LESSON 13.3 Assignment

Name KEY Date

What's Your Strategy?
Solving Exponential Equations

Vocabulary

1. Define the Change of Base Formula and explain how it is used.

The Change of Base Formula states: $\log_b c = \frac{\log_a c}{\log_a b}$, where $a, b, c > 0$ and $a, b \neq 1$. It allows you to calculate an exact value for a logarithm by rewriting it in terms of a different base.

Use the Change of Base Formula to evaluate each logarithm. Round to four decimal places if necessary.

2. $log_{16}8$

$\frac{\log 8}{\log 16} = 0.75$

3. $log_{243}27$

$\frac{\log 27}{\log 243} = 0.6$

4. $log_3 92$

$\frac{\log 92}{\log 3} = 4.1159$

5. $log_7 35$

$\frac{\log 35}{\log 7} = 1.8271$

6. $log_6\left(\frac{1}{6}\right)$

$\frac{\log(1/6)}{\log 6} = -1$

7. $log_5 38$

$\frac{\log 38}{\log 5} = 2.2602$

8. Ten volunteers begin recruiting people to be volunteers for a large fundraising event. After 1 week the total number of volunteers has doubled to 20. Each subsequent week the total number of volunteers doubles.

a. Write a function to model the total number of volunteers, V, in the group after t weeks.

The function $V(t) = 10 \cdot 2^t$ models the total number of volunteers in the group after t weeks.

b. How many weeks will it take for the total number of volunteers to reach 1280?

It will take exactly 7 weeks for the total number of volunteers to reach 1280.

$$1280 = 10 \cdot 2^t$$
$$128 = 2^t$$
$$\log 128 = \log 2^t$$
$$\log 128 = t \log 2$$
$$\frac{\log 128}{\log 2} = t$$
$$7 = t$$

c. How many weeks will it take for the volunteers to reach their goal of 15,000 total volunteers?

It will take approximately 10.6 weeks for the volunteers to reach their goal of 15,000 total volunteers.

$$15{,}000 = 10 \cdot 2^t$$
$$1500 = 2^t$$
$$\log 1500 = \log 2^t$$
$$\log 1500 = t \log 2$$
$$\frac{\log 1500}{\log 2} = t$$
$$10.55 \approx t$$

Use common bases to solve.

9. $9^{3x-7} = 9^{5-x}$

$3x - 7 = 5 - x$
$4x - 7 = 5$
$4x = 12$

10. $8^{6y+4} = 64$

$8^{6y+4} = 8^2$
$6y + 4 = 2$
$6y = -2$
$y = -1/3$

Rewrite each exponential equation as a logarithmic equation and solve using the Change of Base Formula.

11. $6^{x-5} = 24$

$\log_6 24 = x - 5$
$\frac{\log 24}{\log 6} = x - 5$
$\frac{\log 24}{\log 6} + 5 = x$
$6.774 = x$

12. $7^{3x} = 15$

$\log_7 15 = 3x$
$\frac{\log 15}{\log 7} = 3x$
$\frac{1}{3}\left(\frac{\log 15}{\log 7}\right) = x$
$.464 = x$

13. $4^{x+3} - 7 = 32$

$4^{x+3} = 39$
$\log_4 39 = x + 3$
$\frac{\log 39}{\log 4} - 3 = x$
$-.351 = x$