Adding and Subtracting Radical Expressions

In this section we will learn how to add and subtract radical expressions. Radical expressions can be added or subtracted only if the radical is the same. Consider the following expression:

$$\mathbf{2\sqrt{5} + 6\sqrt{5}}$$

Because $\sqrt{5}$ is a common factor of both terms we can factor it out to get:

$$\mathbf{2\sqrt{5} + 6\sqrt{5} = (2 + 6)\sqrt{5} = 8\sqrt{5}}$$

Now consider the following expression:

$$\mathbf{5\sqrt{6} - 2\sqrt{3}}$$

Because the radical expressions are not the same, we can not simplify this further.

Check yourself:

In exercises below, add or subtract radical expressions as indicated:

1) $5\sqrt{7} - 2\sqrt{7}$

2) $14\sqrt[4]{12} + 5\sqrt[4]{12}$

3) $5\sqrt{11} - 4\sqrt{11} - 3\sqrt{11}$

Answers:

1) $3\sqrt{7}$

2) $19\sqrt[4]{12}$

3) $-2\sqrt{11}$

Sometimes before adding or subtracting radical expressions we need to first simplify them to make the radicals the same. Consider the following expression:

$$\mathbf{4\sqrt{45} - 5\sqrt{12}}$$

At first it looks like it is impossible to perform the subtraction because the expressions under the radicals are not the same; however, if we simplify them like we learned in Section 3.3 we get:

$$\mathbf{4\sqrt{45} - 5\sqrt{20}}$$

$$\mathbf{4 \cdot \sqrt{9} \cdot \sqrt{5} - 5 \cdot \sqrt{4} \cdot \sqrt{5}}$$

$$\mathbf{4 \cdot 3 \cdot \sqrt{5} - 5 \cdot 2 \cdot \sqrt{5}}$$

$$\mathbf{12\sqrt{5} - 10\sqrt{5}}$$

$$\mathbf{2\sqrt{5}}$$

Check yourself:

In exercises below, add or subtract radical expressions as indicated:

4) $8\sqrt{75} - 4\sqrt{27}$

5) $4\sqrt{8} + 2\sqrt{32}$

6) $7\sqrt{80} - 5\sqrt{45} - 6\sqrt{20}$

Answers:

4) $28\sqrt{3}$

5) $16\sqrt{2}$

6) $\sqrt{5}$