Concepts
Exponential Equations in One Variable

Based on power point presentations by Pearson Education, Inc.
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Learning Objectives

1. Use logarithms to solve exponential equations.
2. Use a short-cut to to solve certain exponential equations.

NOTE: This lesson contains some examples. You can find more examples in the "Examples" document also located in the appropriate MOM Learning Materials folder.

1. Use Logarithms to Solve Exponential Equations

An exponential equation of the form $a^M = b^N$, where at least one term has a variable in the exponent, can be solved follows. Assume that M and N are any mathematical expression.

a. Take the common or natural logarithm on both sides of the equation. It does not matter which one you use!

Example 1: Given $3^{x+1} = 10$, we can write it either as $\log 3^{x+1} = \log 10$ or as $\ln 3^{x+1} = \ln 10$.

b. Simplify using the logarithmic Power Rule.

Example 1continued: $(x + 1) \log 3 = \log 10$ Note the parentheses placement!

b. Solve for the variable. As required, show the solution in logarithmic form or without logarithms.

2. Use a Short-Cut to Solve Certain Exponential Equations

Sometimes, we can use a short-cut method to solve certain exponential equations of the form $a^M = b^N$. Specifically, base a must be equal to base b.

a. Write all terms with the same base, if necessary.

Example 2: Given $27^x = 9$, we can write it as $(3^3)^x = 3^2$.

b. Set the exponents equal.

Example 2 continued: $3x = 2$

c. Solve for the variable.

Please note that we can use the logarithmic solution method discussed earlier if we wish to do so!