

# 6.2

## Notetaking with Vocabulary

I can identify and use properties of exponents

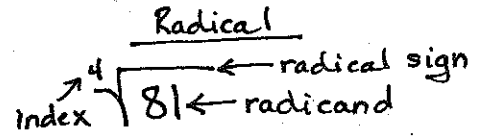
I can find  $n$ th roots.

I can use fractional (rational) exponents.

I can solve real world problems involving exponents.

Finding  $n$ th roots

$$\sqrt[2]{81} = 9 \quad \text{b/c } 9 \cdot 9 = 81$$



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

$$3^4 = 81$$

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

$$\sqrt{\quad} = \sqrt{\quad} \quad \text{roots undo powers}$$

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

You can also write an  $n$ th root of  $a$  as a power of  $a$ .

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

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

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

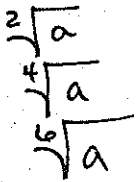
$$\sqrt[3]{a} = a^{\frac{1}{3}}$$



### Real $n$ th Roots of $a$

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



Notes:

**6.2 Notetaking with Vocabulary (continued)****Rational Exponents**

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

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

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

Notes:

repeated multiplication

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

no calc

Roots - 2 forms

① Exponential

② Radical

$a^{\frac{m}{n}}$  denominator = index  
 ↓ base

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

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

1.  $n = 2, a = 64$

2.  $n = 3, a = 27$

3.  $n = 4, a = 256$

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

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

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

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

**6.2** Notetaking with Vocabulary (continued)

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

8.  $(\sqrt[5]{4})^3 = 4^{\frac{3}{5}}$

9.  $(\sqrt[3]{-8})^2 = (-8)^{\frac{2}{3}}$

10.  $(\sqrt[4]{15})^7 = 15^{\frac{7}{4}}$

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

11.  $(-3)^{2/5} = (\sqrt[5]{-3})^2$

12.  $6^{3/2} = (\sqrt[2]{6})^3$

13.  $12^{3/4} = (\sqrt[4]{12})^3$

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

In Exercises 14-17, evaluate the expression.

14.  $32^{2/5} = (\sqrt[5]{32})^2 = 2^2 = 4$

15.  $(-64)^{3/2} = (\sqrt[2]{-64})^3 = \text{no real roots}$

16.  $256^{7/8}$

17.  $-729^{5/6} = -1 \cdot 729^{\frac{5}{6}} = -1 \cdot (\sqrt[6]{729})^5 = -243$

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  $\pi$ .