Formulas for Applied Problems with Exponential or Logarithmic Formulas

Radioactive Decay Formula: $A = A_0 2^{-t/h}$ or $A = A_0 2^{-\frac{t}{h}}$ where A is the final amount, A_0 is the initial amount present at time 0, t is the time, and h is the half-life of the material.

Population Growth: $P = P_0 e^{kt}$ where P is the current population, P_0 is the initial population at time 0, t is time in years, and k is the growth rate.

Light Intensity: $I = I_0 k^x$ where I is the intensity of light (in lumens) at a distance of x meters below the surface of water and I_0 is the intensity of light above the water and k is a constant that depends on the clarity of the water.

pH formula: $pH = -\log[H_3O^+]$ where pH is the number representing the acidity or alkalinity of a solution and $[H_3O^+]$ is the hydronium ion concentration in moles per liter. (A pH of 7 is neutral, less than 7 (0-7) is acidic with the smaller the number the more acidic, and more than 7 (7-14) is alkaline with the greater the number the more alkaline.)

Richter Scale: $R = \log\left(\frac{A}{P}\right)$ where R is the Richter scale measurement, A is the amplitude measured in micrometers, and P is the period or the time of one oscillation in seconds on the surface of the earth.

Decibel Voltage Gain: $db = 20\log\left(\frac{E_o}{E_I}\right)$ where db is the decibel voltage gain, E_0 is the output voltage of a device and E_I is the input voltage.

Decibel Level of Sound: $D = 10\log\left(\frac{I}{I_0}\right)$ where D is the decibel level, I is the intensity level, and I_0 is the threshold sound intensity (a very faint sound).

Population Doubling Time: $t = \frac{\ln 2}{r}$ where t is the time for a population to double and r is the growth rate as a decimal.