Simplifying Radical Expressions (Lesson 10-2)

- A square root is one of two equal factors of a number.
- A number whose square root is a integer number is called a perfect square.
- The positive square root is called the principal square root.
- Every positive number has 2 square roots. (One positive and one negative.)
- $\sqrt{\ }$ is called a radical sign. It represents the principal square root unless there is a negative sign in front of the radical or a $\pm$ in front of the radical.

Examples:

A. $\pm\sqrt{\frac{16}{9}} = \pm\frac{4}{3}$ ✓ positive/negative

B. $\sqrt{0.0144} = 0.12$

C. $\sqrt{\frac{64}{25}} = \frac{8}{5}$

D. $\sqrt{0.36} = 0.6$

Note: Most square roots are irrational numbers because they are neither a repeating nor a terminating decimal.

- A radical expression is an expression that contains a square root. or cube root
- A radicand is the expression under the radical sign.
- The index is the number telling what kind of root (square/cube, ect.) you are finding.

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Simplifying Square Roots

Factor, pull out pairs of like factors.

E. $\sqrt{52} = \sqrt{2 \cdot 2 \cdot 13}$

$= 2\sqrt{13}$

F. $\sqrt{72} = \sqrt{2 \cdot 2 \cdot 2 \cdot 3 \cdot 3}$

$= 2 \cdot 3\sqrt{2}$

$= 6\sqrt{2}$

$2 \mid 72$
$2 \mid 36$
$2 \mid 18$
$3 \mid 9$
3

Simplify:

H. $\sqrt{45} = \sqrt{3 \cdot 3 \cdot 5}$

$3\sqrt{5}$

I. $\sqrt{60} = \sqrt{2 \cdot 2 \cdot 3 \cdot 5}$

$2\sqrt{3 \cdot 5} = 2\sqrt{15}$

Simplify a Square Root with Variations

IMPORTANT NOTE: For radical expressions where the exponent of the variable inside the radical is *even* and the resulting simplified exponent is odd, you must use absolute value to guarantee nonnegative results.

J. Simplify $\sqrt{45a^4b^5c^6}$ $= \sqrt{3 \cdot 3 \cdot 5 \; a \cdot a \cdot a \cdot a \cdot b \cdot b \cdot b \cdot b \cdot b \; c \cdot c \cdot c \cdot c \cdot c \cdot c}$

$3 \cdot a \cdot a \cdot b \cdot b \cdot c \cdot c \cdot c \sqrt{5b}$

$3a^2b^2c^3\sqrt{5b}$

$4 \div 2 = 2$

OPTION: Divide the exponent under the radical by 2:

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K. Simplify $\sqrt{32m^2n^3c^4}$ $= \sqrt{2\cdot2\cdot2\cdot2\cdot2\cdot m^2\cdot n^2\cdot n\cdot c^4}$

$2\cdot2\cdot m\cdot n\cdot c^2\sqrt{2n}$

$4mnc^2\sqrt{2n}$

Write variables as product of an even exponent

Cube Roots: [Pull out groups of 3 identical factors]

Negative numbers have negative cube roots

L. $\sqrt[3]{-8} = \sqrt[3]{-2(-2)(-2)}$

$= -2$

M. $\sqrt[3]{a^6b^9} = \sqrt[3]{a^3\cdot a^3\cdot b^3\cdot b^3\cdot b^3}$

$= a^2\cdot b^3$

N. $\sqrt[3]{c^7d^{14}} = \sqrt[3]{c^6\cdot c\cdot d^{12}\cdot d^2}$ (12 is the largest multiple of 3 less than 14)

$= c^2d^4\sqrt[3]{cd^2}$

O. $\sqrt[3]{32m^2n^3c} = \sqrt[3]{2\cdot2\cdot2\cdot2\cdot2\cdot m^2\cdot n^3\cdot c}$

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

P. $\sqrt[3]{54a^4b^6c^5} = \sqrt[3]{2\cdot3\cdot3\cdot3\cdot a^3\cdot a\cdot b^6\cdot c^3\cdot c^2}$

$3ab^2c\sqrt[3]{2ac^2}$

Q. $\sqrt[3]{192x^{10}y^5z^9} = \sqrt[3]{2\cdot2\cdot2\cdot2\cdot2\cdot2\cdot3\cdot x^9\cdot x\cdot y^3\cdot y^2\cdot z^9}$

$2\cdot2\cdot x^{9\div3}\cdot y^{3\div3}\cdot z^{9\div3}\sqrt[3]{3xy^2}$

$4x^3yz^3\sqrt[3]{3xy^2}$

2	192
2	96
2	48
2	24
2	12
2	6
	3

Simplifying Radical Expressions (Lesson 10-2)

TRY THESE ON YOUR OWN:

PRACTICE PROBLEMS: Simplify each radical expression

1. $\sqrt{250\,n^5}$

2. $\sqrt{25\,x^3y^4}$

3. $\sqrt{216\,v^3}$

4. $\sqrt{72x\,y^6}$

5. $\sqrt{600\,w^{11}}$

6. $\sqrt{162x^4y^7}$

7. $\sqrt{20\,k^6}$

8. $\sqrt{64h^9k^4}$

9. $\sqrt{1000n^8}$

10. $\sqrt{196m^2}$

11. $\sqrt[3]{5000b^7}$

12. $\sqrt[3]{27g^2}$

13. $\sqrt[3]{1000n^8}$

14. $\sqrt[3]{64h^9k^4}$