P is the principal (original investment amount), and r is the annual interest rate as a decimal.

Objective 2: Exponential Growth and Decay Applications

Uninhibited Exponential Growth

The **uninhibited exponential growth model** is used when a population grows at a rate proportional to the size of its population and continues to grow without any limiting factors.

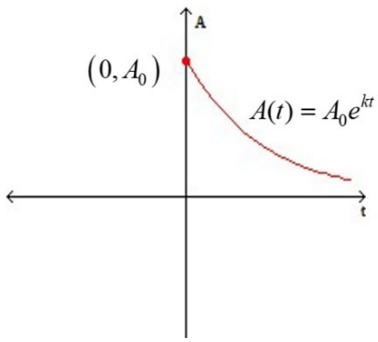
This model that describes the population, P, after a certain time, *t,* is $P(t) = P_0 e^{kt}$ where $P_0 = P(0)$ is the initial population and $k > 0$ is a constant called the **relative growth rate**. (Note: k may be given as a percent.)



Uninhibited Exponential Decay

The **uninhibited exponential decay model** is used when a population decays (or declines) at a rate proportional to the size of its population and continues to decay without any limiting factors. The unhibited exponential growth and decay models are the same except for the sign of the constant, k.

This model that describes the exponential decay of a population, quantity, or amount A, after a certain time, t, is $A(t) = A_0 e^{kt}$ where $A_0 = A(0)$ is the initial quantity and $k < 0$ is a constant called the **relative decay constant**. (Note: k is sometimes given as a percent.)



Half-Life: Every radioactive substance has a half-life, which is the required time for a given quantity of that element to decay to half of its original mass.

In other words,

half-life is the time, t, it takes for the amount present, A, to equal half the initial amount, A_0 and in symbols,

half-life is t when $A = 0.5A_0$.