

Unit 11: Radicals and Sequences
Simplifying Radicals Class Notes

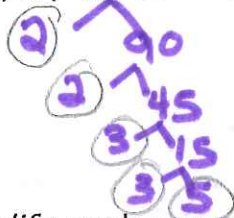
The expression under a radical sign is the radicand.

A radical expression is in simplest form when

- no radicands have perfect square factors other than 1. EX: $\sqrt{18} = \boxed{3\sqrt{2}}$
- no radicands contain fractions. EX: $\sqrt{\frac{1}{4}} = \boxed{\frac{1}{2}}$
- no radicals can appear in the denominator of a fraction. EX: $\frac{3}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \boxed{\frac{3\sqrt{2}}{2}}$

Product Property of Square Roots: For any numbers a and b , where $a \geq 0$ and $b \geq 0$, $\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$

Example: Simplify $\sqrt{180}$.
 $\sqrt{180} = \sqrt{2 \cdot 2 \cdot 3 \cdot 3 \cdot 5}$ prime factorization of 180
 $= \sqrt{2} \cdot \sqrt{3} \cdot \sqrt{5}$ product property of square roots
 $= 2 \cdot 3 \cdot \sqrt{5}$ Simplify
 $= 6\sqrt{5}$ Simplified square root!



Practice: Simplify each expression.

1. $\sqrt{18}$ $\boxed{3\sqrt{2}}$

2. $\sqrt{68}$ $\boxed{2\sqrt{17}}$

3. $\sqrt{75}$ $\boxed{5\sqrt{3}}$

4. $\sqrt{162}$ $\boxed{9\sqrt{2}}$

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Quotient Property of Square Roots: For any numbers a and b, where

$$a \geq 0 \text{ and } b \geq 0, \sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$$

Example 1: Simplify $\sqrt{\frac{3}{4}}$ \rightarrow $\sqrt{\frac{3}{4}} = \frac{\sqrt{3}}{\sqrt{4}}$ quotient property of square roots
 $= \frac{\sqrt{3}}{\sqrt{2 \cdot 2}}$ prime factor to simplify
 $= \frac{\sqrt{3}}{2}$ simplified square root!

Rationalize the Denominator

Example 2: Simplify $\frac{2}{\sqrt{7}}$ \rightarrow $\frac{2}{\sqrt{7}} = \frac{2 \cdot \sqrt{7}}{\sqrt{7} \cdot \sqrt{7}}$ Multiply by $\frac{\sqrt{7}}{\sqrt{7}}$ to make the denominator a rational number
 $= \frac{2\sqrt{7}}{7}$ simplified square root!

$\sqrt{7 \cdot 7}$

Practice: Simplify each expression

5. $\sqrt{\frac{18}{9}} = \sqrt{2}$

6. $\sqrt{\frac{5}{16}} = \frac{\sqrt{5}}{\sqrt{16}} = \frac{\sqrt{5}}{4}$

$\frac{\sqrt{18}}{\sqrt{9}} = \frac{3\sqrt{2}}{3} = \sqrt{2}$

$\sqrt{\frac{3}{25}} = \frac{\sqrt{3}}{\sqrt{25}} = \frac{\sqrt{3}}{5}$

7. $\frac{5}{\sqrt{15}} \cdot \frac{\sqrt{15}}{\sqrt{15}} = \frac{5\sqrt{15}}{\sqrt{15 \cdot 15}}$

8. $\frac{7}{\sqrt{13}} \cdot \frac{\sqrt{13}}{\sqrt{13}} = \frac{7\sqrt{13}}{\sqrt{13 \cdot 13}}$

$\frac{5\sqrt{15}}{15} = \frac{\sqrt{15}}{3}$

$\frac{7\sqrt{13}}{13}$

Rationalize the denominator