Name Key Period _____

Lesson 7.3 Notes (Rational Exponents)

Objectives:

- Evaluate and rewrite expressions involving rational exponents.
- Solve equations involving expressions with rational exponents.

Rational Exponents:

- **Exponential Form** – number or variable raised to a power $(x^{1/n})$
- **Radical Form** – number or variable under a radical symbol $(\sqrt[n]{x})$

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

Square Roots: 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. $\sqrt{17}$ $17^{1/2}$

4. $\sqrt{12n}$ $(12n)^{1/2} = 2(3n)^{1/2}$

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

6. $\sqrt{18b}$ $(18b)^{1/2} = 3(2b)^{1/2}$

***n*th Roots:** Simplify each expression.

7. $\sqrt[3]{27}$ 3

8. $\sqrt[5]{32}$ 2

9. $\sqrt[4]{10{,}000}$ 10

10. $\sqrt[3]{64}$ 4

11. $125^{\frac{1}{3}}$ 5

12. $256^{\frac{1}{4}}$ 4

13. $1296^{\frac{1}{4}}$ 6

Name _____ Period _____

Extension: $\boxed{b^{\frac{m}{n}} = (\sqrt[n]{b})^m \text{ or } \sqrt[n]{b^m}}$

The Power of a Power property allows us to extend the definition of $b^{\frac{1}{n}}$ to $b^{\frac{m}{n}}$.

$b^{\frac{m}{n}} = \left(b^{\frac{1}{n}}\right)^m$ Power of a Power

$= (\sqrt[n]{b})^m$ or $\sqrt[n]{b^m}$ $b^{\frac{1}{n}} = \sqrt[n]{b}$

Examples: Simplify each expression.

14. $64^{\frac{2}{3}}$ $(64^{1/3})^2$

$= (4)^2 = 16$

15. $36^{\frac{3}{2}}$ $(36^{1/2})^3$

$= (6)^3 = 216$

16. $27^{\frac{2}{3}}$ $(27^{1/3})^2$

$= (3)^2 = 9$

Exponential Equation – an equation in which variables occur as exponents

- Use the Power Property of Equality and the other properties of exponents to solve exponential equations.

KeyConcept Power Property of Equality

Words	For any real number $b > 0$ and $b \neq 1$, $b^x = b^y$ if and only if $x = y$.
Examples	If $5^x = 5^3$, then $x = 3$. If $n = \frac{1}{2}$, then $4^n = 4^{\frac{1}{2}}$.

Examples: Solve each equation.

17. $2^x = 128$

$2^x = 2^7$

$x = 7$

18. $3^{3x+1} = 81$

$3^{3x+1} = 3^4$

$3x + 1 = 4$

$3x = 3$

$x = 1$

19. $5^x = 125$

$5^x = 5^3$

$x = 3$

20. $6^{3x+2} = 216$

$6^{3x+2} = 6^3$

$3x + 2 = 3$

$3x = 1$

$x = 1/3$