

# SIMPLIFYING SQUARE ROOTS EXAMPLES



1. Definition of a “**simplified form**” for a square root → The square root of a positive integer is in “**simplest form**” if the “**radicand**” has no perfect square factor other than one.
2. Have students analyze the following to see if it is true or false: (**ALL ARE TRUE.**)

$$\sqrt{40} = \sqrt{4 \cdot 10} = \sqrt{4} \cdot \sqrt{10} = 2\sqrt{10}$$



3. For any numbers “a” and “b,” where  $a \geq 0$  and  $b \geq 0$ ,  $\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$ .

4. **Example:** Simplify →  $\sqrt{72}$

The Product Property of Square Roots and prime factorization can be used to simplify radical expressions in which the radicand is not a perfect square.

	$\sqrt{72}$	
	$\sqrt{2 \cdot 2 \cdot 2 \cdot 3 \cdot 3}$	<b>Prime factorization</b>
<b>Product Property</b>	$\sqrt{2} \cdot \sqrt{2^2} \cdot \sqrt{3^2}$	
	$\sqrt{2} \cdot 2 \cdot 3$	
	$6\sqrt{2}$	

5. **Example:** Simplify →  $\sqrt{150}$

The Product Property of Square Roots and prime factorization can be used to simplify radical expressions in which the radicand is not a perfect square.

	$\sqrt{150}$	
	$\sqrt{2 \cdot 3 \cdot 5 \cdot 5}$	<b>Prime factorization</b>
<b>Product Property</b>	$\sqrt{2} \cdot \sqrt{3} \cdot \sqrt{5^2}$	
	$\sqrt{2} \cdot 3 \cdot 5$	
	$5\sqrt{6}$	

6. When finding the positive square root of an expression containing variables, you must be sure that the result is not negative. **Consider that  $5^2 = 25$  and  $(-5)^2 = 25$ .** When you find  $\sqrt{25}$ , however, you want only the “**principal square root.**” Therefore, “**absolute values**” are used as needed to ensure “**nonnegative**” results.

$$\sqrt{x^2} = |x|$$

$$\sqrt{x^3} = x\sqrt{x}$$

$$\sqrt{x^4} = x^2$$

$$\sqrt{x^6} = |x^3|$$

7. Point out that to “**simplify**” a square root with a variable, “**absolute value**” symbols are necessary when the variable has an “**even**” exponent and the exponent of its square root is “**odd.**” For example in  $\sqrt{x^4} = x^2$ , since “**x**” is squared in the answer, it will automatically be positive. In  $\sqrt{x^6} = x^3$ , in order to guarantee that  $x^3$  is positive,  $|x^3|$  is necessary.



8. **Example:** Simplify  $\rightarrow \sqrt{81y^2}$

**The Product Property of Square Roots and prime factorization can be used to simplify radical expressions in which the radicand is not a perfect square.**

$$\begin{array}{l} \sqrt{81y^2} \\ \sqrt{9^2 \cdot y^2} \\ \sqrt{9^2} \cdot \sqrt{y^2} \\ 9|y| \end{array}$$

**Product Property** (points to the step  $\sqrt{9^2} \cdot \sqrt{y^2}$ )

**Prime factorization** (points to the step  $\sqrt{9^2 \cdot y^2}$ )

9. **Example:** Simplify  $\rightarrow \sqrt{200a^4b^3}$

**The Product Property of Square Roots and prime factorization can be used to simplify radical expressions in which the radicand is not a perfect square.**

$$\begin{array}{l} \sqrt{200a^4b^3} \\ \sqrt{2 \cdot 2 \cdot 2 \cdot 5 \cdot 5 \cdot a \cdot a \cdot a \cdot a \cdot b \cdot b \cdot b} \\ \sqrt{2} \cdot 2 \cdot 5 \cdot a^2 \cdot b \cdot \sqrt{b} \\ 10a^2b\sqrt{2b} \end{array}$$

**Product Property** (points to the step  $\sqrt{2} \cdot 2 \cdot 5 \cdot a^2 \cdot b \cdot \sqrt{b}$ )

**Prime factorization** (points to the step  $\sqrt{2 \cdot 2 \cdot 2 \cdot 5 \cdot 5 \cdot a \cdot a \cdot a \cdot a \cdot b \cdot b \cdot b}$ )

