

## 5-5 Roots of Real Numbers

**Objective:** Simplify Radicals.  
Use a calculator to approximate radicals.

Square Root: 7 is a square root of 49:  $7 \times 7 = 49$ .

6 is a square root of 36:  $6 \times 6 = 36$ .

-6 is a square root of 36:  $-6 \times -6 = 36$ .

6 (the nonnegative one) is called the principal root.

-Finding the square root and squaring are inverse operations.

-Raising a number to the nth power and finding the nth root are inverse operations.

### Powers

$$a^3=125$$

$$a^4=81$$

$$a^5=32$$

$$a^n=b$$

### Factors

$$5 \times 5 \times 5 = 125$$

$$3 \times 3 \times 3 \times 3 = 81$$

$$2 \times 2 \times 2 \times 2 \times 2 = 32$$

$$a \times a \dots a = b$$

### Roots

5 is a cube root of 125

3 is a fourth root of 81

2 is a fifth root of 32

a is an nth root of b.

$\sqrt[n]{50}$  indicates and nth root

n: index, 50: radicand,  $\sqrt{\phantom{x}}$ : radical sign

-See chart on P.246.

Simplify

$$\text{EX 1. } \pm\sqrt{16x^6} = \boxed{\pm 4x^3}$$

$$\text{EX 2. } -\sqrt{(q^3+5)^4} = -(q^3+5)^2$$

$$\text{EX 3. } \sqrt[5]{243a^{10}b^{15}} = \boxed{3a^2b^3}$$

$$\begin{array}{c} a^2 \cdot a^2 \cdot a^2 \cdot a^2 \cdot a^2 \\ b^3 \cdot b^3 \cdot b^3 \cdot b^3 \cdot b^3 \end{array}$$

$$\text{EX 4. } \sqrt{-4} = \text{Not real} \\ \text{non-real answer}$$

$$\text{EX 5. } \sqrt[8]{x^8} = x$$

$$\underbrace{x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x}_8$$

$$\text{EX 6. } \sqrt[4]{81(a+1)^{12}}$$

$$= \boxed{3(a+1)^3}$$

$$\text{EX 7. } \sqrt[5]{243(x+2)^{15}}$$

$$\boxed{3(x+2)^3}$$

Approximate each value to the three decimal places.

$$\text{EX 8. } \sqrt{4.27} = 2.066$$

$$\text{EX 9. } -\sqrt{147} = -12.124$$

$$\text{EX 10. } \sqrt[5]{891} = 3.890$$

$$\text{EX 11. } \sqrt[4]{(3500)^2} = 59.161$$

