Exponential & Logarithmic Functions

7 – Natural Logarithms

General Formula for Growth and Decay in Nature:
$y = ne^{kt}$, where *y* is the final amount, *n* is the initial amount, *k* is a constant, and *t* is time.

If a population is growing, $k > 0$; if a population is decaying, $k < 0$.

Natural Logarithm: A logarithm with base *e*. Natural logarithm are usually denoted *ln x*. $\log_e x = \ln x$

Antiln x: The antilogarithm of a natural logarithm.
Antiln $x = e^x$

Ex A: Use a calculator to find each value to the nearest ten thousandth.

#1) ln 9.32

#2) antiln 0.7831

#3) antiln –3.874

#4) ln 0.21

Ex B: Solve each equation. Round solutions to the nearest hundredth.

#1) $9 = e^x$

#2) $18 = e^{3x}$

#3) $e^{6x} = 65$

#4) $\ln 20.8 = \ln e^{0.5t}$

Ex C: Word problems.

#1) The city planners of Springfield are studying the current and future needs of the city. The sewage system they have in place now can support 250,000 residents. The current population of the city is 175,000, up from 106,000 ten years ago.

A) Assuming that the population will continue to grow at this rate, when will the sewage system need to be updated?

B) How many people will the new system have to accommodate for the system to last 15 years before needing to be updated again?

#2) If two languages have evolved separately from a common ancestral language, the number of years since the split, *n(r)*, is given by the formula n(r) = -5000 ln r, where *r* is the percent of words from the ancestral language that are common to both languages now. If two languages split off from a common ancestral language about 2000 years ago, what portion of the words from the ancestral language would you expect to find in each language today?