

**Like radicals** are radical expressions that have the same index and radicand.

**Essential Understanding** You can combine like radicals using properties of real numbers.

Here is how you can combine like radicals using the Distributive Property.

#### Like Radicals With Numbers

$$\sqrt{2} + 3\sqrt{2} = 4\sqrt{2}$$

$$\sqrt[3]{7} - 5\sqrt[3]{7} = -4\sqrt[3]{7}$$

#### Like Radicals With Variables

$$\sqrt{5xy} + 8\sqrt{5xy} = 9\sqrt{5xy}$$

$$\sqrt[3]{9x^2y} - 8\sqrt[3]{9x^2y} = -7\sqrt[3]{9x^2y}$$

### Problem 1 Adding and Subtracting Radical Expressions

**Got It?** What is the simplified form of each expression?

a.  $7\sqrt[3]{5} - 4\sqrt{5}$

b.  $3x\sqrt{xy} + 4x\sqrt{xy}$

c.  $17\sqrt[5]{3x^2} - 15\sqrt[5]{3x^2}$

**Practice** Simplify if possible.

1.  $4\sqrt{3} + 4\sqrt[3]{3}$

2.  $7\sqrt[3]{x^2} - 2\sqrt[3]{x^2}$

## Problem 2 Using Radical Expressions

- A Practice** 3. The design of a garden path uses stone pieces shaped as squares with a side length of 15 in. Find the length of the path.



## Problem 3 Simplifying Before Adding or Subtracting

**Got It?** What is the simplest form of the expression?  $\sqrt[3]{250} + \sqrt[3]{54} - \sqrt[3]{16}$

**A Practice** Simplify.

4.  $\sqrt[3]{54} + \sqrt[3]{16}$

5.  $3\sqrt[3]{81} - 2\sqrt[3]{54}$

## Problem 4 Multiplying Binomial Radical Expressions

**Got It?** What is the product  $(3 + 2\sqrt{5})(2 + 4\sqrt{5})$ ?

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**A Practice** Multiply.

6.  $(3 - 4\sqrt{2})(5 - 6\sqrt{2})$

7.  $(\sqrt{3} + \sqrt{5})^2$

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Conjugates are expressions, like  $\sqrt{a} + \sqrt{b}$  and  $\sqrt{a} - \sqrt{b}$ , that differ only in the signs of the second terms. When  $a$  and  $b$  are rational numbers, the product of two radical conjugates is a rational number.

**Problem 5** Multiplying Conjugates**Got It?** What is each product?

a.  $(6 - \sqrt{12})(6 + \sqrt{12})$

b.  $(3 + \sqrt{8})(3 - \sqrt{8})$

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**A Practice** Multiply each pair of conjugates.

8.  $(4 - 2\sqrt{3})(4 + 2\sqrt{3})$

9.  $(\sqrt{3} + \sqrt{5})(\sqrt{3} - \sqrt{5})$ 

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**Problem 6** Rationalizing the Denominator**Got It?** How can you write the expression with a rationalized denominator?

a.  $\frac{2\sqrt{7}}{\sqrt{3} - \sqrt{5}}$

b.  $\frac{4x}{3 - \sqrt{6}}$

**A Practice** Rationalize each denominator. Simplify your answer.

10.  $\frac{4}{1 + \sqrt{3}}$

11.  $\frac{3 + \sqrt{8}}{2 - 2\sqrt{8}}$