10. **Example:** Simplify  $\rightarrow \sqrt{10} \cdot \sqrt{20}$

$$\begin{aligned} &\sqrt{10} \cdot \sqrt{20} \\ &\sqrt{10 \cdot 20} \\ &\sqrt{10 \cdot 10 \cdot 2} \\ &10\sqrt{2} \end{aligned}$$



Name: \_\_\_\_\_

Date: \_\_\_\_\_

Class: \_\_\_\_\_

## SIMPLIFYING SQUARE ROOTS WORKSHEET

Simplify. Use absolute value symbols when necessary.

1.  $\sqrt{8}$

2.  $\sqrt{12}$

3.  $\sqrt{20}$

4.  $\sqrt{24}$

5.  $\sqrt{m^2}$

6.  $\sqrt{y^6}$

7.  $\sqrt{x^5}$

8.  $\sqrt{8a^3}$

9.  $\sqrt{9a^4}$

10.  $\sqrt{4} \cdot \sqrt{9}$

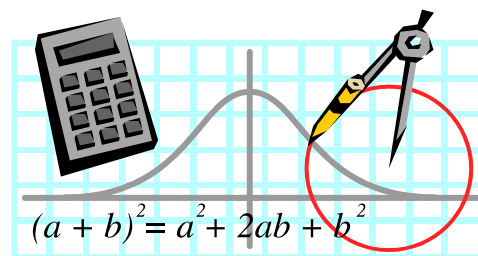
11.  $\sqrt{8} \cdot \sqrt{3}$

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

13.  $\sqrt{11} \cdot \sqrt{11}$

14.  $\sqrt{80a^2b^3}$

15.  $4\sqrt{5} \cdot 3\sqrt{15}$



# SIMPLIFYING SQUARE ROOTS WORKSHEET KEY

Simplify. Use absolute value symbols when necessary.

1.  $\sqrt{8}$

$$\begin{array}{l} \sqrt{2 \cdot 2 \cdot 2} \\ \sqrt{2^2 \cdot 2} \\ 2\sqrt{2} \end{array}$$

2.  $\sqrt{12}$

$$\begin{array}{l} \sqrt{2 \cdot 2 \cdot 3} \\ \sqrt{2^2 \cdot 3} \\ 2\sqrt{3} \end{array}$$

3.  $\sqrt{20}$

$$\begin{array}{l} \sqrt{2 \cdot 2 \cdot 5} \\ \sqrt{2^2 \cdot 5} \\ 2\sqrt{5} \end{array}$$

4.  $\sqrt{24}$

$$\begin{array}{l} \sqrt{2 \cdot 2 \cdot 2 \cdot 3} \\ \sqrt{2^3 \cdot 3} \\ 2\sqrt{2 \cdot 3} \\ 2\sqrt{6} \end{array}$$

5.  $\sqrt{m^2}$

$$|m|$$

6.  $\sqrt{y^6}$

$$\boxed{|y^3|}$$

7.  $\sqrt{x^5}$

$$\boxed{\begin{array}{l} \sqrt{x^4 \cdot x} \\ x^2 \sqrt{x} \end{array}}$$

8.  $\sqrt{8a^3}$

$$\boxed{\begin{array}{l} \sqrt{2^2 \cdot 2 \cdot a^2 \cdot a} \\ 2a\sqrt{2a} \end{array}}$$

9.  $\sqrt{9a^4}$

$$\boxed{\begin{array}{l} \sqrt{3^2 \cdot a^4} \\ 3a^2 \end{array}}$$

10.  $\sqrt{4} \cdot \sqrt{9}$

$$\boxed{\begin{array}{l} 2 \cdot 3 \\ 6 \end{array}}$$

11.  $\sqrt{8} \cdot \sqrt{3}$

$$\boxed{\begin{array}{l} \sqrt{8 \cdot 3} \\ \sqrt{2^2 \cdot 2 \cdot 3} \\ 2\sqrt{6} \end{array}}$$

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

$$\boxed{\begin{array}{l} \sqrt{5 \cdot 10} \\ \sqrt{50} \\ \sqrt{5^2 \cdot 2} \\ 5\sqrt{2} \end{array}}$$

