Name ______________________ Date ________

6.2 Notetaking with Vocabulary

I can identify and use properties of exponents

I can find *n*th roots.

I can use fractional (rational) exponents.

I can solve real world problems involving exponents.

Finding *n*th roots $\sqrt[2]{81} = 9$ b/c $9 \cdot 9 = 81$

Radical

Index $\sqrt[4]{81}$ ← radical sign ← radicand

$\sqrt[4]{81} = 3$

$x^4 = 81$

If $b^n = a$ then $\sqrt[n]{a} = b$

$\sqrt[2]{\ } = \sqrt{\ }$ roots undo powers

$\sqrt{a^2} = a = (\sqrt{a})^2$

You can also write an nth root of *a* as a power of *a*.

$(\sqrt{a})^2 = a$ $(a^{\frac{1}{2}})^2 = a^1$

$\sqrt[2]{a} = a^{\frac{1}{2}}$

$\sqrt[3]{a} = a^{\frac{1}{3}}$

$\sqrt[3]{\ }$ $\sqrt[5]{\ }$ $\sqrt[7]{\ }$

Real *n*th Roots of *a*

$\sqrt[n]{a}$ Let *n* be an integer greater than 1, and let *a* be a real number.

- If *n* is odd, then *a* has one real n^{th} root $\rightarrow \sqrt[n]{a} = a^{\frac{1}{n}}$
- $\sqrt[2]{a}$ If *n* is even and $a > 0$, then *a* has two real n^{th} roots $= \pm\sqrt[n]{a}$
- $\sqrt[4]{a}$ If *n* is even and $a = 0$, then *a* has one real n^{th} root $\sqrt[n]{0} = 0$
- $\sqrt[6]{a}$ If *n* is even and $a < 0$, then *a* has no real n^{th} roots

Notes:

Name ______________________________ Date ______

6.2 Notetaking with Vocabulary (continued)

Rational Exponents

repeated multiplication

Let $a^{1/n}$ be an nth root of a, and let m be a positive integer.

$a^{\frac{1}{n}} = \sqrt[n]{a}$

Algebra $a^{\frac{m}{n}} = \left(a^{\frac{1}{n}}\right)^m = \left(a^m\right)^{\frac{1}{n}} = \left(\sqrt[n]{a}\right)^m = \sqrt[n]{a^m}$

root

Numbers $27^{\frac{2}{3}} = \left(27^{\frac{1}{3}}\right)^2 = \left(27^2\right)^{\frac{1}{3}} = \left(\sqrt[3]{27}\right)^2 = \sqrt[3]{27^2}$

no calc

Notes:

Roots - 2 forms

① Exponential ② Radical

$a^{\frac{m}{n}}$ denominator = index $\left(\sqrt[n]{a}\right)^m$

base

$\sqrt[n]{a^m}$ radicand

Practice

In Exercises 1–3, find the indicated real *n*th root(s) of *a*.

1. $n = 2, a = 64$

$\pm\sqrt[2]{64} = \pm 8$

2. $n = 3, a = 27$

$\sqrt[3]{27} = 3$

3. $n = 4, a = 256$

$\sqrt[4]{256} = \pm 4$

In Exercises 4–7, evaluate the expression.

4. $\sqrt[4]{625} = 5$

5. $\sqrt[3]{-512} = -8$

6. $729^{1/6} = \sqrt[6]{729} = 3$

7. $(-81)^{1/2} = \sqrt{-81}$ = not possible

Name ______________________________ Date ______

6.2 Notetaking with Vocabulary (continued)

In Exercises 8 - 10, rewrite the expression in rational exponent form.

8. $\left(\sqrt[5]{4}\right)^3 = 4^{\frac{3}{5}}$ **9.** $\left(\sqrt[3]{-8}\right)^2 = (-8)^{\frac{2}{3}}$ **10.** $\left(\sqrt[4]{15}\right)^7 = 15^{\frac{7}{4}}$

In Exercises 11–13, rewrite the expression in radical form.

11. $(-3)^{2/5} = \left(\sqrt[5]{-3}\right)^2$ **12.** $6^{3/2} = \left(\sqrt[2]{6}\right)^3$ **13.** $12^{3/4} = \left(\sqrt[4]{12}\right)^3$

$= \sqrt[2]{6^3}$

$\Rightarrow$ #

In Exercises 14–17, $\boxed{\text{evaluate}}$ the expression.

14. $32^{2/5} = \left(\sqrt[5]{32}\right)^2$

$= 2^2 = 4$

15. $(-64)^{3/2} = \left(\sqrt[2]{-64}\right)^3$

= no real roots

16. $256^{7/8}$

17. $-729^{5/6} = -1 \cdot 729^{\frac{5}{6}}$

$= -1 \cdot \left(\sqrt[6]{729}\right)^5$

$= -243$

18. The radius r of a sphere is given by the equation

$$r = \left(\frac{A}{4\pi}\right)^{1/2}$$

where A is the surface area of the sphere. The surface area of a sphere is 1493 square meters. Find the radius of the sphere to the nearest tenth of a meter. Use 3.14 for π.