UNIT 5—Roots of Radical Expressions

- *Students will find nth roots of numbers and algebraic expressions*

Day One

Algebra 3-4

What is a "root" of a number?

"Definition" of a mathematical root:

- $5^2 = 25$, so 5 is a square root of 25 ("five squared")
- $5^3 = 125$, so 5 is a cube root of 125 ("five cubed")
- $5^4 = 625$, so 5 is a fourth root of 625 ("five to the fourth power")
- $5^5 = 3125$, so 5 is a fifth root of 3125 ("five to the ~~fourth~~ FIFTH power")
- and so on . . . up to the "nth" root of . . .

Rules for the "nth" real root of any number:

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

If n is odd: ("odd root")

$\sqrt[3]{\ }$

ONE ANSWER/ ROOT

If n is even: ("even root")

and b is positive: $\sqrt{4} = \pm 2$

2 ROOTS:
1 POSITIVE
1 NEGATIVE

and b is negative: $\sqrt[4]{-17}$

NO REAL ROOTS

Roots of Radical Expressions

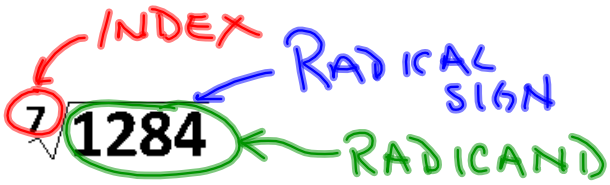
- *Students will find nth roots of numbers and algebraic expressions*

Algebra 3-4

How are exponent properties used?

How are roots with variables different?

"Parts" of a radical"



Examples: Find all real roots for the following:

PRIMES: 2, 3, 5, 7, 11, 13, 17, 19, 23 . . . . .

3 | 27
3 | 9
3

a) $\sqrt[3]{-27}$

$(-3)^3$

-3

b) $\sqrt[4]{1}$

$\sqrt[4]{1^4} = \pm 1$

2 | 80
2 | 40
2 | 20
2 | 10
5

c) $\sqrt[3]{80}$

$= \sqrt[3]{2 \cdot 2 \cdot 2 \cdot 2 \cdot 5}$

2^3

$= 2\sqrt[3]{10}$ ∴

d) $\sqrt{-49}$ NO REAL ROOTS ∴

Finding roots of variable expressions (expressions with variables . . .):

$$\sqrt[n]{x^n} = x \quad OR \quad \sqrt[n]{x^n} = |x|$$

To determine whether your "answer" needs an absolute value symbol, remember the phrase:

"Even – Even – Odd"

$\sqrt[4]{x^4} = |x^1|$

$$\sqrt[EVEN]{x^{EVEN}} = x^{ODD}$$

Roots of Radical Expressions

- *Students will find nth roots of numbers and algebraic expressions*

Algebra 3-4

How are roots with variables different?

Examples: Simplify the following radical expressions. Use absolute value symbols when necessary:

a) $\sqrt[3]{8x^3}$ $= \sqrt[3]{8} \cdot \sqrt[3]{x^3}$

$2x$

b) $\sqrt[4]{16x^4}$ $= \sqrt[4]{16}\ \sqrt[4]{x^4}$

$= \sqrt[4]{2^4}\ \sqrt[4]{x^4} = 2|x|$

16

4 4

2 2 2 2

c) $\sqrt[3]{24x^5y^3}$ $\sqrt[3]{24}\ \sqrt[3]{x^5}\ \sqrt[3]{y^3}$

$= \sqrt[3]{2^3 \cdot 3} \cdot \sqrt[3]{x^3 \cdot x^2} \cdot \sqrt[3]{y^3}$

$= 2\sqrt[3]{3} \cdot x\sqrt[3]{x^2} \cdot y = 2xy\sqrt[3]{3x^2}$

2 | 24

2 | 12

2 | 6

3

d) $\sqrt[4]{32x^4y^{12}z^8}$

$= 2|x|y^3|z^4\sqrt[4]{2}$

e) $\sqrt{32xy^2z^7}$

$= 4|yz^3|\sqrt{2xz}$

Assignment: Simplifying Radicals Worksheet