

# Simplifying Radicals

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

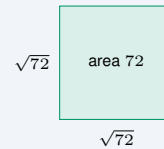
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## Quick Review and Helpful Hints

A square root  $\sqrt{a}$  asks “what nonnegative number squared gives  $a$ ?” To simplify, pull out the largest *perfect square* factor:  $\sqrt{a^2b} = a\sqrt{b}$ . Multiply or divide roots with  $\sqrt{a} \cdot \sqrt{b} = \sqrt{ab}$ . Combine *like* radicals (the same number under the root) by adding or subtracting their coefficients.

► **Example:** Simplify  $\sqrt{72}$ . **Work:** Factor out the largest perfect square:  $72 = 36 \cdot 2$ , and 36 is a perfect square. So  $\sqrt{72} = \sqrt{36} \cdot \sqrt{2} = 6\sqrt{2}$ .  
 ★ **Answer:**  $6\sqrt{2}$



$\sqrt{72} = 6\sqrt{2}$  is the side of a square of area 72.

## ◆ Practice Problems

Simplify each radical expression.

1.  $\sqrt{49}$

8.  $\sqrt{32}$

2.  $\sqrt{12}$

9.  $\sqrt{75}$

3.  $\sqrt{50}$

10.  $\sqrt{2} \cdot \sqrt{8}$

4.  $\sqrt{18}$

11.  $3\sqrt{5} + 2\sqrt{5}$

5.  $\sqrt{8}$

12.  $\sqrt{200}$

6.  $\sqrt{45}$

13.  $\sqrt{27}$

7.  $\sqrt{100}$

14.  $\frac{\sqrt{50}}{\sqrt{2}}$

## ◆ Word Problems

15. A square room has an area of 144 square feet. What is the length of one side?

16. A square garden has an area of 50 square meters. Write its side length in simplest radical form.

17. A square tile has an area of 32 square inches. Write its side length in simplest radical form.

18. A square has an area of 18 square centimeters. Write its side length in simplest radical form.



## Answer Keys

- |                        |                          |                                    |
|------------------------|--------------------------|------------------------------------|
| 1. $\boxed{7}$         | 7. $\boxed{10}$          | 13. $\boxed{3\sqrt{3}}$            |
| 2. $\boxed{2\sqrt{3}}$ | 8. $\boxed{4\sqrt{2}}$   | 14. $\boxed{5}$                    |
| 3. $\boxed{5\sqrt{2}}$ | 9. $\boxed{5\sqrt{3}}$   | 15. $\boxed{12 \text{ ft}}$        |
| 4. $\boxed{3\sqrt{2}}$ | 10. $\boxed{4}$          | 16. $\boxed{5\sqrt{2} \text{ m}}$  |
| 5. $\boxed{2\sqrt{2}}$ | 11. $\boxed{5\sqrt{5}}$  | 17. $\boxed{4\sqrt{2} \text{ in}}$ |
| 6. $\boxed{3\sqrt{5}}$ | 12. $\boxed{10\sqrt{2}}$ | 18. $\boxed{3\sqrt{2} \text{ cm}}$ |

### Step-by-Step Explanations

1. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Ask yourself “what number squared gives 49?” Since  $7 \times 7 = 49$ , the root is 7. So the final answer is 7.

2. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Pull out the perfect-square factor:  $12 = 4 \cdot 3$ , so  $\sqrt{12} = \sqrt{4} \sqrt{3} = 2\sqrt{3}$ . So the final answer is  $2\sqrt{3}$ .

3. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $50 = 25 \cdot 2$ , and 25 is a perfect square, so  $\sqrt{50} = 5\sqrt{2}$ . So the final answer is  $5\sqrt{2}$ .

4. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $18 = 9 \cdot 2$ , so  $\sqrt{18} = 3\sqrt{2}$ . So the final answer is  $3\sqrt{2}$ .

5. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $8 = 4 \cdot 2$ , giving  $\sqrt{8} = 2\sqrt{2}$ . So the final answer is  $2\sqrt{2}$ .

6. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $45 = 9 \cdot 5$ , so  $\sqrt{45} = 3\sqrt{5}$ . So the final answer is  $3\sqrt{5}$ .

7. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $100 = 10^2$  is a perfect square, so the root is exactly 10 with no radical left. So the final answer is 10.

8. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is The largest perfect-square factor of 32 is 16:  $\sqrt{32} = \sqrt{16} \sqrt{2} = 4\sqrt{2}$ . So the final answer is  $4\sqrt{2}$ .

9. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $75 = 25 \cdot 3$ , so  $\sqrt{75} = 5\sqrt{3}$ . So the final answer is  $5\sqrt{3}$ .

10. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Multiply under one root first:  $\sqrt{2} \cdot \sqrt{8} = \sqrt{16} = 4$ . So the final answer is 4.

11. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is These are like radicals (both  $\sqrt{5}$ ), so add the coefficients:  $3 + 2 = 5$ , giving  $5\sqrt{5}$ . So the final answer is  $5\sqrt{5}$ .

12. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $200 = 100 \cdot 2$ , so  $\sqrt{200} = 10\sqrt{2}$ . So the final answer is  $10\sqrt{2}$ .

13. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $27 = 9 \cdot 3$ , so  $\sqrt{27} = 3\sqrt{3}$ . So the final answer is  $3\sqrt{3}$ .

14. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Combine under a single root:  $\sqrt{\frac{50}{2}} = \sqrt{25} = 5$ . So the final answer is 5.

15. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is The side of a square is the square root of its area:  $\sqrt{144} = 12$  feet. So the final answer is 12 ft.

16. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Side =  $\sqrt{50} = \sqrt{25 \cdot 2} = 5\sqrt{2}$  meters. So the final answer is  $5\sqrt{2}$  m.

17. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Side =  $\sqrt{32} = \sqrt{16 \cdot 2} = 4\sqrt{2}$  inches. So the final answer is  $4\sqrt{2}$  in.

18. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Side =  $\sqrt{18} = \sqrt{9 \cdot 2} = 3\sqrt{2}$  centimeters. So the final answer is  $3\sqrt{2}$  cm.



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