

Study Guide

Simplifying Radical Expressions

The product property of square roots and prime factorization can be used to simplify irrational square roots. When you simplify radical expressions with variables, use absolute values to ensure nonnegative results.

Example 1: Simplify $\sqrt{180}$.

$$\begin{aligned}\sqrt{180} &= \sqrt{2 \cdot 2 \cdot 3 \cdot 3 \cdot 5} \\ &= \sqrt{2 \cdot 2} \cdot \sqrt{3 \cdot 3} \cdot \sqrt{5} \\ &= 2 \cdot 3 \cdot \sqrt{5} \\ &= 6\sqrt{5}\end{aligned}$$

Example 2: Simplify $\sqrt{100a^2}$.

$$\begin{aligned}\sqrt{100a^2} &= \sqrt{100} \cdot \sqrt{a^2} \\ &= 10|a|\end{aligned}$$

Use the quotient property of square roots and a method called **rationalizing the denominator** when simplifying radical expressions involving division. Study the example below.

Example 3: Simplify $\sqrt{\frac{56}{45}}$.

$$\begin{aligned}\sqrt{\frac{56}{45}} &= \frac{\sqrt{56}}{\sqrt{45}} \\ &= \frac{2 \cdot \sqrt{14}}{3 \cdot \sqrt{5}} \\ &= \frac{2\sqrt{14}}{3\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}} = \frac{2\sqrt{70}}{15}\end{aligned}$$

Simplify. Leave in radical form and use absolute value symbols when necessary.

1. $\sqrt{18}$

2. $\sqrt{68}$

3. $\sqrt{60}$

4. $\sqrt{75}$

5. $\sqrt{162}$

6. $\sqrt{4a^2}$

7. $\sqrt{9x^4}$

8. $\sqrt{300a^4}$

9. $\sqrt{128c^6}$

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

11. $\sqrt{3x^2} \cdot 3\sqrt{3x^4}$

12. $4\sqrt{10} \cdot 3\sqrt{6}$

13. $\frac{\sqrt{9}}{\sqrt{18}}$

14. $\frac{\sqrt{8}}{\sqrt{24}}$

15. $\frac{\sqrt{x^6}}{\sqrt{y^4}}$

16. $\sqrt{100}$

17. $\frac{\sqrt{75}}{\sqrt{3}}$

18. $\frac{8\sqrt{2}}{2\sqrt{8}}$

19. $\frac{\sqrt{4}}{\sqrt[3]{5}}$

20. $\frac{\sqrt{8}}{2\sqrt{7} + 4\sqrt{10}}$