Common Logarithmic and Exponential Formulas

Compound Interest Formula

If P dollars are deposited in an account earning interest at an annual rate r, compounded k times each year, the amount A in the account after t years is given by

$$A = P\left(1 + \frac{r}{k}\right)^{kt}$$

Continuous Compound Interest Formula

If P dollars are deposited in an account earning interest at an annual rate r, compounded continuously, the amount A after t years is given by the formula

$$A = Pe^{rt}$$

Malthusian Model of Population Growth

If b is the annual birth rate, d is the annual death rate, t is the time (in years), P_0 is the initial population at $t = 0$, and P is the current population, then

$$P = P_0e^{kt}$$

Where $k = b - d$ is the annual growth rate, the difference between the annual birth rate and death rate

Decibel Voltage Gain

If E_O is the output voltage of a device and E_I is the input voltage, the decibel voltage gain is given by

$$db_{Gain} = 20\ log\ log\ \frac{E_O}{E_I}$$

Richter Scale

If R is the intensity of an earthquake, A is the amplitude (measured in micrometers), and P is the period (the time of one oscillation of the Earth's surface, measured in seconds), then

$$R = log\ log\ \frac{A}{P}$$

Charging Batteries

If M is the theoretical maximum charge that a battery can hold and k is a positive constant that depends on the battery and the charger, the length of time (in minutes) required to charge the battery to a given level C is given by

$$t = -\frac{1}{k}\ ln\ ln\ \left(1 - \frac{C}{M}\right)$$

Isothermal Expansion

If the temperature T is constant, the energy E required to increase the volume of 1 mole of gas from an initial volume V_i to a final volume V_f is given by

$$E = RT\ ln\ ln\ \left(\frac{V_f}{V_i}\right)$$

E is measured in joules and T in Kelvins. R is the universal gas constant, which is $8.314\ \frac{joules}{mol \cdot K}$

Radioactive Decay Formula

The amount A of radioactive material present at time t is given by

$$A = A_0 2^{-\frac{t}{h}}$$

Where A_0 is the amount that was present initially (at $t = 0$) and h is the material's half-life