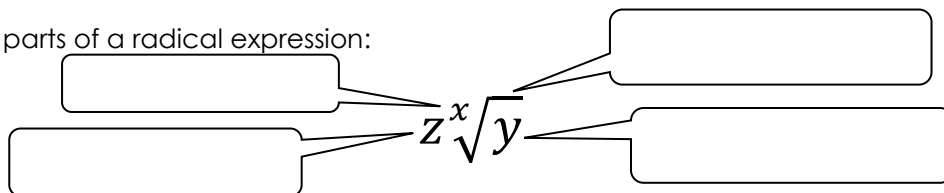# Simplifying Radicals

Label the following parts of a radical expression:

$$z^x\sqrt{y}$$

Radicals are simplified when:

Example 1: Simplify the following radicals.

a) $\sqrt{16}$

b) $\sqrt{x^2}$

c) $\sqrt{25y^2}$

d) $\sqrt[3]{27x^3}$

Multiplication Property of Square Roots: Algebra   Example

Example 2: Remove Perfect Square Factor

a) $\sqrt{160}$

b) $\sqrt{72}$

c) $\sqrt{99}$

d) $\sqrt{128}$

A variable with an even exponent is a perfect square. A variable with an odd exponent is the product of a perfect square and the variable. Example:

Example 3: Removing Variable Factors

a) $\sqrt{54n^7}$

b) $-m\sqrt{80m^9}$

c) $\sqrt{192s^2}$

d) $\sqrt{50t^5}$

Simplify the following radical. Decimals are not acceptable.

Step 1: Factor the number
Step 1: Factor the number
Step 2: Rewrite under the radical
Step 3: Circle like terms (circle the same amount of like terms as the number of the index)
Step 4: Simplify

$\sqrt{28}$ $\sqrt[3]{32}$ $-5\sqrt[4]{1200}$

You Try! Simplify the following. Decimals are not acceptable answers.

a) $\sqrt[3]{750}$

b) $\sqrt[3]{162}$

c) $\sqrt{24}$

Example 4: Simplify $\sqrt{75x^4y^7}$

Example 5: Simplify $\sqrt[5]{224r^7}$

You Try! Simplify the following. Decimals are not acceptable answers.

a) $\sqrt[2]{128n^8}$

b) $\sqrt[3]{56x^5y}$

c) $\sqrt[4]{448x^7y^7}$

Practice: pg 610 #10-21

Multiplying Radicals: To multiply radicals, multiply the coefficients, then the radicands and reduce! You can use the Multiplication Property of Square Roots $\sqrt{a} \bullet \sqrt{b} = \sqrt{ab}$

$2\sqrt{7t} \bullet 3\sqrt{14t^2}$

Example 6: Multiply the following.

a) $3\sqrt{21} \cdot 4\sqrt{14}$

b) $\sqrt{15x^4y^2} \cdot \sqrt{6xy^5}$

You Try! What is the simplified form of each of the following?

a. $\sqrt{2a} \cdot \sqrt{9a^3}$

b. $7\sqrt{5x} \cdot 3\sqrt{20x^5}$

Practice: pg. 610 # 22 - 33

Writing a Radical Expression: A rectangular door in a museum is three times as tall as it is wide. What is a simplified expression for the maximum length of a painting that fits through the door?

Example 7: A door's height is four times its width **w**. What is the maximum length of a painting that fits through the door?

You Try!
Students are building rectangular wooden frames for the set of a school play. The height of a frame is 6 times the width **w**. Each frame has a brace that connects tow opposite corners of the frame. What is a simplified expression for the length of a brace?

A park is shaped like a rectangle with a length 5 times its width w. What is a simplified expression for the distance between opposite corners of the park?

Dividing Radicals: Algebra   Examples:

When the denominator of a radicand is not a perfect square it may be easier to simplify the fraction first.

Simplifying Fractions Within Radicals

a. $\sqrt{\dfrac{64}{49}}$ b. $\sqrt{\dfrac{8x^3}{50x}}$ c. $\sqrt{\dfrac{36a}{4a^3}}$ d. $\sqrt{\dfrac{25y^3}{z^2}}$

Rationalizing the Denominators: Means to remove the radical. To do this, multiply the numerator and denominator by the same radical expression. Choose an expression that makes the radicand and in the denominator a perfect square.

a. $\dfrac{\sqrt{3}}{\sqrt{7}}$ b. $\dfrac{\sqrt{7}}{\sqrt{8n}}$ c. $\dfrac{\sqrt{2}}{\sqrt{3}}$ d. $\dfrac{\sqrt{5}}{\sqrt{18m}}$ e. $\sqrt{\dfrac{7s}{3}}$

Practice:
pg. 610 #36-48

Practice: pg 611 # 56-72