# Practice Book

## 3 Practice and Apply

**Use Practice Book pp. 221–222**

| Assignment Guide | |
|---|---|
| **Decelerated** | 1–12, 21–24 |
| **Average** | 2–38 Even, 39 |
| **Accelerated** | 13–20, 25–39 |

- Before assigning the exercises on Practice Book pages 221–222, discuss the examples in the teaching display. Check that students understand why $\sqrt{x^6}$ in the second example is simplified as $|x^3|$ and not just as $x^3$, as well as why it is not necessary to take the absolute value of $y^4$.
- In exercises 1–20, remind the class that the radical sign means the positive square root. Students may find it helpful to write decimal radicands as the product of a negative power of 10 and a whole number. For example, exercise 13 can be written as $\sqrt{(0.01)(72)}$ and simplified as $(0.1)(6)\sqrt{2}$, or $0.6\sqrt{2}$.

***Errors Commonly Made***

Some students may tend to focus on one part of a problem and forget to carry over the rest of the factors. For example, in exercise 11, they may correctly write $23\sqrt{92} = 23\sqrt{4 \cdot 23}$, but then they may omit the factor 23 and give $2\sqrt{23}$ as the answer. Suggest that students align their work vertically.

- In exercises 21–36, remind students that if any factor of a radicand has an integer exponent greater than 1, the radical expression can be simplified. Discuss when it is necessary to use absolute value symbols when simplifying radical expressions containing variables.

### Problem Solving

- Suggest using a *Guess and Test* strategy for solving problems 37–38.

### Critical Thinking

- Suggest that students check their work for exercise 39 by simplifying their answers.





# 9-1 Simplify Radical Expressions

Name ____________________ Date __________

Simplify: $-12\sqrt{45}$

$= -12\sqrt{9 \cdot 5}$ ⟵Factor out the greatest perfect square.

$= -12\sqrt{9}\sqrt{5}$ ⟵Use the Product Property of Square Roots: $\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$, where $a \geq 0$ and $b \geq 0$.

$= -12(3\sqrt{5})$ ⟵Simplify.

$= -36\sqrt{5}$ ⟵Simplify.

So in simplest form, $-12\sqrt{45} = -36\sqrt{5}$.

Simplify: $8\sqrt{72x^7y^8z}$

$= 8\sqrt{9 \cdot 4 \cdot 2 \cdot x^6 \cdot x \cdot y^8 \cdot z}$ ⟵Factor out perfect squares.

$= 8\sqrt{36x^6y^8 \cdot 2xz}$ ⟵Use the Commutative Property.

$= 8\sqrt{36x^6y^8}\sqrt{2xz}$ ⟵Use the Product Property of Square Roots.

$= 8(6|x^3|y^4\sqrt{2xz})$ ⟵Simplify.

$= 48|x^3|y^4\sqrt{2xz}$ ⟵Simplify.

So in simplest form, $8\sqrt{72x^7y^8z} = 48|x^3|y^4\sqrt{2xz}$.

**Simplify the expression.**

1. $\sqrt{27}$
   $\sqrt{9 \cdot 3}$
   $\sqrt{9} \cdot \sqrt{3}$
   $3\sqrt{3}$

2. $\sqrt{44}$
   $\sqrt{4 \cdot 11}$
   $\sqrt{4} \cdot \sqrt{11}$
   $2\sqrt{11}$

3. $\sqrt{700}$
   $\sqrt{100 \cdot 7}$
   $\sqrt{100} \cdot \sqrt{7}$
   $10\sqrt{7}$

4. $\sqrt{20{,}000}$
   $\sqrt{10{,}000 \cdot 2}$
   $\sqrt{10{,}000} \cdot \sqrt{2}$
   $100\sqrt{2}$

5. $-\sqrt{18}$
   $-\sqrt{9 \cdot 2}$
   $-\sqrt{9} \cdot \sqrt{2}$
   $-3\sqrt{2}$

6. $-\sqrt{48}$
   $-\sqrt{16 \cdot 3}$
   $-\sqrt{16} \cdot \sqrt{3}$
   $-4\sqrt{3}$

7. $-12\sqrt{54}$
   $-12\sqrt{9 \cdot 6}$
   $-12(3\sqrt{6})$
   $-36\sqrt{6}$

8. $-11\sqrt{20}$
   $-11\sqrt{4 \cdot 5}$
   $-11(2\sqrt{5})$
   $-22\sqrt{5}$

9. $7\sqrt{441}$
   $7\sqrt{9 \cdot 7 \cdot 7}$
   $7(3 \cdot 7)$; $7(21)$
   $147$

10. $9\sqrt{625}$
    $9\sqrt{25 \cdot 25}$
    $9 \cdot 25$
    $225$

11. $23\sqrt{92}$
    $23\sqrt{4 \cdot 23}$
    $23 \cdot 2\sqrt{23}$
    $46\sqrt{23}$

