11-8 Multiplying and Dividing Radial Expressions

Warm Up

Lesson Presentation

Lesson Quiz

11-8 Multiplying and Dividing Radical Expressions

Warm Up

Simplify each expression.

$x\sqrt{y}$ $\sqrt{x} = x^{1/2}$

1. $\sqrt{72}$ $6\sqrt{2}$

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

3. $\sqrt{\dfrac{24}{9}}$ $\dfrac{2\sqrt{6}}{3}$

4. $\sqrt{\dfrac{18}{x^2}}$ $\dfrac{3\sqrt{2}}{|x|}$

11-8 Multiplying and Dividing Radical Expressions

Objectives

Multiply and divide radical expressions.

Rationalize denominators.

You can use the Product and Quotient Properties of square roots you have already learned to multiply and divide expressions containing square roots.

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○ No $\sqrt{}$ in the denominator

○ Radicands only change when ×/÷ by another radical or simplifyied

◉ Constants ∗ Constants
   Radicand ∗ Radicands

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11-8 Multiplying and Dividing Radical Expressions

Example 1A: Multiplying Square Roots

Multiply. Write the product in simplest form.

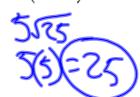| $\sqrt{8}\sqrt{6}$	$\left(2\sqrt{5}\right)^2$	$\sqrt{3y}\sqrt{12y}$
$\sqrt{8}\sqrt{6}$	$2\sqrt{5}\cdot2\sqrt{5}$	$\sqrt{36y^2}$
$\sqrt{8(6)}$	$2(2)\sqrt{5}\sqrt{5}$	$\sqrt{36}\sqrt{y^2}$
$\sqrt{48}$	$4\sqrt{5(5)}$	$6y$
$\sqrt{16(3)}$	$4\sqrt{25}$	
$\sqrt{16}\sqrt{3}$	$4(5)$	
$4\sqrt{3}$	20	

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Check It Out! Examples

Multiply. Write the product in simplest form.

$\sqrt{15}\cdot\sqrt{5}=\sqrt{75}$

$\sqrt{25}\sqrt{3}$

$5\sqrt{3}$

$\sqrt{42}\cdot\sqrt{12}=\sqrt{504}$

$6\sqrt{14}$

$\left(2\sqrt{10}\right)^2$

$2\sqrt{10}\cdot2\sqrt{10}$

$4\sqrt{100}=4(10)=40$

$5\left(\sqrt{5}\right)^2$

$5\sqrt{25}$

$5(5)=25$

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Example 2A: Using the Distributive Property

Multiply. Write each product in simplest form.

$\sqrt{3}\left(7 - \sqrt{8}\right)$

$\sqrt{3}\left(7 - \sqrt{8}\right)$

$\sqrt{3}\left(7\right) - \sqrt{3}\sqrt{8}$

$7\sqrt{3} - \sqrt{3(8)}$

$7\sqrt{3} - \sqrt{24}$

$7\sqrt{3} - \sqrt{4(6)}$

$7\sqrt{3} - \sqrt{4}\sqrt{6}$

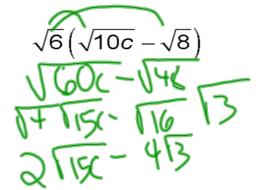$7\sqrt{3} - 2\sqrt{6}$

$\sqrt{2}\left(\sqrt{8} + \sqrt{18}\right)$

$\sqrt{16} + \sqrt{36}$

$4 + 6 = 10$

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Check It Out! Example 2a

Multiply. Write the product in simplest form.

$\sqrt{3}\left(\sqrt{12} + 6\right)$

$\sqrt{36} + 6\sqrt{3}$

$6 + 6\sqrt{3}$

$6\left(1 + \sqrt{3}\right)$

$\sqrt{6}\left(\sqrt{10c} - \sqrt{8}\right)$

$\sqrt{60c} - \sqrt{48}$

$\sqrt{15c} - \sqrt{16}\ \sqrt{3}$

$2\sqrt{15c} - 4\sqrt{3}$

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Check It Out! Example 2d

Multiply. Write each product in simplest form.

$5\sqrt{5}\left(-4 + 6\sqrt{5}\right)$

$-20\sqrt{5} + 30\sqrt{25}$

$-20\sqrt{5} + 30(5)$

$-20\sqrt{5} + 150$

$10(-2\sqrt{5} + 15)$

11-8 Multiplying and Dividing Radical Expressions

In Chapter 7, you learned to multiply binomials by using the FOIL method. The same method can be used to multiply square-root expressions that contain two terms.

