

LESSON
7-5

Reteach

Exponential and Logarithmic Equations and Inequalities

An **exponential equation** contains an expression that has a variable as an exponent.

$5^x = 25$ is an exponential equation.

$x = 2$, since $5^2 = 25$.

If $x = y$, then
 $\log x = \log y$
($x > 0$ and $y > 0$).

Remember: You can take the logarithm of both sides of an exponential equation. Then use other properties of logarithms to solve.

Solve $6^{x+2} = 500$.

Step 1 Since the variable is in the exponent, take the log of both sides.

$6^{x+2} = 500$
 $\log 6^{x+2} = \log 500$

Step 2 Use the Power Property of Logarithms: $\log a^p = p \log a$.

$\log 6^{x+2} = \log 500$
 $(x + 2) \log 6 = \log 500$

"Bring down" the exponent to multiply.

Step 3 Isolate the variable. Divide both sides by log 6.

$(x + 2) \log 6 = \log 500$
 $x + 2 = \frac{\log 500}{\log 6}$

Step 4 Solve for x. Subtract 2 from both sides.

$x = \frac{\log 500}{\log 6} - 2$

Step 5 Use a calculator to approximate x.

$x \approx 1.468$

Step 6 Use a calculator to check.

$6^{1.468 + 2} \approx 499.607$

Solve and check.

1. $4^{-x} = 32$

$\log 4^{-x} = \log 32$
 $-x \log 4 = \log 32$

2. $3^{4x} = 90$

$\log 3^{4x} = \log 90$
 $4x \log 3 = \log 90$

3. $5^{x-3} = 600$

LESSON

7-5

Reteach

Exponential and Logarithmic Equations and Inequalities (continued)

A **logarithmic equation** contains a logarithmic expression that has a variable.

$$\log_5 x = 2 \text{ is a logarithmic equation.}$$

$$x = 25, \text{ since } 5^2 = 25.$$

Combine and use properties of logarithms to solve logarithmic equations.

Solve: $\log 80x - \log 4 = 1$

Step 1 Use the Quotient Property of Logarithms.

$$\log 80x - \log 4 = 1$$

$$\log \frac{80x}{4} = 1$$

$\log x - \log y = \log \frac{x}{y}$

Step 2 Simplify.

$$\log \frac{80x}{4} = 1$$

$$\log 20x = 1$$

Step 3 Use the definition of the logarithm:

if $b^x = a$, then $\log_b a = x$.

$$\log_{10} 20x = 1$$

$$10^1 = 20x$$

Remember: Use 10 as the base when the base is not given.

Step 4 Solve for x . Divide both sides by 20.

$$10 = 20x$$

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

Solve and check.

4. $\log_3 x^4 = 8$

$$4 \log_3 x = 8$$

$$\log_3 x = \frac{8}{4}$$

5. $\log 4 + \log (x + 2) = 2$

$$\log 4 (x + 2) = 2$$

$$\log_{10} (4x + 8) = 2$$

$$4x + 8 = 10^2$$

6. $\log 75x - \log 3 = 1$

Assignment : pg 526 # 2-15

skip # 9, 11, 13