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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. $14^{\frac{1}{2}}$ $\sqrt{14}$

2. $5x^{\frac{1}{2}}$ $5\sqrt{x}$

3. $17y^{\frac{1}{2}}$ $17\sqrt{y}$

4. $12^{\frac{1}{2}}$ $\sqrt{12}$

5. $19ab^{\frac{1}{2}}$ $19a\sqrt{b}$

6. $\sqrt{17}$ $17^{\frac{1}{2}}$

7. $\sqrt{12n}$ $(12n)^{\frac{1}{2}}$

8. $\sqrt{18b}$ $(18b)^{\frac{1}{2}}$

9. $\sqrt{37}$ $37^{\frac{1}{2}}$

Simplify.

10. $\sqrt[3]{343}$ 7

11. $\sqrt[5]{1024}$ 4

12. $512^{\frac{1}{3}}$ 8

13. $\sqrt[4]{2401}$ 7

14. $\sqrt[6]{64}$ 2

15. $243^{\frac{1}{5}}$ 3

16. $\sqrt[3]{1331}$ 11

17. $\sqrt[4]{6561}$ 9

18. $4096^{\frac{1}{4}}$ 8

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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. $2^x = 128$ **7**

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

3. $4^{x-3} = 32$ $\frac{11}{2}$

4. $5^x = 15{,}625$ **6**

5. $6^{3x+2} = 216$ $\frac{1}{3}$

6. $4^{5x-3} = 16$ **1**

7. $8^x = 4096$ **4**

8. $9^{3x+3} = 6561$ $\frac{1}{3}$

9. $11^{x-1} = 1331$ **4**

10. $3^x = 6561$ **8**

11. $2^{5x+4} = 512$ **1**

12. $7^{x-2} = 343$ **5**

13. $8^x = 262{,}144$ **6**

14. $5^{5x} = 3125$ **1**

15. $9^{2x-6} = 6561$ **5**

16. $7^x = 2401$ **4**

17. $7^{3x} = 117{,}649$ **2**

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

19. $9^x = 729$ **3**

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

21. $13^{3x-8} = 28{,}561$ **4**