

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 n th root of b . Rational exponents can be used to represent n th roots.

Square Root	$b^{\frac{1}{2}} = \sqrt{b}$
Cube Root	$b^{\frac{1}{3}} = \sqrt[3]{b}$
n th 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 $625^{\frac{1}{4}}$.

$$\begin{aligned} 625^{\frac{1}{4}} &= \sqrt[4]{625} & b^{\frac{1}{n}} &= \sqrt[n]{b} \\ &= \sqrt[4]{5 \cdot 5 \cdot 5 \cdot 5} & 625 &= 5^4 \\ &= 5 & & \text{Simplify.} \end{aligned}$$

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

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**