

# 11-7 Adding and Subtracting Radical Expressions

Warm Up

Lesson Presentation

Lesson Quiz

Holt Algebra 1

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# 11-7 Adding and Subtracting Radical Expressions

**Warm Up**

**Simplify each expression.**

1.  $14x + 15y - 12y + x$   
 $15x + 3y$

2.  $9xy + 2xy - 8xy$   
 $3xy$

3.  $-3(a + b) + 5\left(2 + \frac{2}{5}b\right)$   
 $-3a - b + 10$

4.  $\sqrt{96}$   $\xrightarrow{\sqrt{16 \cdot 6}}$   $4\sqrt{6}$

5.  $\sqrt{x^9 y^{10}}$   $x^4 y^5 \sqrt{x}$

6.  $\sqrt{\frac{72a^5}{81}}$   $\frac{\sqrt{36 \cdot 2} \sqrt{a^4 \cdot a}}{\sqrt{81}}$   $\frac{6a^2 \sqrt{2a}}{9}$

Holt Algebra 1

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**11-7 Adding and Subtracting Radical Expressions**

**Homework Answers p. 833**

- |  |  |   |
|--|--|---|
| 26. 5                                    | 44. $\frac{5\sqrt{6}}{14x}$  | 66. $14\sqrt{5} \text{ m}^2;$<br>$31.3 \text{ m}^2$ |
| 30. $\frac{4}{a}$                        |  | 67. (C)   |
| 34. $ 5 - x $                            | 51. $\frac{x^3\sqrt{x}}{3}$  | 68. (F)   |
| 38. $6ab\sqrt{6}$                        |  | 69. (C)   |
| 42. $\sqrt{10} \text{ s}; 3.2 \text{ s}$ | 65. Sears: $\frac{10\sqrt{87}}{3} \text{ mi}; 31.1 \text{ mi}$<br>Empire: $\frac{50\sqrt{3}}{3} \text{ mi}; 28.9 \text{ mi}$<br>Aon: $\frac{4\sqrt{426}}{3} \text{ mi}; 27.5 \text{ mi}$ | 72. $3x\sqrt{x-2}$                                  |

**11-7 Adding and Subtracting Radical Expressions**

**Objective**

Add and subtract radical expressions.

**Vocabulary**

like radicals

## 11-7 Adding and Subtracting Radical Expressions

Square-root expressions with the same radicand are examples of **like radicals**.

Like Radicals	$2\sqrt{5}$ and $4\sqrt{5}$	$6\sqrt{x}$ and $-2\sqrt{x}$	$3\sqrt{4t}$ and $\sqrt{4t}$
Unlike Radicals	$2$ and $\sqrt{15}$	$6\sqrt{x}$ and $\sqrt{6x}$	$3\sqrt{2}$ and $2\sqrt{3}$

Like radicals must have identical radicands and degrees

$\sqrt[3]{x}$  &  $\sqrt{x}$  are not like radicals. Although the radicands are identical the degrees are different. (Cubed & Squared)

## 11-7 Adding and Subtracting Radical Expressions

Like radicals can be combined by adding or subtracting. You can use the Distributive Property to show how this is done:

$$2\sqrt{5} + 4\sqrt{5} = (2 + 4)\sqrt{5} = 6\sqrt{5}$$

$$6\sqrt{x} - 2\sqrt{x} = (6 - 2)\sqrt{x} = 4\sqrt{x}$$

Notice that you can combine like radicals by adding or subtracting the numbers multiplied by the radical and keeping the radical the same.

## 11-7 Adding and Subtracting Radical Expressions

### Helpful Hint

Combining like radicals is similar to combining like terms.

$$2\sqrt{5} + 4\sqrt{5} = 6\sqrt{5}$$

$$2x + 4x = 6x$$

## 11-7 Adding and Subtracting Radical Expressions

### Example 1: Adding and Subtracting Square-Root Expressions

Add or subtract.

