

# 10-2 Study Guide and Intervention

## Simplifying Radical Expressions

**Product Property of Square Roots** The **Product Property of Square Roots** and prime factorization can be used to simplify expressions involving irrational square roots. When you simplify radical expressions with variables, use absolute value to ensure nonnegative results.

<b>Product Property of Square Roots</b>	For any numbers $a$ and $b$ , where $a \geq 0$ and $b \geq 0$ , $\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$ .
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**Example 1: Simplify  $\sqrt{180}$ .**

$$\begin{aligned} \sqrt{180} &= \sqrt{2 \cdot 2 \cdot 3 \cdot 3 \cdot 5} && \text{Prime factorization of 180} \\ &= \sqrt{2^2} \cdot \sqrt{3^2} \cdot \sqrt{5} && \text{Product Property of Square Roots} \\ &= 2 \cdot 3 \cdot \sqrt{5} && \text{Simplify.} \\ &= 6\sqrt{5} && \text{Simplify.} \end{aligned}$$

**Example 2: Simplify  $\sqrt{120a^2 \cdot b^5 \cdot c^4}$ .**

$$\begin{aligned} &\sqrt{120a^2 \cdot b^5 \cdot c^4} \\ &= \sqrt{2^3 \cdot 3 \cdot 5 \cdot a^2 \cdot b^5 \cdot c^4} \\ &= \sqrt{2^2} \cdot \sqrt{2} \cdot \sqrt{3} \cdot \sqrt{5} \cdot \sqrt{a^2} \cdot \sqrt{b^4 \cdot b} \cdot \sqrt{c^4} \\ &= 2 \cdot \sqrt{2} \cdot \sqrt{3} \cdot \sqrt{5} \cdot |a| \cdot b^2 \cdot \sqrt{b} \cdot c^2 \\ &= 2|a|b^2c^2\sqrt{30b} \end{aligned}$$

**Exercises**

Simplify each expression.

- |                                  |                                      |                              |                               |
|----------------------------------|--------------------------------------|------------------------------|-------------------------------|
| 1. $\sqrt{28}$                   | 2. $\sqrt{68}$                       | 3. $\sqrt{60}$               | 4. $\sqrt{75}$                |
| 5. $\sqrt{162}$                  | 6. $\sqrt{3} \cdot \sqrt{6}$         | 7. $\sqrt{2} \cdot \sqrt{5}$ | 8. $\sqrt{5} \cdot \sqrt{10}$ |
| 9. $\sqrt{4a^2}$                 | 10. $\sqrt{9x^4}$                    | 11. $\sqrt{300a^4}$          | 12. $\sqrt{128c^6}$           |
| 13. $4\sqrt{10} \cdot 3\sqrt{6}$ | 14. $\sqrt{3x^2} \cdot 3\sqrt{3x^4}$ | 15. $\sqrt{20a^2b^4}$        | 16. $\sqrt{100x^3y}$          |
| 17. $\sqrt{24a^4b^2}$            | 18. $\sqrt{81x^4y^2}$                | 19. $\sqrt{150a^2b^2c}$      |                               |
| 20. $\sqrt{72a^6b^3c^2}$         | 21. $\sqrt{45x^2y^5z^8}$             | 22. $\sqrt{98x^4y^6z^2}$     |                               |

# 10-2 Study Guide and Intervention *(continued)*

## Simplifying Radical Expressions

**Quotient Property of Square Roots** A fraction containing radicals is in simplest form if no radicals are left in the denominator. The **Quotient Property of Square Roots** and **rationalizing the denominator** can be used to simplify radical expressions that involve division. When you rationalize the denominator, you multiply the numerator and denominator by a radical expression that gives a rational number in the denominator.

**Quotient Property of Square Roots**

For any numbers  $a$  and  $b$ , where  $a \geq 0$  and  $b > 0$ ,  $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$ .

**Example: Simplify**  $\sqrt{\frac{56}{45}}$ .

$$\sqrt{\frac{56}{45}} = \sqrt{\frac{4 \cdot 14}{9 \cdot 5}}$$

Factor 56 and 45.

$$= \frac{2 \cdot \sqrt{14}}{3 \cdot \sqrt{5}}$$

Simplify the numerator and denominator.

$$= \frac{2\sqrt{14}}{3\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}}$$

Multiply by  $\frac{\sqrt{5}}{\sqrt{5}}$  to rationalize the denominator.

$$= \frac{2\sqrt{70}}{15}$$

Product Property of Square Roots

### Exercises

Simplify each expression.

1.  $\frac{\sqrt{9}}{\sqrt{18}}$

2.  $\frac{\sqrt{8}}{\sqrt{24}}$

3.  $\frac{\sqrt{100}}{\sqrt{121}}$

4.  $\frac{\sqrt{75}}{\sqrt{3}}$

5.  $\frac{8\sqrt{2}}{2\sqrt{8}}$

6.  $\sqrt{\frac{2}{5}} \cdot \sqrt{\frac{6}{5}}$

7.  $\sqrt{\frac{3}{4}} \cdot \sqrt{\frac{5}{2}}$

8.  $\sqrt{\frac{5}{7}} \cdot \sqrt{\frac{2}{5}}$

9.  $\sqrt{\frac{3a^2}{10b^6}}$

10.  $\sqrt{\frac{x^6}{y^4}}$

11.  $\sqrt{\frac{100a^4}{144b^8}}$

12.  $\sqrt{\frac{75b^3c^6}{a^2}}$

13.  $\frac{\sqrt{4}}{3 - \sqrt{5}}$

14.  $\frac{\sqrt{8}}{2 + \sqrt{3}}$

15.  $\frac{\sqrt{5}}{5 + \sqrt{5}}$

16.  $\frac{\sqrt{8}}{2\sqrt{7} + 4\sqrt{10}}$