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7-3 Study Guide and Intervention

Rational Exponents

Rational Exponents For any real numbers a and b and any positive integer n, if $a^n = b$, then a is an nth root of b. Rational exponents can be used to represent nth roots.

Square Root	$b^{\frac{1}{2}} = \sqrt{b}$
Cube Root	$b^{\frac{1}{3}} = \sqrt[3]{b}$
nth Root	$b^{\frac{1}{n}} = \sqrt[n]{b}$

Example 1: Write $(6xy)^{\frac{1}{2}}$ in radical form.

$(6xy)^{\frac{1}{2}} = \sqrt{6xy}$ Definition of $b^{\frac{1}{2}}$

Example 2: Simplify $625^{\frac{1}{4}}$.

$625^{\frac{1}{4}} = \sqrt[4]{625}$ $b^{\frac{1}{n}} = \sqrt[n]{b}$

$= \sqrt[4]{5 \cdot 5 \cdot 5 \cdot 5}$ $625 = 5^4$

$= 5$ Simplify

Exercises

Write each expression in radical form, or write each radical in exponential form.

1. $14^{\frac{1}{2}}$ **2.** $5x^{\frac{1}{2}}$ **3.** $17y^{\frac{1}{2}}$

4. $12^{\frac{1}{2}}$ **5.** $19ab^{\frac{1}{2}}$ **6.** $\sqrt{17}$

7. $\sqrt{12n}$ **8.** $\sqrt{18b}$ **9.** $\sqrt{37}$

Simplify.

10. $\sqrt[3]{343}$ **11.** $\sqrt[5]{1024}$ **12.** $512^{\frac{1}{3}}$

13. $\sqrt[4]{2401}$ **14.** $\sqrt[6]{64}$ **15.** $243^{\frac{1}{5}}$

16. $\sqrt[3]{1331}$ **17.** $\sqrt[4]{6561}$ **18.** $4096^{\frac{1}{4}}$

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7-3 Study Guide and Intervention *(continued)*

Rational Exponents

Solve Exponential Equations In an **exponential equation**, variables occur as exponents. Use the Power Property of Equality and the other properties of exponents to solve exponential equations.

Example: Solve $1024^{x-1} = 4$.

$1024^{x-1} = 4$	Original equation
$(4^5)^{x-1} = 4$	Rewrite 1024 as 4^5.
$4^{5x-5} = 4\ 1$	Power of a Power, Distributive Property
$5x - 5 = 1$	Power Property of Equality
$5x = 6$	Add 5 to each side.
$x = \frac{6}{5}$	Divide each side by 5.

Exercises

Solve each equation.

1. $2^x = 128$

2. $3^{3x+1} = 81$

3. $4^{x-3} = 32$

4. $5^x = 15{,}625$

5. $6^{3x+2} = 216$

6. $4^{5x-3} = 16$

7. $8^x = 4096$

8. $9^{3x+3} = 6561$

9. $11^{x-1} = 1331$

10. $3^x = 6561$

11. $2^{5x+4} = 512$

12. $7^{x-2} = 343$

13. $8^x = 262{,}144$

14. $5^{5x} = 3125$

15. $9^{2x-6} = 6561$

16. $7^x = 2401$

17. $7^{3x} = 117{,}649$

18. $6^{2x-7} = 7776$

19. $9^x = 729$

20. $8^{3x+1} = 4096$

21. $13^{3x-8} = 28{,}561$