A.  $9\sqrt{3} - 4\sqrt{3}$

$$9\sqrt{3} - 4\sqrt{3}$$

*The terms are like radicals.*

$$5\sqrt{3}$$

B.  $6\sqrt{x} + 8\sqrt{y}$

$$6\sqrt{x} + 8\sqrt{y}$$

*The terms are unlike radicals. Do not combine.*

## 11-7 Adding and Subtracting Radical Expressions

### Example 1: Adding and Subtracting Square-Root Expressions

Add or subtract.

C.  $\sqrt{m} - 7\sqrt{m}$

$$1\sqrt{m} - 7\sqrt{m}$$

$$-6\sqrt{m}$$

$\sqrt{m} = 1\sqrt{m}$ , the terms are like radicals.

D.  $2\sqrt{xy} + 2\sqrt{y} + 9\sqrt{xy}$

$$2\sqrt{xy} + 2\sqrt{y} + 9\sqrt{xy}$$

$$11\sqrt{xy} + 2\sqrt{y}$$

Identify like radicals.

Combine like radicals.

## 11-7 Adding and Subtracting Radical Expressions

### Check It Out! Example 1

Add or subtract.

a.  $5\sqrt{7} - 6\sqrt{7}$

$$-1\sqrt{7}$$

c.  $4\sqrt{n} + 4\sqrt{n}$

$$8\sqrt{n}$$

b.  $8\sqrt{3} - 5\sqrt{3}$

$$3\sqrt{3}$$

d.  $\sqrt{2s} - \sqrt{5s} + 9\sqrt{5s}$

$$8\sqrt{5s} + \sqrt{2s}$$

## 11-7 Adding and Subtracting Radical Expressions

Sometimes radicals do not appear to be like until they are simplified, Simplify all radicals in an expression before trying to identify like radicals.

**Simplify each expression.**

$$\sqrt{45} - \sqrt{20}$$

$$\sqrt{9(5)} - \sqrt{4(5)}$$

*Factor the radicands using perfect squares.*

$$\sqrt{9}\sqrt{5} - \sqrt{4}\sqrt{5}$$

*Product Property of Square Roots.*

$$3\sqrt{5} - 2\sqrt{5}$$

*Simplify.*

$$\sqrt{5}$$

*Combine like radicals.*

## 11-7 Adding and Subtracting Radical Expressions

**Example 2B: Simplify Before Adding or Subtracting**

$$\sqrt{75} = 5\sqrt{3}$$

$$\sqrt{12} = 2\sqrt{3}$$

**Simplify each expression.**

$$9\sqrt{75} + 2\sqrt{50}$$

$$9\sqrt{3(25)} + 2\sqrt{2(25)}$$

*Factor the radicands using perfect squares.*

$$9\sqrt{3}\sqrt{25} + 2\sqrt{2}\sqrt{25}$$

*Product Property of Square Roots.*

$$9(5)\sqrt{3} + 2(5)\sqrt{2}$$

*Simplify.*

$$45\sqrt{3} + 10\sqrt{2}$$

*The terms are unlike radicals. Do not combine.*

## 11-7 Adding and Subtracting Radical Expressions

### Example 2C: Simplify Before Adding or Subtracting

Simplify each expression.

$$\sqrt{75y} - 2\sqrt{27y} + \sqrt{48y}$$

$$\sqrt{25} \sqrt{3y} - 2 \sqrt{9} \sqrt{3y} + \sqrt{16} \sqrt{3y}$$

$$5\sqrt{3y} - 6\sqrt{3y} + 4\sqrt{3y}$$

$$3\sqrt{3y}$$

## 11-7 Adding and Subtracting Radical Expressions

### Remember!

When you write a radicand as a product, make at least one factor a perfect square.

## 11-7 Adding and Subtracting Radical Expressions

Simplify each expression.

$$\begin{aligned} \sqrt{243} + \sqrt{192} \\ \sqrt{81 \cdot 3} + \sqrt{64 \cdot 3} \\ 9\sqrt{3} + 8\sqrt{3} = 17\sqrt{3} \end{aligned}$$

$$3\sqrt{98} + 5\sqrt{2}$$

$$\begin{aligned} \sqrt{450} + \sqrt{18} \\ \sqrt{225} \sqrt{2} + \sqrt{9} \sqrt{2} \\ 15\sqrt{2} + 3\sqrt{2} = 18\sqrt{2} \end{aligned}$$

$$8 - 2\sqrt{147}$$

$$8 - 2\sqrt{49} \sqrt{3}$$

$$8 - 2 \cdot 7\sqrt{3}$$

$$8 - 14\sqrt{3} = -6\sqrt{3}$$

## 11-7 Adding and Subtracting Radical Expressions

### Check It Out! Example 2c

Simplify each expression.

