Lesson 10-2   Simplifying Radicals

Sometimes you can simplify radical expressions that contain variables. 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. For example, $n^3 = n^2 \cdot n$, so $\sqrt{n^3} = \sqrt{n^2 \cdot n}$. In this lesson, assume that all variables in radicands represent nonnegative numbers.

Problem 2 Removing Variable Factors

What is the simplified form of $\sqrt{54n^7}$?

Got It? 2. What is the simplified form of $-m\sqrt{80m^9}$?

You can use the Multiplication Property of Square Roots to write $\sqrt{a} \cdot \sqrt{b} = \sqrt{ab}$.

Problem 3 Multiplying Two Radical Expressions

What is the simplified form of $2\sqrt{7t} \cdot 3\sqrt{14t^2}$?

Got It? 3. What is the simplified form of each expression in parts (a)–(c)?

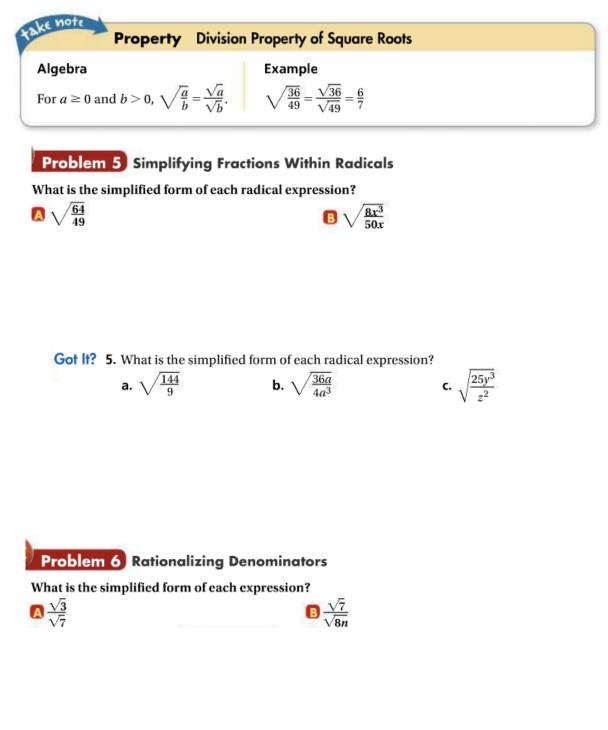a. $3\sqrt{6} \cdot \sqrt{18}$ b. $\sqrt{2a} \cdot \sqrt{9a^3}$ c. $7\sqrt{5x} \cdot 3\sqrt{20x^5}$

Simplifying Radicals

Simplify each radical expression. Show all work!

1. $\sqrt{169}$

2. $\sqrt{200}$

3. $\sqrt{125}$

4. $-5\sqrt{112}$

5. $\sqrt{68}$

6. $3\sqrt{121}$

7. $\sqrt{63t^4}$

8. $-2b\sqrt{136b^2}$

9. $\sqrt{30} \cdot \sqrt{6}$

10. $\sqrt{5} \cdot \sqrt{70}$

11. $2\sqrt{3} \cdot \sqrt{96}$

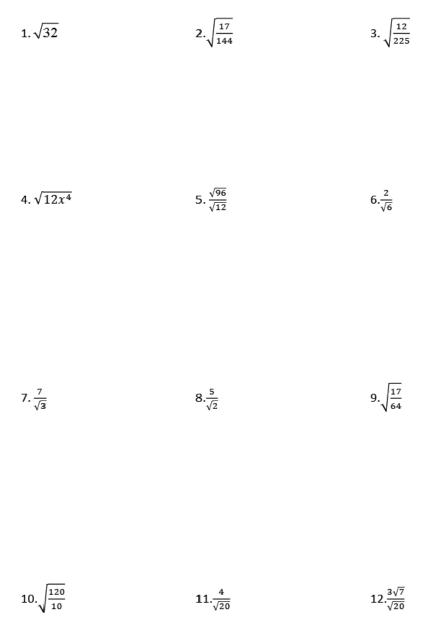12. $-4\sqrt{7} \cdot \sqrt{42}$

13. $\sqrt{4a} \cdot \sqrt{12a^5}$

You can simplify some radical expressions using the following property.

Property   Division Property of Square Roots

Algebra

For $a \geq 0$ and $b > 0$, $\sqrt{\dfrac{a}{b}} = \dfrac{\sqrt{a}}{\sqrt{b}}$.

Example

$\sqrt{\dfrac{36}{49}} = \dfrac{\sqrt{36}}{\sqrt{49}} = \dfrac{6}{7}$

Problem 5   Simplifying Fractions Within Radicals

What is the simplified form of each radical expression?

A $\sqrt{\dfrac{64}{49}}$

B $\sqrt{\dfrac{8x^3}{50x}}$

Got It? **5.** What is the simplified form of each radical expression?

a. $\sqrt{\dfrac{144}{9}}$

b. $\sqrt{\dfrac{36a}{4a^3}}$

c. $\sqrt{\dfrac{25y^3}{z^2}}$

Problem 6   Rationalizing Denominators

What is the simplified form of each expression?

A $\dfrac{\sqrt{3}}{\sqrt{7}}$

B $\dfrac{\sqrt{7}}{\sqrt{8n}}$

Got It? **6.** What is the simplified form of each radical expression?

a. $\dfrac{\sqrt{2}}{\sqrt{3}}$

Simplify each radical. Show all of your work.

1. $\sqrt{32}$

2. $\sqrt{\dfrac{17}{144}}$

3. $\sqrt{\dfrac{12}{225}}$

4. $\sqrt{12x^4}$

5. $\dfrac{\sqrt{96}}{\sqrt{12}}$

6. $\dfrac{2}{\sqrt{6}}$

7. $\dfrac{7}{\sqrt{3}}$

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

9. $\sqrt{\dfrac{17}{64}}$

10. $\sqrt{\dfrac{120}{10}}$

11. $\dfrac{4}{\sqrt{20}}$

12. $\dfrac{3\sqrt{7}}{\sqrt{20}}$

Simplifying Radicals

Complete the following examples with your teacher:

Simplify each radical expression.   **Now you try one:**

    a. $\sqrt{\dfrac{13}{64}} =$ b. $\sqrt{\dfrac{48}{75}} =$

Simplify each radical expression.   **Now you try one:**

    a. $\sqrt{\dfrac{120}{10}} =$ b. $\sqrt{\dfrac{144}{9}} =$

Simplify each radical expression.   **Now you try one:**

    a. $\dfrac{3}{\sqrt{7}} =$ b. $\dfrac{5}{\sqrt{2}} =$

Simplify each radical expression:

1. $\sqrt{\dfrac{21}{49}} =$ 2. $\sqrt{\dfrac{27}{4}} =$

3. $\sqrt{\dfrac{625}{100}} =$ 4. $\sqrt{\dfrac{120}{121}} =$

5. $\sqrt{\dfrac{15}{5}} =$

6. $\sqrt{\dfrac{54}{24}} =$

7. $\sqrt{\dfrac{60}{5}} =$

8. $-\sqrt{\dfrac{160}{8}} =$

9. $\dfrac{3}{\sqrt{2}} =$

10. $\dfrac{5}{\sqrt{5}} =$

11. $\dfrac{9}{\sqrt{8}} =$

12. $\dfrac{12}{\sqrt{12}} =$

13. $\sqrt{12} \cdot \sqrt{75} =$

14. $\sqrt{26 \cdot 2} =$

15. $\dfrac{\sqrt{72}}{\sqrt{64}} =$

16. $\dfrac{\sqrt{180}}{\sqrt{3}} =$