NAME _____ DATE _____ PERIOD _____

7-2 Study Guide and Intervention

Solving Exponential Equations and Inequalities

Solve Exponential Equations All the properties of rational exponents that you know also apply to real exponents. Remember that $a^m \cdot a^n = a^{m+n}$, $(a^m)^n = a^{mn}$, and $a^m \div a^n = a^{m-n}$.

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

Example 1 **Solve $4^{x-1} = 2^{x+5}$.**

$4^{x-1} = 2^{x+5}$	Original equation
$(2^2)^{x-1} = 2^{x+5}$	Rewrite 4 as 2^2.
$2(x-1) = x+5$	Prop. of Inequality for Exponential Functions
$2x - 2 = x + 5$	Distributive Property
$x = 7$	Subtract x and add 2 to each side.

Example 2 **Write an exponential function whose graph passes through the points (0, 3) and (4, 81).**

The y-intercept is (0, 3), so $a = 3$. Since the other point is (4, 81), $b = \sqrt[4]{\frac{81}{3}}$.

Simplifying $\sqrt[4]{\frac{81}{3}} = \sqrt[4]{27} \approx 2.280$, the equation is $y = 3(2.280)^x$.

Exercises

Solve each equation.

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

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

3. $3^{2x-1} = \frac{1}{9}$

4. $4^{x+1} = 8^{2x+3}$

5. $8^{x-2} = \frac{1}{16}$

6. $25^{2x} = 125^{x+2}$

7. $9^{x+1} = 27^{x+4}$

8. $36^{2x+4} = 216^{x+5}$

9. $\left(\frac{1}{64}\right)^{x-2} = 16^{3x+1}$

Write an exponential function for the graph that passes through the given points.

10. (0, 4) and (2, 36)

11. (0, 6) and (1, 81)

12. (0, 5) and (6, 320)

13. (0, 2) and (5, 486)

14. (0, 8) and $\left(3, \frac{27}{8}\right)$

15. (0, 1) and (4, 625)

16. (0, 3) and (3, 24)

17. (0, 12) and (4, 144)

18. (0, 9) and (2, 49)

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7-2 Study Guide and Intervention *(continued)*

Solving Exponential Equations and Inequalities

Solve Exponential Inequalities An **exponential inequality** is an inequality involving exponential functions.

Property of Inequality for Exponential Functions	If $b > 1$ then $b^x > b^y$ if and only if $x > y$ and $b^x < b^y$ if and only if $x < y$.

Example **Solve $5^{2x-1} > \frac{1}{125}$.**

$5^{2x-1} > \frac{1}{125}$	Original inequality
$5^{2x-1} > 5^{-3}$	Rewrite $\frac{1}{125}$ as 5^{-3}.
$2x - 1 > -3$	Prop. of Inequality for Exponential Functions
$2x > -2$	Add 1 to each side.
$x > -1$	Divide each side by 2.

The solution set is $\{x \mid x > -1\}$.

Exercises

Solve each inequality.

1. $3^{x-4} < \frac{1}{27}$

2. $4^{2x-2} > 2^{x+1}$

3. $5^{2x} < 125^{x-5}$

4. $10^{4x+1} > 100^{x-2}$

5. $7^{3x} < 49^{1-x}$

6. $8^{2x-5} < 4^{x+8}$

7. $16 \geq 4^{x+5}$

8. $\left(\frac{1}{27}\right)^{2x+1} \leq \left(\frac{1}{243}\right)^{3x-2}$

9. $\left(\frac{1}{2}\right)^{x-3} > 8^{2x}$

10. $\frac{1}{81} < 9^{2x-4}$

11. $32^{3x-4} > 128^{4x+3}$

12. $27^{2x-5} < \left(\frac{1}{9}\right)^{5x}$

13. $\left(\frac{1}{25}\right)^{2x-1} \leq 125^{3x+1}$

14. $\left(\frac{7}{343}\right)^{x-3} \geq \left(\frac{1}{49}\right)^{2x+1}$

15. $\left(\frac{9}{27}\right)^{6x-1} \geq \left(\frac{27}{9}\right)^{-x+6}$

Lesson 7-2