What "kind" of answer will come from each?

1. x^{12} = POS
2. x^{15} = pos or neg
3. x^{8} = POS
4. x^{7} = pos or neg

A real number raised to an even power is ALWAYS POSITIVE.

A real number raised to an odd power can either be negative or positive.

The answer will have the same sign as the base.

What "kind" of answer will come from each radical?

1. $\sqrt[4]{\square}$ = POS
2. $\sqrt[5]{\square}$ = pos or neg
3. $\sqrt[9]{\square}$ = pos or neg
4. $\sqrt[8]{\square}$ = POS

The answer from an even radical must be POSITIVE. "Principal Root"

The answer from an odd radical can be anything.

Answer will have the same sign as the radicand.

What do you do to find a root of a variable with an exponent?

For example: $\sqrt[3]{w^{12}} = w^{\frac{12}{3}} = w^{4}$

To find the answer you divide the exponent by the index.

Simplify.

1. $\sqrt{a^2} \rightarrow$ An even root without any sign in front means the Principal Root (Pos Root).

$$\sqrt{a^2} = \cancel{a} = |a|$$

since the variable a could be a negative quantity we must assure that the result of this square root is positive by using Absolute Value symbols.

2. $\sqrt[3]{x^3} = x$ The answer to an odd radical will have the same sign as the radicand which means the answer can be either positive OR negative. DON'T use Absolute Value symbols!

Take a white board, rag, and dry-erase marker.

Simplify each. Use absolute value symbols when needed.

1. $\sqrt[4]{m^{12}}$

$= |m^3|$

This is an even radical so the answer must come out positive. Since m^3 could be negative we must use Absolute Value symbols to make sure it's positive.

2. $\sqrt[5]{w^{40}}$

$= w^8$

This is an odd radical so the answer could be anything.... DON'T use Absolute Value symbols. In addition, the answer has an even exponent so it would be positive anyway!

Answer Example 4 "Try It!"
on the top of page 115 in the Student Companion.

4. Simplify each expression.

a. $\sqrt[3]{-8a^3b^9}$

$= -2ab^3$

No Abs Values needed since it's an odd radical.

b. $\sqrt[4]{256x^{12}y^{24}}$

$= 4|x^3|y^6$

An even radical means that Abs Values may be needed. Since x^3 is the only part of the answer that could be negative we only need Abs Values around that part.

What if the exponent on the radicand isn't evenly divisible by the index?

Simplify each.

1. $\sqrt{x^9}$

9 isn't divisible by 2

$= \sqrt{x^8 \cdot x^1}$

$= x^4\sqrt{x}$

2. $\sqrt{x^{15}}$

15 isn't divisible by 2

$= \sqrt{x^{14} \cdot x^1}$

$= x^7\sqrt{x}$

$= |x^7|\sqrt{x}$

Another way to find the root of a variable with an exponent when the exponent isn't evenly divisible by the index:

$\sqrt[5]{x^{23}} = x^{23/5} = x^{4\,3/5} = x^{4+3/5}$

$= x^4 \cdot x^{3/5}$

$= x^4\sqrt[5]{x^3}$

When the exponent isn't evenly divisible by the index: The exponent on the coefficient (outside the radical) ends up being the number of times that the index divides into the exponent of the radicand. The remainder is the part that remains under the radical.

5 goes into 23 4 times with a remainder of 3

Simplify each.

1. $(25a^{18}b^7c^{13})^{\frac{1}{2}}$

$= \sqrt{25a^{18}b^7c^{13}}$

$= 5|a^9|b^3|c^6\sqrt{bc}$

2. $(-27e^{12}f^{17}g^{19})^{\frac{1}{3}}$

$= \sqrt[3]{-27e^{12}f^{17}g^{19}}$

$= -3e^4f^5g^6\sqrt[3]{f^2g}$

Answer "Habits of Mind" page 114 of Student Companion.

What is true about the denominators of fractional exponents in which absoltue value must be considered?

If the denominator of the rational exponent is even (even radical), then you might need to use Absolute Value symbols.

Simplify each.

16. $\sqrt[4]{16m^{12}n^{25}} =$

$2|m^3| n^6 \sqrt[4]{n}$

17. $\sqrt[5]{32R^{21}S^{34}} =$

$2R^4S^6\sqrt[5]{RS^4}$

Absolute value symbols **may** be needed when taking an even root.

Absolute value symbols are **not** used when taking an odd root.

If the result of an even root **could** be negative then absolute value symbols are needed.

This will occur when the result of taking the root is a variable raised to an odd power.

Answer Example 5 "Try It!" page 115 in Student Companion.

5. a. $\frac{5x^3}{5} = \frac{320}{5}$

$\sqrt[3]{x^3} = \sqrt[3]{64}$

$x = 4$

there is only one answer to the odd root of a number

b. $\frac{2p^4}{2} = \frac{162}{2}$

$\sqrt[4]{p^4} = \pm\sqrt[4]{81}$

$p = \pm 3$

there are two answers when finding the even roots of a positive number.

Hwk #1: Sec 5-1

Page 245 Due Monday

Problems: 23, 25, 26, 31, 32, 35, 37, 39, 40, 43

Unless stated otherwise, when simplifying radical expressions you must consider whether absolute values are needed.