12. $15\sqrt{261}$
    $15\sqrt{9 \cdot 29}$
    $15 \cdot 3\sqrt{29}$
    $45\sqrt{29}$

13. $\sqrt{0.72}$
    $\sqrt{0.36 \cdot 2}$
    $\sqrt{0.36} \cdot \sqrt{2}$
    $0.6\sqrt{2}$

14. $\sqrt{1.25}$
    $\sqrt{0.25 \cdot 5}$
    $\sqrt{0.25} \cdot \sqrt{5}$
    $0.5\sqrt{5}$

15. $\sqrt{0.4}$
    $\sqrt{4 \cdot 0.1}$
    $\sqrt{4} \cdot \sqrt{0.1}$
    $2\sqrt{0.1}$

16. $\sqrt{0.9}$
    $\sqrt{9 \cdot 0.1}$
    $\sqrt{9} \cdot \sqrt{0.1}$
    $3\sqrt{0.1}$

17. $8\sqrt{1.44}$
    $8\sqrt{1.2 \cdot 1.2}$
    $8 \cdot 1.2$
    $9.6$

18. $6\sqrt{1.21}$
    $6\sqrt{1.1 \cdot 1.1}$
    $6 \cdot 1.1$
    $6.6$

19. $-11\sqrt{2.56}$
    $-11\sqrt{1.6 \cdot 1.6}$
    $-11 \cdot 1.6$
    $-17.6$

20. $-13\sqrt{3.24}$
    $-13\sqrt{1.8 \cdot 1.8}$
    $-13 \cdot 1.8$
    $-23.4$

Use with SOURCEBOOK Lesson 9-1, pages 226–227.

For More Practice Go To:

ONLINE www.progressinmathematics.com Practice/Test Generator

Simplify the expression. (*Hint:* Expressions of the form $\sqrt{x^{2m}}$, where $m$ is odd, must be written in the form $|x^m|$, after simplification.)

**21.** $6\sqrt{25x^2y}$

$6\sqrt{25x^2 \cdot y}$
$6\sqrt{25x^2} \cdot \sqrt{y}$
$6(5|x|\sqrt{y})$
$30|x|\sqrt{y}$

**22.** $9\sqrt{81ab^2}$

$9\sqrt{81b^2 \cdot a}$
$9\sqrt{81b^2} \cdot \sqrt{a}$
$9(9|b|\sqrt{a})$
$81|b|\sqrt{a}$

**23.** $4\sqrt{120x^4y^5}$

$4\sqrt{4x^4y^4 \cdot 30y}$
$4\sqrt{4x^4y^4} \cdot \sqrt{30y}$
$4(2x^2y^2)\sqrt{30y}$
$8x^2y^2\sqrt{30y}$

**24.** $3\sqrt{60x^7y^6}$

$3\sqrt{4x^6y^6 \cdot 15x}$
$3\sqrt{4x^6y^6} \cdot \sqrt{15x}$
$3(2|x^3y^3|\sqrt{15x})$
$6|x^3y^3|\sqrt{15x}$

**25.** $-4\sqrt{180a^5b^2c^{10}}$

$-4\sqrt{36a^4b^2c^{10} \cdot 5a}$
$-4\sqrt{36a^4b^2c^{10}} \cdot \sqrt{5a}$
$-4(6a^2|bc^5|\sqrt{5a})$
$-24a^2|bc^5|\sqrt{5a}$

**26.** $-2\sqrt{98m^3n^8p^2}$

$-2\sqrt{49m^2n^8p^2 \cdot 2m}$
$-2\sqrt{49m^2n^8p^2} \cdot \sqrt{2m}$
$-2(7n^4|mp|\sqrt{2m})$
$-14n^4|mp|\sqrt{2m}$

**27.** $\sqrt{350t^8u^{12}v^{10}}$

$\sqrt{25t^8u^{12}v^{10} \cdot 14}$
$\sqrt{25t^8u^{12}v^{10}} \cdot \sqrt{14}$
$5t^4u^6|v^5|\sqrt{14}$

**28.** $\sqrt{320a^{14}b^6c^{20}}$

$\sqrt{64a^{14}b^6c^{20} \cdot 5}$
$\sqrt{64a^{14}b^6c^{20}} \cdot \sqrt{5}$
$8c^{10}|a^7b^3|\sqrt{5}$

**29.** $-15\sqrt{540k^6\ell m}$

$-15\sqrt{36k^6 \cdot 15\ell m}$
$-15\sqrt{36k^6} \cdot \sqrt{15\ell m}$
$-90|k^3|\sqrt{15\ell m}$

**30.** $-20\sqrt{272fg^8h}$

$-20\sqrt{16g^8 \cdot 17fh}$
$-20\sqrt{16g^8} \cdot \sqrt{17fh}$
$-80g^4\sqrt{17fh}$

