



5-2

Properties of
Exponents and
Radicals**CRITIQUE & EXPLAIN**

Olivia was practicing evaluating and simplifying expressions. Her work for three expressions is shown.

1. $24^2 = 400 + 16 = 416$

2. $3^6 = 9(27) = 270 - 27 = 243$

3. $\sqrt{625} = \sqrt{400} + \sqrt{225} = 20 + 15 = 35$

A. Is Olivia's work in the first example correct? Explain your thinking.

B. Is Olivia's work in the second example correct? Explain your thinking.

C. Is Olivia's work in the third example correct? Explain your thinking.

D. **Make Sense and Persevere** What advice would you give Olivia on simplifying expressions? © MP.1

HABITS OF MIND

Construct Arguments You know that $3^2 + 4^2 = 5^2$. Does $\sqrt{3^2} + \sqrt{4^2} = \sqrt{5^2}$? If not, how could you rewrite the equation using radicals so that it is true? © MP.3

EXAMPLE 1  **Try It! Use Properties of Exponents**

1. How can you rewrite each expression using the properties of exponents?

a. $\left(\frac{3}{32^{\frac{1}{2}}}\right)^{\frac{1}{2}}$

b. $2a^{\frac{1}{3}}(ab^{\frac{1}{2}})^{\frac{2}{3}}$

EXAMPLE 2  **Try It! Use Properties of Exponents to Rewrite Radicals**

2. How can you rewrite each expression?

a. $\sqrt[4]{81a^8b^5}$

b. $\sqrt[3]{x^4y^2}$

HABITS OF MIND

Make Sense and Persevere What do you have to check to be sure that an expression is in simplest radical form? © MP.1

EXAMPLE 3  **Try It! Rewrite the Product or Quotient of a Radical**

3. What is the reduced radical form of each expression?

a. $\frac{\sqrt[5]{7}}{\sqrt{16x^3}}$

b. $\sqrt[4]{27x^2} \cdot \sqrt{3x}$

**EXAMPLE 4** **Try It! Add and Subtract Radical Expressions**

4. How can you rewrite each expression in a simpler form?

a. $\sqrt[3]{2,000} + \sqrt{2} - \sqrt[3]{128}$

b. $\sqrt{20} - \sqrt{600} - \sqrt{125}$

HABITS OF MIND

Critique Reasoning Divit says that you can simplify the product of any two radical expressions, but not necessarily the sum. Is he correct? Give an example. © MP.3

EXAMPLE 5 **Try It! Multiply Binomial Radical Expressions**

5. Multiply.

a. $(x - \sqrt{10})(x + \sqrt{10})$

b. $\sqrt{6}(5 + \sqrt{3})$

EXAMPLE 6 **Try It! Rationalize a Binomial Denominator**

6. What is the reduced radical form of each expression?

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

b. $\frac{-4x}{1 - \sqrt{x}}$

HABITS OF MIND

Reason Is the product of two irrational binomials always irrational? Explain. © MP.2



Do You UNDERSTAND?

1. **ESSENTIAL QUESTION** How can properties of exponents and radicals be used to rewrite radical expressions?

2. **Vocabulary** How can you determine if a radical expression is in reduced form?

3. **Use Structure** Explain why $(-64)^{\frac{1}{3}}$ equals $-64^{\frac{1}{3}}$ but $(-64)^{\frac{1}{2}}$ does not equal $-64^{\frac{1}{2}}$. © MP.7

4. **Error Analysis** Explain the error in Julie's work in rewriting the radical expression. © MP.3

$$\sqrt{-3} \cdot \sqrt{-12} = \sqrt{-3(-12)} = \sqrt{36} = 6$$

Do You KNOW HOW?

What is the reduced radical form of each expression?

5. $49^{\frac{3}{4}} \cdot 49^{-\frac{1}{4}}$

6. $\left(\frac{a^2b^8}{a^{\frac{1}{3}}}\right)^{\frac{3}{4}}$

7. $\sqrt[4]{1,024x^9y^{12}}$

8. $\sqrt[3]{\frac{4}{9m^2}}$

9. $\sqrt{63} - \sqrt{700} - \sqrt{112}$

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

11. $\frac{3}{\sqrt{6}}$

12. $\frac{\sqrt{7}}{\sqrt{5} + 3}$

