**Real Life Application of Logarithms:**

Logarithms are not only used to solve mathematical equations. They can also be applied in real world applications. These problems commonly involve:

Earthquakes:  
- Logarithms are commonly used in determining the magnitude of an Earthquake.

Compound Interest:  
- Logarithms are used in measuring the growth of a deposit.

The pH levels of an element:  
- Logarithms are used in determining the concentration of the amount of a certain substance.

Population Growth:

- Logarithms are used in determining the growth of a population, which can be exponential.

**STEP BY STEP PROCESS OF SOLVING LOGARITHMIC WORD PROBLEMS:  
1. Read through the entire problem.**

**2. Take notes of keywords such as: growth, decrease, increase, etc.**

**3. Use the appropriate formula for the word problem.**

**Things to consider:**

* **If the number has a specific unit of measurement, make sure to include that in your final answer. (Ex. PHP and m/s^2)**
* **If your final answer is in decimal form, depending on the word problem, follow the appropriate decimal places.**

**- Rate has at least 4 decimal places.**

**- Population and Time has to be in whole number form**

**- Money has at least 2 decimal places.**

**Word Problems:**

**Magnitude:**  
  
Suppose that an Earthquake has occurred in the Pampanga area. The energy (E) released was stated to have been 10^15. Determine the magnitude of the Earthquake using the Richter scale formula: , wherein E is the energy released:

Solution:

E = 10^15

Look for the given.

= 2/3 log (10^15)/10^4.40

Substitute the given values to given formula.

= 2/3 log (10^15) – log (10^4.40)

Apply quotient rule.

= 2/3(15 – 4.40)

If logarithms do not have a specific value base, it is understood that the base value is 10. Since the base is the same as the argument, the answer is the exponent. (logb b^x = x)

= 2/3(11.40)

Simplify

= 7.6

The magnitude of the earthquake is 7.6

**pH Levels:**Suppose that the hydrogen ion concentration [H+] of an element is 10^-5. What is the pH level of the solution given the formula *-log[H+]?*

Solution:

[H+] = 10^5

Look for the given.

= -log[10^-5]

Substitute the given value.

= -[-5]

Simplify. (Base value of log is 10 therefore logb b^x = x)

= 5

Is the pH level of the

**Compound Interest:**

50,000 PHP has been set for investment in a bank. It is annually compounded with a 4% rate. How many years will it take for the principal amount to reach 75,000 PHP?

Compound Interest Formula: A = P(1 + R)^n

Solution:

Determine the given: A = 75 000PHP ; P = 50 000 PHP ; R = 4% or 0.004 ; n = ?

Substitute the given values:

75 000 = 50 000(1 + 0.004)^n

Divide both sides by 50 000:

75 000 / 50 000 = 500,000(1 + 0.004)^n / 50 000

Simplify:

3/2 = (1.004)^n

Take the natural log of both sides:

ln(3/2) = ln(1.004)^n

Since we are looking for the value of n only, divide both sides by ln(1.004) to isolate the n.  
  
ln(3/2) / ln(1.004) = ln(1.004)^n / ln(1.004)

= ln(3/2) / ln(1.004) = n

Simplify:

= 101.57 years

**Population Growth:**

A barangay has a population growth rate of 1%. If they have a population of 200 in 2006. How many years will it take to reach 700 people?

Formula: A = Pe^rt, wherein P is the original population, r is the rate of growth, and t is the time given.

Given: A = 700 ; P = 200 ; R = 1% or 0.01 ; t = ?

Solution:  
  
Substitute the given values:  
 700 = 200e^0.01t

Divide both sides by 200:  
  
700 / 200 = 200e^0.01t / 200

= 700 / 200 = e^0.01t

Take the natural log (ln) of both sides:

ln(700 / 200) = lne^0.01t

Apply the exponential property of logarithms:

ln(700 / 200) = 0.01t lne

= ln (700 / 200) = 0.01t (lne = 1, therefore we do not need to write it.)

Divide both sides by 0.01 to isolate t:

ln700 / 200 / 0.01 = 0.01t / 0.01

= ln 700/200 /0.01 = t

=ln 3.5 / 0.1 = t

Simplify:

= 12 years