$$\sqrt{12y} + \sqrt{27y}$$

$$\sqrt{4(3y)} + \sqrt{9(3y)}$$

Factor the radicands using perfect squares.

$$\sqrt{4} \sqrt{3y} + \sqrt{9} \sqrt{3y}$$

Product Property of Square Roots.

$$2\sqrt{3y} + 3\sqrt{3y}$$

Simplify.

$$5\sqrt{3y}$$

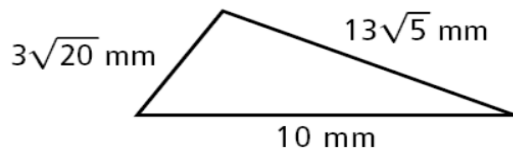
Combine like radicals.



## 11-7 Adding and Subtracting Radical Expressions

### Example 3: *Geometry Application*

Find the perimeter of the triangle. Give the answer as a radical expression in simplest form.



$$10 + 13\sqrt{5} + 3\sqrt{20} \quad \text{Write an expression for perimeter.}$$

$$10 + 13\sqrt{5} + 3\sqrt{4(5)} \quad \text{Factor 20 using a perfect square.}$$

$$10 + 13\sqrt{5} + 3\sqrt{4}\sqrt{5} \quad \text{Product Property of Square Roots.}$$

$$10 + 13\sqrt{5} + 3(2)\sqrt{5} \quad \text{Simplify.}$$

$$10 + 13\sqrt{5} + 6\sqrt{5} \quad \text{Combine like radicals.}$$

$$10 + 19\sqrt{5}$$

The perimeter is  $(10 + 19\sqrt{5})$  mm.

## 11-7 Adding and Subtracting Radical Expressions

$$\frac{1}{5}\sqrt{75} + \frac{1}{2}\sqrt{20}$$

$\sqrt{25}\sqrt{3}$        $\sqrt{4}\sqrt{5}$

$$\frac{1}{5}(5)\sqrt{3} + \frac{1}{2}(2)\sqrt{5}$$

$\sqrt{3} + \sqrt{5}$

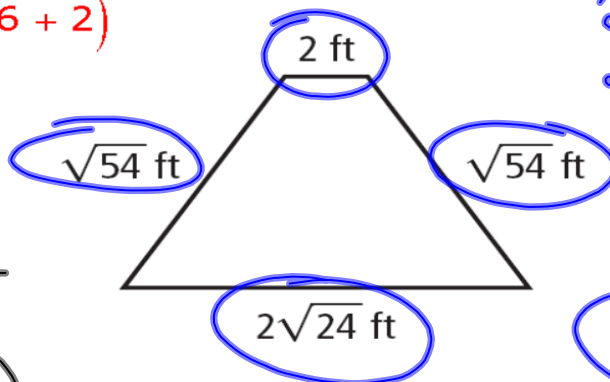
$$-5\sqrt{99} - 4\sqrt{44} + \frac{\sqrt{11}}{2}$$

# 11-7 Adding and Subtracting Radical Expressions

## Lesson Quiz: Part I

1. Find the perimeter of the trapezoid. Give the answer as a radical expression in simplest form.

$(10\sqrt{6} + 2)$



$2\sqrt{54} + 2\sqrt{24}$   
 $2\sqrt{9\sqrt{6}} + 2\sqrt{4\sqrt{6}}$   
 $2 \cdot 3\sqrt{6} + 2 \cdot 2\sqrt{6}$   
 $6\sqrt{6} + 4\sqrt{6}$

$2 + 10\sqrt{6}$   
 $2(1 + 5\sqrt{6})$

$10\sqrt{6} + 2$

# 11-7 Adding and Subtracting Radical Expressions

## Homework

p. 838 # 30- 46 even, 59, 60, 61, 67

Due  
4/24/13