Formulas containing exponential expressions can be solved by converting to logarithmic form just like the exponential equations we’ve already solved. The only additional step we need to do when solving formulas containing exponential expressions is to isolate the exponential expression first, before converting from exponential form to logarithmic form. Other than that, the process is the same.

**Example 1:** Solve the following exponential formula for the variable \( t \) by converting to logarithmic form and isolating the variable \( t \).

\[
A = Pe^{rt}
\]

*Keep in mind that we must **ALWAYS** isolate the exponential expression first, prior to converting to logarithmic form.*
Example 2: Solve each of the following exponential formulas for the specified variable by converting to logarithmic form and isolating the specified variable.

a. $Q = Q_0 e^{kt}$; solve for $k$  

b. $P = M - Ce^{-kt}$; solve for $t$
c. \( y = \frac{L}{1 + Ae^{-kx}} \); solve for \( k \)

\[
y(1 + Ae^{-kx}) = L
\]

\[
y + Ay e^{-kx} = L
\]

\[
Ae^{-kx} = L - y
\]

\[
e^{-kx} = \frac{L - y}{Ay}
\]

\[
-kx = \log_e \left( \frac{L - y}{Ay} \right)
\]

\[
k = -\frac{1}{x} \ln \left( \frac{L - y}{Ay} \right)
\]

Keep in mind that this answer could also be expressed as \( k = \frac{\ln \left( \frac{L - y}{Ay} \right)}{-x} \) or \( k = -\frac{\ln \left( \frac{L - y}{Ay} \right)}{x} \). Regardless, the argument does not change when a logarithm is multiplied or divided by a factor. So whether you multiply the logarithm by \(-\frac{1}{x}\), or whether you divide by \(-x\), the argument is still the same \( \left( \frac{L - y}{Ay} \right) \).
Answers to Examples:

1. \( t = \frac{1}{r} \ln \left( \frac{A}{P} \right) \); 2a. \( k = \frac{1}{t} \ln \left( \frac{Q}{Q_0} \right) \); 2b. \( t = -\frac{1}{k} \ln \left( \frac{M-P}{C} \right) \);
2c. \( k = -\frac{1}{x} \ln \left( \frac{L-y}{A_y} \right) \);