

ROOTS AND RADICALS *Good Morning*

Consider... (just think about it!)

Solve for x: $x^2 = 25$

$$\sqrt{x^2} = \sqrt{25}$$

$$x = \pm 5$$

Solve for x: $y^2 = 3$

$$\sqrt{y^2} = \sqrt{3}$$

$$y = \pm \sqrt{3}$$

The square root of a number is one of the 2 equal factors whose product is that number.

$$(-5)(-5) = 25$$

$$(5)(5) = 25$$

$$(-\sqrt{3})(\sqrt{3}) = 3$$

$$(\sqrt{3})(\sqrt{3}) = 3$$

$$+ \sqrt{25}$$

Dec 1-8:02 AM

Every Positive Real Number has 2 square roots. $\sqrt{25}$ is read "the square root of 25"

→ The Principle Square Root $\sqrt{25} = 5$

→ The Negative Square Root $\sqrt{25} = -5$

→ The Square Root of zero is zero $\sqrt{0} = 0$

→ The Square Root of a negative number is a nonreal number (imaginary) $\sqrt{-2} = \text{imaginary \#}$
"NONREAL ANS"

$$\sqrt{-25} \text{ imaginary}$$

Dec 1-8:03 AM

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The cube root of a number is one of 3 equal factors whose product is that number.

$$\sqrt[3]{64} = 4 \text{ because } 4 \times 4 \times 4 = 64$$

$$\sqrt{-25} = ? \text{ imaginary}$$

$$\sqrt[3]{-8} = -2$$

$$\sqrt{-16} = \text{imaginary}$$

The n^{th} root of a number is one of n equal factors whose product is that number.

Positive Under Radical

$$\sqrt[4]{84} = 3$$

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

Negative Under Radical

$$\sqrt[4]{-84} \quad n^{\text{th}} = \text{even}$$

$$\sqrt[3]{-64} = -4 \quad n^{\text{th}} = \text{odd}$$



Also: $\sqrt[n]{x^n} = x$

Dec 1-8:03 AM

✧ Identify the parts:

$$c^a \sqrt[b]{}$$

Coefficient:

c

Index:

a

Radicand:

b

Radical:

\sqrt{b}

\sqrt{a} is called a radical, a is called the radicand.

$$3x \sqrt[6]{4a^2}$$

↑
coefficient

index

radicand

Dec 1-8:04 AM

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Simplify (Simplifying Perfect Squares):

1. $\sqrt{4} = 2$

2. $\sqrt{16}$

3. $-\sqrt{100}$
 $(-1)(10) = -10$

4. $\sqrt{a^8}$

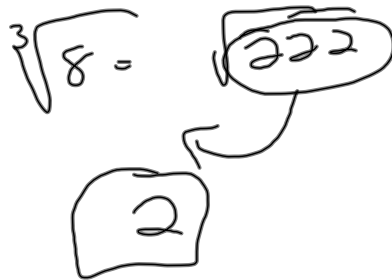
5. $\sqrt{w^{12}}$

6. $\sqrt{9a^2}$

7. $-\sqrt{81m^{64}}$
 $-9m^{32}$

8. $\sqrt{49a^4b^{12}}$

9. $\sqrt{121x^{14}y^6}$



11. $x^2y^3 = \sqrt{121x^{14}y^6}$

$x^1 = \sqrt{x^2}$
 $x^2 = \sqrt{x^4}$
 $x^3 = \sqrt{x^6}$

Dec 1-8:04 AM

Simplify (Simplifying Radicals that are not Perfect Squares):

1. Break the radicand all the way down to prime factors
2. Index = # of repeaters ↗ (smallest possible #)
3. Take out one for each pair of factors
4. Losers stay under radical

1. $\sqrt{18} = \sqrt{2 \cdot 9}$
 $\sqrt{2 \cdot 3 \cdot 3}$
 $3\sqrt{2}$

2. $\sqrt{125} = \sqrt{25 \cdot 5}$
 $\sqrt{5 \cdot 5 \cdot 5}$
 $5\sqrt{5}$

3. $\sqrt{72}$
 $\sqrt{6 \cdot 6 \cdot 2}$
 $6\sqrt{2}$

4. $\sqrt{180}$

5. $\sqrt{a^3}$

6. $\sqrt{b^7}$

7. $\sqrt{m^9}$

8. $\sqrt{75x^7y^{15}}$
 $\sqrt{3 \cdot 5 \cdot 5 \cdot 3 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y \cdot y \cdot y}$
 $5x^3y^4\sqrt{3xy}$

9. $\sqrt{27a^{11}b^7}$

10. $\sqrt{32a^7b^4}$

$\sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot a \cdot a \cdot a \cdot b \cdot b \cdot b \cdot b}$
 $4 \cdot a \cdot a \cdot a \cdot b \cdot b \sqrt{2a}$

11. $\sqrt{9a^8}$
 $3a^4\sqrt{a^0}$

12. $\sqrt{45a^7}$

13. $\sqrt{36x^2y^6}$

14. $\sqrt{12x^{20}y^8}$
 $\sqrt{2 \cdot 2 \cdot 3 \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y \cdot y}$
 $2x^{10}y^4\sqrt{3}$

15. $-\sqrt{200}$
 $-\sqrt{2 \cdot 100}$
 $-\sqrt{2 \cdot 10 \cdot 10} = -10\sqrt{2}$

Dec 1-8:04 AM

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$$\begin{aligned}\sqrt[3]{-8x^3} &= \sqrt[3]{-1 \cdot 8x^3} \\ &= \sqrt[3]{\underbrace{-1}_{(-1)} \cdot \underbrace{2 \cdot 2 \cdot 2}_{(2 \cdot 2 \cdot 2)} \cdot \underbrace{x \cdot x \cdot x}_{(x \cdot x \cdot x)}} \\ &= 2x \sqrt[3]{\underbrace{-1 \cdot -1 \cdot -1}_{(-1 \cdot -1 \cdot -1)}} \\ &= -1 \cdot 2x = \boxed{-2x}\end{aligned}$$

$$\begin{aligned}\sqrt[3]{16y^4} &= \sqrt[3]{4 \cdot 4 \cdot y \cdot y \cdot y \cdot y} \\ &= \sqrt[3]{\underbrace{2 \cdot 2 \cdot 2 \cdot 2}_{(2 \cdot 2 \cdot 2 \cdot 2)} \cdot \underbrace{y \cdot y \cdot y \cdot y}_{(y \cdot y \cdot y \cdot y)}} \\ &= 2y \sqrt[3]{2y}\end{aligned}$$

Jan 6-8:50 AM

Simplify each of the following expressions completely.

_____ 1. $\sqrt{64}$	_____ 2. $-\sqrt{18}$	_____ 3. $\sqrt{32}$
_____ 4. $\sqrt{50}$	_____ 5. $\sqrt{400}$	_____ 6. $\sqrt{x^6}$
_____ 7. $\sqrt{x^7}$	_____ 8. $\sqrt{16x^{16}}$	_____ 9. $\sqrt{9x^9}$

Jan 4-10:47 AM

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10. $\sqrt{40x^8}$	11. $\sqrt{25x^7}$	12. $\sqrt{12x^5}$
13. $\sqrt{a^2b^4}$	14. $\sqrt{49a^8x^{12}}$	15. $\sqrt{28x^9y^6}$
16. $\sqrt{32m^7n^{11}}$	17. $\sqrt{20x^{10}y^5}$	18. $\sqrt{100ab^4}$
19. $\sqrt{75x^8y^3}$	20. $\sqrt{98x^7y^5}$	

Jan 4-10:48 AM