

Lesson Two Purpose

Algebra Body of Knowledge

Standard 6: Radical Expressions and Equations

- MA.912.A.6.2
Add, subtract, multiply and divide radical expressions (square roots and higher).

Add and Subtract Radical Expressions

We can add or subtract radical expressions only when those radical expressions match. For instance,

$$5\sqrt{2} + 6\sqrt{2} = 11\sqrt{2}.$$

Notice that we did not change the $\sqrt{2}$'s. We simply added the **coefficients** because they had matching radical parts.



Remember: *Coefficients* are any factor in a **term**. Usually, but not always, a coefficient is a number instead of a **variable** or a *radical*.

The same is true when we subtract radical expressions.

$$5\sqrt{7} - 3\sqrt{7} = 2\sqrt{7}$$

At first glance, it may sometimes appear that there are no matching numbers under the radical sign. But, if we **simplify** the expressions, we often find radical expressions that we can add or subtract.

Look at this example.

$$3\sqrt{8} + 5\sqrt{2} - 4\sqrt{32}$$

Notice that $\sqrt{8}$ and $\sqrt{32}$ each have perfect square factors and can be simplified. Follow the simplification process step by step and see what happens.

$$3\sqrt{8} + 5\sqrt{2} - 4\sqrt{32} =$$

$$3\sqrt{4}\sqrt{2} + 5\sqrt{2} - 4\sqrt{16}\sqrt{2} =$$

↖ We *found* the perfect square factors of $\sqrt{8}$ and $\sqrt{32}$ and rewrote the problem.

$$3 \cdot 2\sqrt{2} + 5\sqrt{2} - 4 \cdot 4\sqrt{2} =$$

← Next, we *simplified* the perfect square roots.

$$6\sqrt{2} + 5\sqrt{2} - 16\sqrt{2} =$$

↖ We *multiplied* the new factors for each coefficient.

$$-5\sqrt{2}$$

← Finally, we *add and subtract* matching radical expressions, in order, from *left to right*.

When Radical Expressions Don't Match or Are Not in Radical Form

What happens when radical expressions don't match, or there is a number that is not in radical form? Just follow the steps on the previous pages and leave your answer, with appropriate terms in descending order. Watch this!

$$\begin{aligned}\sqrt{75} + \sqrt{27} - \sqrt{16} + \sqrt{80} &= \\ \sqrt{25}\sqrt{3} + \sqrt{9}\sqrt{3} - 4 + \sqrt{16}\sqrt{5} &= \\ 5\sqrt{3} + 3\sqrt{3} - 4 + 4\sqrt{5} &= \\ 8\sqrt{3} - 4 + 4\sqrt{5} &= \\ 8\sqrt{3} + 4\sqrt{5} - 4 &\longleftarrow \text{rewritten in descending order}\end{aligned}$$