Exponential and Logarithmic Equations and Inequalities

An **exponential equation** is an equation containing one or more expressions that have a variable as an exponent. To solve exponential equations:

- Try writing them so that the $\text{If } b^x = b^y$, then $x = y (b \neq 0, b \neq 1)$. bases are all the same.
- Take the logarithm of both If a = b, then $\log a = \log b$ (a > 0, b > 0). sides.

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Exponential and Logarithmic Equations and Inequalities

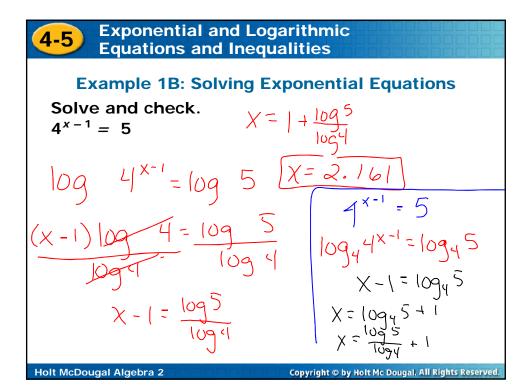
Example 1A: Solving Exponential Equations

Solve and check.

$$9^{8-x} = 27^{x-3}$$

$$(3^2)^{8 \cdot x} = (3^3)^{x - 3}$$

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4-5 Exponential and Logarithmic Equations and Inequalities

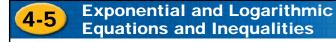
Check It Out! Example 1a

Solve and check.

$$3^{2x} = 27$$

 $3^{2x} = 3^{3}$
 $2x = 3$

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Check It Out! Example 1b

Solve and check.

$$7^{-x} = 21$$

$$|\log_{7} 7^{-x} = |\log_{7} 2|$$

$$\frac{-X}{-1} = \frac{|\log_{7} 2|}{-1}$$

$$X = -|\log_{7} 2| = -\frac{|\log^{2} 1|}{|\log_{7} 7|} \approx -\frac{|.565|}{|\log_{7} 7|}$$

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Check It Out! Example 1c

Solve and check.

$$2^{3x} = 15$$

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Exponential and Logarithmic Equations and Inequalities

A <u>logarithmic equation</u> is an equation with a logarithmic expression that contains a variable. To solve logartihmic equations:

- Rewrite the logarithmic equation in exponential form; solve.
- Use the properties of logarithms. Think: If $\log_b x = \log_b y$ then x = y

CHECK FOR EXTRANEOUS SOLUTIONS!!

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Exponential and Logarithmic Equations and Inequalities

Example 2A: Solving Logarithmic Equations

Solve.

$$\log_6(2x-1) = -1$$

$$6^{-1} = 2x - 1$$

$$\frac{1}{6} = 2x - 1$$

$$\frac{2x}{2} = \frac{7}{6}$$

$$x = \frac{7}{12}$$

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Example 2B: Solving Logarithmic Equations

Solve.

$$\log_4 100 - \log_4 (x+1) = 1$$

$$\log_{1}\left(\frac{100}{x+1}\right)=1$$

$$4 = \frac{\chi+1}{100}$$

 $L = \frac{100}{X+1}$

$$X + 1 = 25$$
 $X = 24$

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Example 2C: Solving Logarithmic Equations

Solve.

$$\log_5 x^4 = 8$$



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