**31.** $3\sqrt{2400x^{30}y^{16}}$

$3\sqrt{400x^{30}y^{16} \cdot 6}$
$3\sqrt{400x^{30}y^{16}} \cdot \sqrt{6}$
$60|x^{15}|y^8\sqrt{6}$

**32.** $7\sqrt{2700a^{100}b^{18}}$

$7\sqrt{900a^{100}b^{18} \cdot 3}$
$7\sqrt{900a^{100}b^{18}} \cdot \sqrt{3}$
$210|a^{50}b^9|\sqrt{3}$

**33.** $4x\sqrt{32x^4y^3}$

$4x\sqrt{16x^4y^2 \cdot 2y}$
$4x\sqrt{16x^4y^2} \cdot \sqrt{2y}$
$4x(4x^2|y|\sqrt{2y})$
$16x^3|y|\sqrt{2y}$

**34.** $3a\sqrt{125a^6b^5}$

$3a\sqrt{25a^6b^4 \cdot 5b}$
$3a\sqrt{25a^6b^4} \cdot \sqrt{5b}$
$3a(5|a^3|b^2\sqrt{5b})$
$15a^4b^2\sqrt{5b}$

**35.** $-2m^3\sqrt{315m^8}$

$-2m^3\sqrt{9m^8 \cdot 35}$
$-2m^3\sqrt{9m^8} \cdot \sqrt{35}$
$-2m^3(3m^4\sqrt{35})$
$-6m^7\sqrt{35}$

**36.** $-5a^4\sqrt{124a^{10}}$

$-5a^4\sqrt{4a^{10} \cdot 31}$
$-5a^4\sqrt{4a^{10}} \cdot \sqrt{31}$
$-5a^4(2|a^5|\sqrt{31})$
$-10|a^9|\sqrt{31}$

## Problem Solving

**37.** Seven more than 3 times the square root of a number is 19. What is the number?

Guess and Test: $3\sqrt{4} + 7 = 13$ (too small)
$3\sqrt{9} + 7 = 16$ (too small)
$3\sqrt{16} + 7 = 3(4) + 7 = 12 + 7 = 19$;
The number is 16.

**38.** The sum of the square roots of two integers is 7. What are two such integers?

Possible response:
Guess and Test; $\sqrt{4} + \sqrt{9} = 2 + 3 = 5$ (too small)
$\sqrt{9} + \sqrt{16} = 3 + 4 = 7$; The numbers are 9 and 16.
Other correct pairs are 0 and 49, 1 and 36, and 4 and 25.

## CRITICAL THINKING

**39.** A radical expression, simplified, equals $15|x^5y^7z|\sqrt{3xy}$. If the original expression was all part of the radicand, what was the original radical expression? Explain your work. First square the part of the expression that is not under the radicand.

Then place its square under a radicand: $15x^5y^7z\sqrt{3xy} = \sqrt{(15x^5y^7z)^2} \cdot \sqrt{3xy}$

Apply the Product Property of Square Roots: $\sqrt{(15x^5y^7z)^2} \cdot \sqrt{3xy} = \sqrt{225x^{10}y^{14}z^2 \cdot 3xy}$

Then simplify: $\sqrt{225x^{10}y^{14}z^2 \cdot 3xy} = \sqrt{675x^{11}y^{15}z^2}$



## Meeting Individual Needs

See page 225F.

## 4 Summarize/Assess

### Conceptual Thinking

■ To assess whether students have conceptualized the lesson concepts, lead a class discussion in which they explain how to simplify a radical expression. Be sure the class discusses why absolute value symbols must be used. Provide examples such as $\sqrt{338a^2b}$. $13|a|\sqrt{2b}$

## 5 Follow-Up

### Reteaching

■ Some students may find it difficult to recognize perfect squares in a numerical expression. Explain that they can factor the number to help identify such squares. Remind them how to write the prime factorization of a number. Use an example such as $\sqrt{252}$. Have students write the prime factorization of 252, using a factor tree if desired. $2^2 \cdot 3^2 \cdot 7$ Write the original expression as $\sqrt{2^2 \cdot 3^2 \cdot 7}$. Then have a volunteer explain how to use the Product Property of Square Roots to write the expression as $\sqrt{2^2} \cdot \sqrt{3^2} \cdot \sqrt{7}$, which is equal to $(2)(3)\sqrt{7} = 6\sqrt{7}$. Observe that if a prime factorization includes an odd exponent (other than 1), students can write it as a product. For example, $5^5 = 5^4 \cdot 5$.

Have pairs of students take turns writing radical expressions that are to be simplified. After they are comfortable with numerical expressions, have them include variables in the radicand. Remind them that when simplifying expressions with variables, they should take the absolute value of an odd power outside the radical symbol.

ONLINE See Chapter 9 Alternative Teaching Models.

## Additional Resources

ONLINE www.progressinmathematics.com

- Meeting Individual Needs Activities
- Alternative Teaching Models
- Vocabulary Activities
- Audio Glossary
- Virtual Manipulatives



End of Lesson