The number of REAL nth roots of a number

Radicand is	n is even	n is odd
Positive	2	1
Zero	1	1
Negative	0	1

Notes 7-1

$\sqrt[5]{243}$

$\sqrt{\ }$ is a Radical symbol

5 is called the Index and it indicates What root you are finding

243 is called the Radicand

$3^2 =$ 9

$(-3)^2 =$ 9

} What are the square roots of 9? ±3

$2^4 =$ 16

$(-2)^4 =$ 16

} What are the 4th roots of 16? ±2

$\sqrt{25}$ = 5 $\sqrt{\ }$ in this situation indicates the Principal Root

→ which means the positive root when there are two roots.

There are 2 even roots of every positive number.

$\sqrt{\ }$ asks for the Positive Root

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

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

$-\sqrt{49}$ = −7

$\pm\sqrt{36}$ = ±6

$\sqrt{81}$ = 9

2^3 = 8

What is the cube root of 8? 2

Is there another cube root of 8? NO

$(-2)^5 =$ -32

What is the ~~cube~~ fifth root of -32? -2

Is there another ~~cube~~ fifth root of -32? NO

There is One odd root of a number.

$\sqrt[3]{-64} =$ -4 $\sqrt[3]{125} =$ 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?

1. x^{15} Pos or Neg
2. x^{12} Pos
3. x^{7} Pos or Neg
4. x^{8} Pos

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.

What kind of answer will come from each radical?

1. $\sqrt[5]{\ }$ Pos or Neg
2. $\sqrt[4]{\ }$ Pos
3. $\sqrt[8]{\ }$ Pos
4. $\sqrt[9]{\ }$ Pos or Neg

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

The answer from an odd radical can be anything.

1. $\sqrt{x^2}$ → the principal square root of x^2 = $|x|$

Simplify each. Use absolute value symbols when needed.

1. $\sqrt{r^{10}}$ $|r^5|$ even radical means you might need abs value symbols.

2. $\sqrt[4]{m^{12}}$ $|m^3|$ even radical means you might need abs value symbols.

3. $\sqrt[5]{w^{40}}$ w^8 odd radical means you DON'T use abs value symbols.

Simplify each. Use absolute value symbols when needed.

2. $\sqrt{x^4}$ = $(x^4)^{1/2}$ x^2 even radical means you might need abs value symbols.

3. $\sqrt{x^6}$ = $|x^3|$ even radical means you might need abs value symbols.

4. $\sqrt{9x^8}$ = $3x^4$ even radical means you might need abs value symbols.

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

even radical means you might need abs value symbols.

6. $\sqrt{x^9}$ → x^8 x^1 $x^4\sqrt{x}$ even radical means you might need abs value symbols.

7. $\sqrt{x^{15}}$ = $x^{14} \cdot x$ $|x^7|\sqrt{x}$ even radical means you might need abs value symbols.

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

even radical means you might need abs value symbols.

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

even radical means you might need abs value symbols.

10. $\sqrt[3]{x^{6}} =$ $(x^{6})^{1/3} = x^{2}$

odd radical means you DON'T use abs value symbols.

11. $\sqrt[3]{x^{15}} =$ x^{5}

odd radical means you DON'T use abs value symbols.

12. $\sqrt[3]{8x^{33}} =$ $2x^{11}$

odd radical means you DON'T use abs value symbols.

13. $\sqrt[3]{x^{14}} =$ $x^{12}x^{2}$ $x^{4}\sqrt[3]{x^{2}}$

odd radical means you DON'T use abs value symbols.

14. $\sqrt[3]{x^{22}} =$ $x^{21}\cdot x^{1}$ $x^{7}\sqrt[3]{x}$

odd radical means you DON'T use abs value symbols.

15. $\sqrt[3]{-27e^{12}f^{17}g^{19}} =$ $-3e^{4}f^{5}g^{6}\sqrt[3]{f^{2}g}$

odd radical means you DON'T use abs value symbols.

16. $\sqrt[4]{16m^{12}n^{25}} =$ $2|m^{3}|n^{6}\sqrt[4]{n}$

even radical means you might need abs value symbols.

17. $\sqrt[5]{32R^{21}S^{34}} =$ $2R^{4}S^{6}\sqrt[5]{RS^{4}}$

odd radical means you DON'T use abs value symbols.

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.