Lesson Three 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).

Multiply and Divide Radical Expressions

Radical expressions *don't* have to match when we multiply or divide them. The following examples show that we simply multiply or divide the **digits** under the radical signs and then simplify our results, if possible.

Example 1

$$\sqrt{5} \times \sqrt{6} = \sqrt{30}$$

Example 2

$$\sqrt{8} \times \sqrt{3} = \sqrt{24} = \sqrt{4}\sqrt{6} = 2\sqrt{6}$$

Example 3

$$\sqrt{18} \times \sqrt{2} = \sqrt{36} = 6$$

Example 4

$$\frac{\sqrt{12}}{\sqrt{3}} = \sqrt{4} = 2$$

Example 5

$$\frac{\sqrt{20}}{\sqrt{10}} = \sqrt{2}$$

Example 6

$$\frac{\sqrt{8}}{\sqrt{24}} = \frac{\sqrt{1}}{\sqrt{3}} \quad \text{(we must simplify this)} \rightarrow \frac{\sqrt{1}}{\sqrt{3}} \bullet \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}}{\sqrt{9}} = \frac{\sqrt{3}}{3}$$

After studying the examples above, try the following practice.

Working with a Coefficient for the Radical

What happens when there is a coefficient for the *radical*? It is important to multiply or divide the radical numbers together separately from the coefficients. Then simplify each answer. Look at the following examples.

Example 1

multiply coefficients
$3 \cdot 5 = 15$

$$3\sqrt{7} \cdot 5\sqrt{2} = 15\sqrt{14}$$

multiply radicands
$\sqrt{7} \cdot \sqrt{2} = \sqrt{14}$

Example 2

$$6\sqrt{3} \cdot \sqrt{3} = 6\sqrt{9} = 6 \cdot 3 = 18$$

Remember: If there is *no* written coefficient, then it is understood to be a 1.

Example 3

$$\frac{2\sqrt{14}}{6\sqrt{7}} = \frac{1\sqrt{2}}{3} = \frac{\sqrt{2}}{3}$$

Example 4

$$\frac{12\sqrt{5}}{6\sqrt{10}} = \frac{2}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{2\sqrt{2}}{\sqrt{4}} = \frac{2\sqrt{2}}{2} = \sqrt{2}$$

Example 5

$$\frac{\sqrt{6} - \sqrt{12}}{\sqrt{3}} = \frac{\sqrt{6}}{\sqrt{3}} - \frac{\sqrt{12}}{\sqrt{3}} = \sqrt{2} - \sqrt{4} = \sqrt{2} - 2$$

Now it's time to practice on the following page.