13.  $\sqrt{11} \cdot \sqrt{11}$

$$\frac{\sqrt{11^2}}{11}$$

14.  $\sqrt{80a^2b^3}$

$$\begin{aligned} &\sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot a^2 \cdot b^2 \cdot b} \\ &\sqrt{2^4 \cdot 5 \cdot a^2 \cdot b^2 \cdot b} \\ &4|a|b\sqrt{5b} \end{aligned}$$

15.  $4\sqrt{5} \cdot 3\sqrt{15}$

$$\begin{aligned} &4 \cdot 3 \cdot \sqrt{5} \cdot \sqrt{15} \\ &12 \cdot \sqrt{75} \\ &12 \cdot \sqrt{5^2 \cdot 3} \\ &12 \cdot 5\sqrt{3} \\ &60\sqrt{3} \end{aligned}$$

Student Name: \_\_\_\_\_

Date: \_\_\_\_\_

## **SIMPLIFYING SQUARE ROOTS CHECKLIST**

1. On question 1, did the student simplify correctly and use absolute value symbols when necessary?
  - a. Yes (15 points)
  - b. Did not use absolute value symbols (10 points)
  - c. Simplified partially (5 points)
  
2. On question 2, did the student simplify correctly and use absolute value symbols when necessary?
  - a. Yes (15 points)
  - b. Did not use absolute value symbols (10 points)
  - c. Simplified partially (5 points)
  
3. On question 3, did the student simplify correctly and use absolute value symbols when necessary?
  - a. Yes (15 points)
  - b. Did not use absolute value symbols (10 points)
  - c. Simplified partially (5 points)
  
4. On question 4, did the student simplify correctly and use absolute value symbols when necessary?
  - a. Yes (15 points)
  - b. Did not use absolute value symbols (10 points)
  - c. Simplified partially (5 points)
  
5. On question 5, did the student simplify correctly and use absolute value symbols when necessary?
  - a. Yes (15 points)
  - b. Did not use absolute value symbols (10 points)
  - c. Simplified partially (5 points)
  
6. On question 6, did the student simplify correctly and use absolute value symbols when necessary?
  - a. Yes (15 points)
  - b. Did not use absolute value symbols (10 points)
  - c. Simplified partially (5 points)

7. On question 1, did the student simplify correctly and use absolute value symbols when necessary?
  - a. Yes (15 points)
  - b. Did not use absolute value symbols (10 points)
  - c. Simplified partially (5 points)
  
8. On question 8, did the student simplify correctly and use absolute value symbols when necessary?
  - a. Yes (15 points)
  - b. Did not use absolute value symbols (10 points)
  - c. Simplified partially (5 points)
  
9. On question 9, did the student simplify correctly and use absolute value symbols when necessary?
  - a. Yes (15 points)
  - b. Did not use absolute value symbols (10 points)
  - c. Simplified partially (5 points)
  
10. On question 10, did the student simplify correctly and use absolute value symbols when necessary?
  - a. Yes (15 points)
  - b. Did not use absolute value symbols (10 points)
  - c. Simplified partially (5 points)
  
11. On question 11, did the student simplify correctly and use absolute value symbols when necessary?
  - a. Yes (15 points)
  - b. Did not use absolute value symbols (10 points)
  - c. Simplified partially (5 points)
  
12. On question 12, did the student simplify correctly and use absolute value symbols when necessary?
  - a. Yes (15 points)
  - b. Did not use absolute value symbols (10 points)
  - c. Simplified partially (5 points)

13. On question 13, did the student simplify correctly and use absolute value symbols when necessary?

- a. Yes (15 points)
- b. Did not use absolute value symbols (10 points)
- c. Simplified partially (5 points)

14. On question 14, did the student simplify correctly and use absolute value symbols when necessary?

- a. Yes (15 points)
- b. Did not use absolute value symbols (10 points)
- c. Simplified partially (5 points)

15. On question 15, did the student simplify correctly and use absolute value symbols when necessary?

- a. Yes (15 points)
- b. Did not use absolute value symbols (10 points)
- c. Simplified partially (5 points)

Total Number of Points \_\_\_\_\_