NAME ______________________________ DATE ____________________ PERIOD __________

Integrated Math 3

Chapter 6 Section 2 Study Guide and Intervention

Solving Logarithmic Equations and Inequalities

Solving Logarithmic Equations

Property of Equality for Logarithmic Functions	If b is a positive number other than 1, then $\log_b x = \log_b y$ if and only if $x = y$.

Example 1: Solve $\log_2 2x = 3$.

$\log_2 2x = 3$	Original equation
$2x = 2^3$	Definition of logarithm
$2x = 8$	Simplify.
$x = 4$	Simplify.

The solution is $x = 4$.

Example 2: Solve the equation $\log_2 (x + 17) = \log_2 (3x + 23)$.

Since the bases of the logarithms are equal, $(x + 17)$ must equal $(3x + 23)$.

$(x + 17) = (3x + 23)$

$-6 = 2x$

$x = -3$

Exercises

Solve each equation.

1. $\log_2 32 = 3x$

2. $\log_3 2c = -2$

3. $\log_{2x} 16 = -2$

4. $\log_{25} \left(\frac{x}{2}\right) = \frac{1}{2}$

5. $\log_4 (5x + 1) = 2$

6. $\log_8 (x - 5) = \frac{2}{3}$

7. $\log_4 (3x - 1) = \log_4 (2x + 3)$

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

9. $\log_x + \log_4 27 = 3$

10. $\log_2 (x + 3) = 4$

11. $\log_x 1000 = 3$

12. $\log_8 (4x + 4) = 2$

13. $\log_2 x = \log_2 12$

14. $\log_3 (x - 5) = \log_3 13$

15. $\log_{10} x = \log_{10} (5x - 20)$

16. $\log_5 x = \log_5 (2x - 1)$

17. $\log_4 (x + 12) = \log_4 4x$

18. $\log_6 (x - 3) = \log_6 2x$

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Integrated Math 3

Chapter 6 Section 2 Study Guide and Intervention *(continued)*

Solving Logarithmic Equations and Inequalities

Solving Logarithmic Inequalities

Property of Inequality for Logarithmic Functions	If $b > 1$, $x > 0$, and $\log_b x > y$, then $x > b^y$. If $b > 1$, $x > 0$, and $\log_b x < y$, then $0 < x < b^y$. If $b > 1$, then $\log_b x > \log_b y$ if and only if $x > y$, and $\log_b x < \log_b y$ if and only if $x < y$.

Example 1: Solve $\log_5 (4x - 3) < 3$.

$\log_5 (4x - 3) < 3$	Original equation
$0 < 4x - 3 < 5^3$	Property of Inequality
$3 < 4x < 125 + 3$	Simplify.
$\frac{3}{4} < x < 32$	Simplify.

The solution set is $\left\{x \middle| \frac{3}{4} < x < 32\right\}$.

Example 2: Solve the inequality $\log_3 (3x - 4) < \log_3 (x + 1)$.

Since the base of the logarithms are equal to or greater than 1, $3x - 4 < x + 1$.

$2x < 5$

$x < \frac{5}{2}$

Since $3x - 4$ and $x + 1$ must both be positive numbers, solve $3x - 4 = 0$ for the lower bound of the inequality.

The solution is $\left\{x \middle| \frac{4}{3} < x < \frac{5}{2}\right\}$.

Exercises

Solve each inequality.

1. $\log_2 2x > 2$

2. $\log_5 x > 2$

3. $\log_2 (3x + 1) < 4$

4. $\log_4 2x > -\frac{1}{2}$

5. $\log_3 (x + 3) < 3$

6. $\log_{27} 6x > \frac{2}{3}$

7. $\log_{10} 5x < \log_{10} 30$

8. $\log_{10} x < \log_{10} (2x - 4)$

9. $\log_{10} 3x < \log_{10} (7x - 8)$

10. $\log_2 (8x + 5) > \log_2 (9x - 18)$

11. $\log_{10} (3x + 7) < \log_{10} (7x - 3)$

12. $\log_2 (3x - 4) < \log_2 (2x + 7)$