Simplifying Square Roots

Vocabulary:
- **radical symbol** - $\left(\sqrt{}\right)$

- **radicand** - the number or expression under the radical symbol

- **principal root** – the positive square root of a number

  To indicate both the positive and negative square roots of a number, use the plus or minus sign (±). $\pm\sqrt{25} = \pm5 = 5 \text{ or } -5$

- **Irrational Numbers** - Square roots of integers that are not perfect squares

$$\sqrt{2} \quad \sqrt{3} \quad \sqrt{5}$$

First 15 Perfect Squares:

$$\sqrt{1} = 1 \qquad \sqrt{25} = 5 \qquad \sqrt{81} = 9 \qquad \sqrt{169} = 13$$
$$\sqrt{4} = 2 \qquad \sqrt{36} = 6 \qquad \sqrt{100} = 10 \quad \sqrt{196} = 14$$
$$\sqrt{9} = 3 \qquad \sqrt{49} = 7 \qquad \sqrt{121} = 11 \quad \sqrt{225} = 15$$
$$\sqrt{16} = 4 \qquad \sqrt{64} = 8 \qquad \sqrt{144} = 12$$

Properties of Square Roots

For $a \geq 0$ and $b > 0$,

WORDS	NUMBERS	ALGEBRA
Product Property of Square Roots The square root of a product is equal to the product of the square roots of the factors.	$\sqrt{12} = \sqrt{4 \cdot 3}$ $= \sqrt{4} \cdot \sqrt{3} = 2\sqrt{3}$ $\sqrt{8} \cdot \sqrt{2} = \sqrt{8 \cdot 2}$ $= \sqrt{16} = 4$	$\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$ $\sqrt{a} \cdot \sqrt{b} = \sqrt{ab}$

- **Notes:**
  The property can be used to:
  - combine quantities under the radical symbol
  - separate them for the purpose of simplifying square-root expressions

- A square root expression is in simplest form when the radicand has no perfect-square factors (except 1)

Guided Example 1:

Process:
1. **Find factors of the radicand that are perfect squares**

2. **Rewrite the radicand as the product of a perfect square factor & another factor**

3. **Take the square root of the perfect square**

$\sqrt{32}$

$\sqrt{16 * 2}$

$4\sqrt{2}$

Factors:
1 * 32
2 * **16**

Guided Example 2:

$2\sqrt{98}$

$2\sqrt{49 * 2}$

$2 * 7\sqrt{2}$

$14\sqrt{2}$

Factors:
1 * 98
2 * **49**

Guided Example 3:

$\sqrt{288}$

$\sqrt{144 * 2}$

$12\sqrt{2}$

Factors:
1 * 288
2 * **144**