The number of REAL nth roots of a number $\sqrt[n]{\square}$

Radicand is	Even Root	Odd Root
Positive	2	1
Zero	1	1
Negative	None	1

There are 2 even roots of every positive number.

$-\sqrt{}$ asks for the Negative Root

$\pm\sqrt{}$ asks for the Pos & Neg Roots

$\sqrt{}$ asks for the Positive Root

$\sqrt{25} = 5$

$\sqrt{}$ in this situation indicates the Principal Root

which means the positive root when there are two roots.

What is the difference?

Simplify.

$\sqrt{36}$ = 6

this is asking you for the Principal (pos) root

Solve.

$x^2 = 36$

x = ± 6

This is asking you for ALL the numbers you could square and get 36.... All the square roots of 36

Simplify each.

1. $-\sqrt{49} = \underline{-7}$

2. $\pm\sqrt{36} = \underline{\pm 6}$

3. $\sqrt{81} = \underline{9}$

$2^3 = \underline{8}$

What is the cube root of 8? 2

Is there another cube root of 8?

No, no other number cubed would equal 8.

$(-2)^5 = \underline{-32}$

What is the 5th root of -32? -2

Is there another 5th root of -32?

No, no other number raised to the fifth power would equal -32.

There is Only One odd root of a number.

$\sqrt[3]{-64} = \underline{-4}$

$\sqrt[3]{125} = \underline{+5}$

The answer to an odd root has the Same sign as the radicand.

Why is there no principal root of an odd radical?

By definition the Principal Root is the positive root when there are two roots but an odd radical gives only one answer.

What kind of number will come from each power?
(x is a real number)

1. x^{15} Pos or Neg

2. x^{12} Pos Only

3. x^{7} Pos or Neg

4. x^{8} Pos Only

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. $\sqrt[5]{\quad}$ Pos or Neg

2. $\sqrt[4]{\quad}$ Pos Only

3. $\sqrt[8]{\quad}$ Pos Only

4. $\sqrt[9]{\quad}$ Pos or Neg

The answer from an even radical must be POSITIVE.
"Principal Root"
unless... there is a - or ± in front of the radical.

The answer from an odd radical can be anything (pos or neg).

Simplify:

$\sqrt{x^2}$ (the principal square root of x^2) $= |x|$

Since this is an even root you must make sure that the result is Positive.
Absolute Value symbols ensures the result is positive.

Simplify:

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

Since you CAN get a negative answer from an odd root
NO absolute value symbols should be used!

Simplify each. Use absolute value symbols when needed.

1. a. $\sqrt{r^{10}} = |r^5|$

b. $\sqrt[4]{m^{12}} = |m^3|$

c. $\sqrt[5]{w^{40}} = w^8$

Simplify each. Use absolute value symbols when needed.

2. $\sqrt{x^4} = x^2$

3. $\sqrt{x^6} = |x^3|$

4. $\sqrt{9x^8} = 3x^4$

Simplify each. Use absolute value symbols when needed.

5. $\sqrt{36x^{22}} = 6|x^{11}|$

6. $\sqrt{x^9} = x^4\sqrt{x}$

7. $\sqrt{x^{15}} = |x^7|\sqrt{x}$

Simplify each. Use absolute value symbols when needed.

8. $\sqrt{16x^{27}} = 4|x^{13}|\sqrt{x}$

9. $\sqrt{25a^{18}b^7c^{13}} = 5|a^9||b^3|c^6\sqrt{bc}$

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

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.

When taking an ODD root, No absolute value symbols should be used.