Remember!

First terms

Outer terms

Inner terms

Last terms

See Lesson 7-7.

treat the $\sqrt{}$ like variables

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$$\left(4 + \sqrt{3}\right)\left(5 + \sqrt{3}\right) = 4(5) + 4\sqrt{3} + 5\sqrt{3} + \sqrt{3}\sqrt{3}$$

$$= 20 \qquad\qquad + 9\sqrt{3} \qquad\qquad + 3$$

$$= 23 + 9\sqrt{3}$$

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Example 3A: Multiplying Sums and Differences of Radicals

Multiply. Write the product in simplest form.

$$\left(3 - \sqrt{8}\right)\left(2 + \sqrt{8}\right) \quad \sim\sqrt{64}$$

$6 - 2\sqrt{8} + 3\sqrt{8} - 8$ *Use the FOIL method.*

$-2 + \sqrt{8}$ *Simplify by combining like terms.*

$-2 + \sqrt{4(2)}$ *Simplify the radicand.*

$-2 + \sqrt{4}\sqrt{2}$

$2(1 + \sqrt{2}) = -2 + 2\sqrt{2}$ *Simplify.*

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Example 3B: Multiplying Sums and Differences of Radicals

Multiply. Write the product in simplest form.

$(4 + \sqrt{3})^2$

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

$16 + 8\sqrt{3} + 3$

$19 + 8\sqrt{3}$

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

$24 - 3\sqrt{3} + 8\sqrt{3} - \sqrt{9}$

$24 + 5\sqrt{3} - 3$

$21 + 5\sqrt{3}$

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$(4 + \sqrt{5})(1 - \sqrt{5})$

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

$(9 - \sqrt{3})^2$

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

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A quotient with a square root in the denominator is not simplified. To simplify these expressions, multiply by a form of 1 to get a perfect-square radicand in the denominator. This is called *rationalizing the denominator.*

$$\frac{\sqrt{11}}{\sqrt{3}}\left(\frac{\sqrt{3}}{\sqrt{3}}\right) \quad \frac{\sqrt{33}}{\sqrt{9}} \quad \frac{\sqrt{33}}{3}$$

In other words: No radical in the denominator

$$\frac{\sqrt{11}}{\sqrt{3}} \qquad \frac{\sqrt{11}\sqrt{3}}{3} \qquad \frac{\sqrt{33}}{3}$$

Mr. Casteel's Method:
Bump & Keep

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Example 4B: Rationalizing the Denominator

Simplify the quotient.

$$\frac{\sqrt{13m}}{\sqrt{20}} \quad \frac{\sqrt{13m}\sqrt{20}}{20} \quad \frac{\sqrt{260m}}{20} \qquad \frac{\sqrt{13}}{\sqrt{5}} \quad \frac{\sqrt{13}(\sqrt{5})}{5} = \frac{\sqrt{65}}{5}$$

$$\frac{2\sqrt{65m}}{20} = \frac{\sqrt{65m}}{10}$$

$$\frac{\sqrt{7a}}{\sqrt{12}} \qquad \frac{\sqrt{7a}\sqrt{12}}{12} = \frac{\sqrt{84a}}{12} \qquad \frac{2\sqrt{21a}}{12}$$

$$\frac{\sqrt{21a}}{6}$$

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Check It Out! Example 4c

Simplify the quotient.

$$\frac{2\sqrt{80}}{\sqrt{7}}\left(\frac{\sqrt{7}}{\sqrt{7}}\right) \qquad \frac{2\sqrt{560}}{7} \qquad \frac{2\cdot 4\sqrt{35}}{7} = \frac{8\sqrt{35}}{7}$$

$$\sqrt{49}$$

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Lesson Quiz

Multiply. Write each product in simplest form.

1. $\sqrt{5}\sqrt{10}$

2. $3\sqrt{6x}\sqrt{8x}$

3. $\sqrt{2}\left(\sqrt{7} + \sqrt{2}\right)$

4. $\left(2 + \sqrt{5}\right)^2$

5. $\left(3\sqrt{6}\right)^2$

6. $\sqrt{3}\left(5 - \sqrt{18}\right)$

7. $\left(6 + \sqrt{3}\right)\left(2 - \sqrt{3}\right)$

Simplify each quotient.

8. $\dfrac{\sqrt{5}}{\sqrt{6}}$

9. $\dfrac{\sqrt{3x}}{\sqrt{18}}$