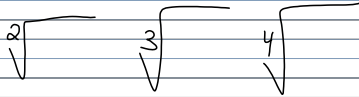


Simplifying Radical Expressions

- If there is no index #, it is understood to be 2
- When simplifying radicals use perfect squares, cubes, etc.
- Use factor to break a number into its prime factors
- Apply the properties of radicals and exponents



Square roots are inverses of squaring a number. Example: $4^2 = 16$, so $\sqrt{16} = 4$

When you are trying to find a square root, ask yourself, "what number when multiplied by itself (squared) would equal this number?" In the above example, "what number when multiplied by itself (squared) would be 16?" 4 because $4 \cdot 4 = 16$.

Cube roots are the inverses of cubing a number. Example $4^3 = 64$, so $\sqrt[3]{64} = 4$

When you are trying to find a cube root, ask yourself, "what number when multiplied by itself 3 times (cubed) would be this number?" In the above example, "what number when multiplied by itself 3 times (cubed) would be this number?" 4 because $4 \cdot 4 \cdot 4 = 64$

Handwritten examples of finding roots:

- $8 = 2 \cdot 2 \cdot 2 = 2^3$, $\sqrt[3]{8} = \sqrt[3]{2^3} = 2$
- $27 = 3 \cdot 3 \cdot 3 = 3^3$, $\sqrt[3]{27} = \sqrt[3]{3^3} = 3$

What numbers are perfect squares?

- $1 \cdot 1 = 1$
- $2 \cdot 2 = 4$
- $3 \cdot 3 = 9$
- $4^2 = 4 \cdot 4 = 16$
- $5 \cdot 5 = 25$
- $6 \cdot 6 = 36$
- 49, 64, 81, 100, 121, 144, ...

Perfect Squares and Cubes are equal to whole number values.

Perfect Square Roots	Perfect Cube Roots
$1^2 = 1$	$1^3 = 1$
$2^2 = 4$	$2^3 = 8$
$3^2 = 9$	$3^3 = 27$
$4^2 = 16$	$4^3 = 64$
$5^2 = 25$	$5^3 = 125$
$6^2 = 36$	$6^3 = 216$
$7^2 = 49$	Keep in mind that all square roots have both positive and negative answers. For example, $\sqrt{4}$ can be 2 or -2 since $-2 \cdot -2 = 4$, but the positive root is called the principal root. If the square root symbol is used, give the principal (positive) square root.
$8^2 = 64$	
$9^2 = 81$	
$10^2 = 100$	
$11^2 = 121$	
$12^2 = 144$	

Simplify

- $\sqrt{4} = 2$
- $\sqrt{16} = 4$
- $\sqrt{25} = 5$
- $\sqrt{100} = 10$
- $\sqrt{144} = 12$

Product Property for Radicals

$\sqrt{50} = \sqrt{25} \cdot \sqrt{2} = 5\sqrt{2}$

- A radical has been simplified when its radicand contains no perfect square factors.
- *Test to see if it can be divided by 4, then 9, then 25, then 49, etc.
- Sometimes factoring the radicand using the "tree" is helpful.

Handwritten examples of factoring radicands:

- $\sqrt{x^9} = x^3$
- $\sqrt{x^{24}} = x^{12}$
- $\sqrt{x^{14}} = x^7$

$$\sqrt{x^{14}} = x^7$$

Look at these examples and try to find the pattern...

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

What is the answer to $\sqrt{x^7}$?

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

$$\sqrt{x^7} = \sqrt{x^6 x^1} = x^3 \sqrt{x}$$

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

As a general rule, divide the exponent by two. The remainder stays in the radical.

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

$$\sqrt{x^5} = x^2 \sqrt{x}$$

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

Steps

1. Try to divide the radicand into a perfect square for numbers
2. If there is an exponent make it even by using rules of exponents
3. Separate the factors to its own square root
4. Simplify

1 Explore

Simplify

$$\sqrt{288}$$

2 Explore

Simplify

A $\sqrt{18}$

$$\begin{array}{r} 9 \overline{)18} \\ \underline{18} \\ 0 \end{array}$$

$3\sqrt{2}$

B $\sqrt{75}$

$$\begin{array}{r} 25 \overline{)75} \\ \underline{75} \\ 0 \end{array}$$

$5\sqrt{3}$

C $\sqrt{24}$

$$\begin{array}{r} 4 \overline{)24} \\ \underline{24} \\ 0 \end{array}$$

$2\sqrt{6}$

D $\sqrt{72}$

$$\begin{array}{r} 9 \overline{)72} \\ \underline{72} \\ 0 \end{array}$$

$6\sqrt{2}$