Exponential & Logarithmic Equations.....Page

Goal: Solving Exponential equations using logs.
&
Solving logarithmic equations using the properties of logs.

Jan 21-9:02 AM

Review: Write your logarithm in exponential form and solve.

1. $\log_{16} x = \frac{3}{2}$ $16^{\frac{3}{2}} = x$ $x=64$
2. $\log_x 2197 = 3$ $\sqrt[3]{x^3} = \sqrt[3]{2197}$ $x=13$
3. $\log 1{,}000 = x$ $10^x = 1000$ $x=3$

Jan 17-12:51 PM

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 bases are all the same. If $b^x = b^y$, then $x = y$ $(b \neq 0, b \neq 1)$.
- Take the logarithm of both sides. If $a = b$, then $\log a = \log b$ $(a > 0, b > 0)$.

Jan 17-12:54 PM

Solve and check.

4. $3^{2x} = 27$

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

Rewrite each side with the same base; 3 and 27 are powers of 3.

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

$2x = 3$

Bases are the same, so the exponents must be equal.

$x = 1.5$

Jan 17-12:57 PM

How should we solve?

What is our first step?

Take the log of both sides?

Get the same base?

5. $4^{5x} = 16^{x+6}$

$4^{5x} = 4^{2(x+6)}$

$5x = 2(x+6)$

$5x = 2x + 12$

$-2x \quad -2x$

$\frac{3x}{3} = \frac{12}{3}$ $x = 4$

6. $100^{x-1} = 1000^{2x+3}$

$10^{2(x-1)} = 10^{3(2x+3)}$

$2x - 2 = 6x + 9$

$-2x \quad -2x$

$\frac{-2}{-9} = \frac{4x}{-9} + \frac{9}{-9}$

$\frac{-11}{4} = \frac{4x}{4}$ $x = \frac{-11}{4}$

Jan 28-12:00 PM

Solve and check.

7. $\log 7^{-x} = \log 21$

$-x \cdot \frac{\log 7}{\log 7} = \frac{\log 21}{\log 7}$

21 is not a power of 7, so take log of both sides.

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

$(-x)\log 7 = \log 21$

Apply the Power Property of Logarithms.

$\frac{-1x}{-1} = \frac{\log 21}{\log 7}$

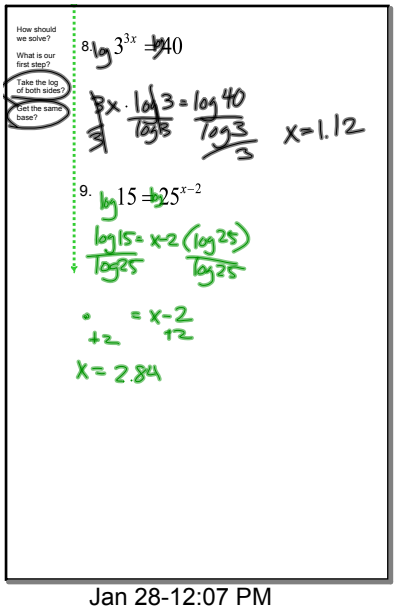
Divide both sides by log 7.

$x = -\frac{\log 21}{\log 7} \approx -1.565$

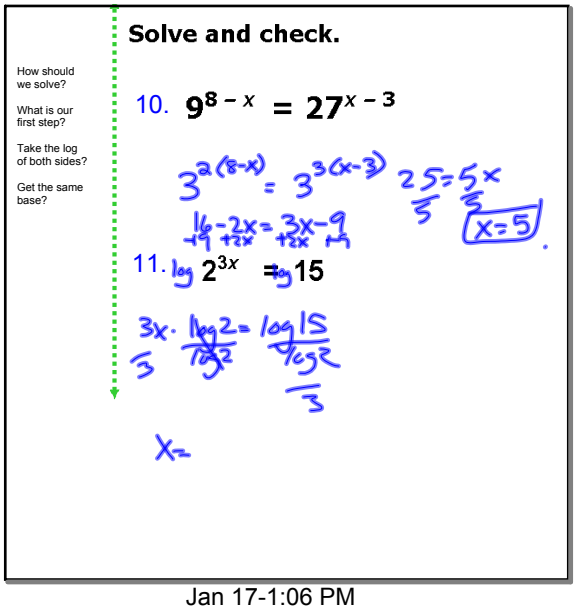
$\frac{-x}{-1} = \frac{1.565\ldots}{-1}$

$x = -1.57$

Jan 17-1:00 PM



Jan 28-12:07 PM



Jan 17-1:06 PM

A **logarithmic equation** is an equation with a logarithmic expression that contains a variable. You can solve logarithmic equations by using the properties of logarithms.

$$\text{If } \log_b x = \log_b y \text{ then } x = y$$

12. $\log_2 (4x + 2) = \log_2 (6x - 8)$

$4x + 2 = 6x - 8$
$-4x \quad -4x$
$2 = 2x$
$\frac{2}{2} = \frac{2x}{2}$
$x = 5$

Jan 17-1:10 PM

Lesson Quiz

Solve for x.

1. $\log 7^x = \log 12$
$x \cdot \frac{\log 7}{\log 7} = \frac{\log 12}{\log 7}$

2. $\log_3 x = 4$
$3^4 = x$
$x = 81$

3. $8^x = \left(\frac{1}{2}\right)^{x-4}$
$2^{3x} = 2^{-1(x-4)}$
$3x = -x + 4$
$+x \quad +x$
$\frac{4x}{4} = \frac{4}{4}$
$x = 1$

4. $\log_8 (2x - 9) = \log_8 (5x + 2)$
$2x - 9 = 5x + 2$

Jan 20-7:46 AM

Assignment:

Worksheet

Jan 17-1:14 PM