

Simplify

Add &
subtract

Multiply

~~Divide~~

Simplifying Square Roots with Operations

How do you **SIMPLIFY** square roots?

- Rewrite as the product of the largest perfect square that the radicand is divisible by and some other factor. Evaluate the perfect square and keep the other factor inside the square root.

Example 1:

$$\begin{aligned} &\sqrt{300} \\ &= \sqrt{100} \cdot \sqrt{3} \\ &= \mathbf{(10\sqrt{3})} \end{aligned}$$

Example 2:

$$\begin{aligned} &\sqrt{99} \\ &= \sqrt{9} \cdot \sqrt{11} \\ &= \mathbf{(3\sqrt{11})} \end{aligned}$$

Example 3:

$$\begin{aligned} &\sqrt{162} \\ &= \sqrt{81} \cdot \sqrt{2} \\ &= \mathbf{(9\sqrt{2})} \end{aligned}$$

How do you **ADD & SUBTRACT** square roots?

- If the radicands (# under the radical) are the same, combine like terms by adding or subtracting the coefficients and keep the radicand.

- 1.) Simplify all radicals
- 2.) Then +/− the simplified radicals

Example 4:

$$\begin{aligned} &3\sqrt{6} + 8\sqrt{6} \\ &= (3 + 8)\sqrt{6} \\ &= \mathbf{(11\sqrt{6})} \end{aligned}$$

Example 5:

$$\begin{aligned} &2\sqrt{7} + 9\sqrt{3} - 8\sqrt{7} \\ &= (2 - 8)\sqrt{7} + 9\sqrt{3} \\ &= \mathbf{(-6\sqrt{7} + 9\sqrt{3})} \end{aligned}$$

Example 6:

$$\begin{aligned} &5\sqrt{3} - \sqrt{27} \\ &= 5\sqrt{3} - \sqrt{9} \cdot \sqrt{3} \\ &= 5\sqrt{3} - 3\sqrt{3} \\ &= \mathbf{(2\sqrt{3})} \end{aligned}$$

★ How do you **MULTIPLY** square roots?

- Multiply the radicands together under one radical.
- Simplify, if possible. If there are any numbers outside the square root, keep them outside.

- 1.) Multiply the radicands together
- 2.) Multiply the coefficients together
- 3.) Simplify the radical.

Example 7:

$$\begin{aligned} &\sqrt{5} \cdot \sqrt{20} \\ &= \sqrt{5 \cdot 20} \\ &= \sqrt{100} \\ &= \mathbf{(10)} \end{aligned}$$

Example 8:

$$\begin{aligned} &\sqrt{8} \cdot 7\sqrt{8} \\ &= 7\sqrt{8 \cdot 8} \\ &= 7\sqrt{64} \\ &= 7 \cdot 8 \\ &= \mathbf{(56)} \end{aligned}$$

Example 9:

$$\begin{aligned} &7\sqrt{2} \cdot 3\sqrt{18} \\ &= 7 \cdot 3\sqrt{2 \cdot 18} \\ &= 21\sqrt{36} \\ &= 21 \cdot 6 \\ &= \mathbf{(126)} \end{aligned}$$

How do you **DIVIDE** square roots?

- Separate the numerator and denominator under their own radical. Simplify each square root, separately.

Example 10:

$$\begin{aligned} &\sqrt{\frac{25}{49}} = \frac{\sqrt{25}}{\sqrt{49}} \\ &= \mathbf{\left(\frac{5}{7}\right)} \end{aligned}$$

Example 11:

$$\begin{aligned} &\sqrt{\frac{72}{4}} = \frac{\sqrt{72}}{\sqrt{4}} \\ &= \frac{\sqrt{36} \cdot \sqrt{2}}{2} \\ &= \frac{6\sqrt{2}}{2} = \mathbf{(3\sqrt{2})} \end{aligned}$$

Example 12:

$$\begin{aligned} &\sqrt{\frac{80}{81}} = \frac{\sqrt{80}}{\sqrt{81}} \\ &= \frac{\sqrt{16} \cdot \sqrt{5}}{9} \\ &= \mathbf{\left(\frac{4\sqrt{5}}{9}\right)} \end{aligned}$$