11.7

Date:

Objective:

A. Review

1) $\log_3 x = 4$

2) $27\left(\dfrac{1}{3}\right)^{x/5} = 3$

3) $16 \cdot 4^{x/3} = 1024$

B. Use the Properties of Logarithms and Exponents to solve equations.

- To avoid extraneous solutions, determine the domain of the variable first.
- Use the *properties of logarithms and exponents* to manipulate the equations.
- Try rewriting as an exponential or logarithmic function: $y = \log_a x \Leftrightarrow x = a^y$
- Remember the properties: $\log_a M = \log_a N \Leftrightarrow M = N$ and $a^u = a^v \Leftrightarrow u = v$ (Make the bases the same).
- Check your solution by substituting into the original equation.

a) $2.05^x = 4.36$

b) $30e^{0.014x} = 600$

c) $8 - 5e^{-x} = -12$

d) $2^{4-x} - 7 = 14$

e) $\ln x = 8$

f) $-4\log(x+5)-3=-4$

g) $\log x = \log_4 9$

h) $\log_4 x=\log_4(3x-8)$

i) $\log_3(2x+5)+\log_3 27 = 5$

j) $3\log_2(x-1)+\log_2 4 = 5$

k) $3\log_2(x-1)+\log_2 4=5$

l) $\ln(5x)-\ln(10)=5$

m) $\log_6(x+4)+\log_6(x+3)=1$

n) $\log_2 x+\log_2(x-2)=\log_2(x+4)$

Exponential Growth and Decay Models

***Law of Uninhibited Growth or Decay*:**
Many natural phenomena have been found to follow the law that an amount A varies with time t according to the function $A(t) = A_0 e^{kt}$, where A_0 is the original amount at time $t = 0$ and k is a constant of growth or decay (growth if $k > 0$, decay if $k < 0$.)

Example: The number N of bacteria present in a culture at time t hours obeys the law of uninhibited growth where $N(t) = 1000e^{0.01t}$.

a) Determine the number of bacteria at $t = 0$ hours.

b) What is the growth rate of the bacteria?

c) What will the population be after 4 hours?

d) When will the number of bacteria reach 1700?

e) When will the number of bacteria double?

Example: Iodine 131 is a radioactive material that decays according to the function $A(t) = A_0 e^{-0.087t}$, where A_0 is the initial amount present and A is the amount present at time t (in days). Assume that a scientist has a sample of 100 grams of iodine 131.

a) What is the decay rate of iodine 131?

b) How much iodine 131 is left after 9 days?

c) When will 70 grams of iodine 131 be left?

d) What is the half-life of iodine 131? (when $A = \frac{1}{2} A_0$.)