Algebra 2
Lesson Radicals Review

Geometrically, a square has four equal sides and the area of a square is the product of any two of its sides. Imagine being given the area of a square, 81 cm^2. What are the lengths of its sides? The answer can be found by going backwards from 81; that is what number times itself is 81? In this case, the sides are 9 cm long because $9 \cdot 9 = 81$.

In mathematical terms, we use a square root to find the length of a square's sides and use the operation "$\sqrt{}$", a radical sign to symbolize the "square root." The number inside a square root is sometimes called a **radicand** and the positive square root is called the **principal root**.

$$\sqrt{81} = 9 \longleftarrow \text{principal root}$$

radicand

There are two basic square root properties:

(a) **Product Property** of Square Roots states that the square root of a product is equal to the product of the square roots of the factors:

Examples: $\sqrt{20} = \sqrt{4 \cdot 5} = \sqrt{4} \cdot \sqrt{5} = 2\sqrt{5} \longrightarrow \sqrt{\boldsymbol{ab}} = \sqrt{\boldsymbol{a} \cdot \boldsymbol{b}} = \sqrt{\boldsymbol{a}} \cdot \sqrt{\boldsymbol{b}}$

$\sqrt{5} \cdot \sqrt{20} = \sqrt{5 \cdot 20} = \sqrt{100} = 10 \longrightarrow \sqrt{\boldsymbol{a}} \cdot \sqrt{\boldsymbol{b}}\sqrt{\boldsymbol{a} \cdot \boldsymbol{b}} = \sqrt{\boldsymbol{ab}}$

(b) **Quotient Property** of Square Roots states that the square root of a quotient is equal to the quotient of the square roots of the dividend and the divisor.

Examples: $\sqrt{\frac{9}{16}} = \frac{\sqrt{9}}{\sqrt{16}} = \frac{3}{4} \longrightarrow \sqrt{\frac{\boldsymbol{a}}{\boldsymbol{b}}} = \frac{\sqrt{\boldsymbol{a}}}{\sqrt{\boldsymbol{b}}}$

$\frac{\sqrt{8}}{\sqrt{2}} = \sqrt{\frac{8}{2}} = \sqrt{4} = 2 \longrightarrow \frac{\sqrt{\boldsymbol{a}}}{\sqrt{\boldsymbol{b}}} = \sqrt{\frac{\boldsymbol{a}}{\boldsymbol{b}}}$

Square roots that have the same radicand are called **like radical terms**, and they may be added together like coefficients and variables**.**

Example: $4\sqrt{5}$ and $2\sqrt{5}$ are like radicals so: $4\sqrt{5} + 2\sqrt{5} = 6\sqrt{5}$.

To **rationalize a denominator** simply means to make the denominator into an integer by multiplying with an identical square root. For example: $\frac{2}{\sqrt{3}} = \frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$.

We can simplify square roots by using the above described concepts.

Simplify: $\sqrt{54}$ $\bigwedge$ 9×6 $\bigwedge$ 3×3 $3\sqrt{6}$	1. Break down into factors, look for perfect square factors. 2. Remember that for 2 under the roof, 1 comes out. 3. Single numbers stay under the roof.