Multiplying Square Roots

Objectives: 1. to multiply a monomial numerical radical expression by another monomial numerical radical expression

2. to multiply a monomial numerical radical expression by a binomial containing numerical radicals

Using the Product Property of Square Roots, we can multiply $\sqrt{2}\sqrt{3} = \sqrt{6}$
Since the number 6 does not contain any factor that is a perfect square other than "1," this is simplified.

If we multiply $3\sqrt{6}$, we get 18, which must then be simplified because 18 contains the factor 9, which is a perfect square. Continuing,

$$\begin{aligned}\sqrt{3}\sqrt{6} &= \sqrt{18}\\ &= \sqrt{9}\sqrt{2}\\ &= 3\sqrt{2}\end{aligned}$$

Example 1: $\sqrt{5}\sqrt{5} = \sqrt{25} = 5$ Also, keep in mind what a square root *is*. The square root of 5 is that number, which when multiplied by itself, yields 5. That is, $\sqrt{5} \cdot \sqrt{5} = 5$.

Example 2: $\sqrt{6}\sqrt{15} = \sqrt{90} = \sqrt{9}\sqrt{10} = 3\sqrt{10}$

Example 3: $\sqrt{7}\sqrt{28} = \sqrt{196} = 14$

When we multiply a monomial times a polynomial, we distribute the monomial to each term in the polynomial. Therefore,

$$\begin{aligned}\sqrt{2}\left(\sqrt{3}+\sqrt{6}\right) &= \sqrt{2}\sqrt{3}+\sqrt{2}\sqrt{6}\\ &= \sqrt{6}+\sqrt{12}\\ &= \sqrt{6}+\sqrt{4}\sqrt{3}\\ &= \sqrt{6}+2\sqrt{3}\end{aligned}$$

This is the simplified answer. Remember that you cannot add or subtract unlike radicals.

Example 4: $\sqrt{3}\left(\sqrt{21}+\sqrt{3}\right)=\sqrt{3}\sqrt{21}+\sqrt{3}\sqrt{3}$

$=\sqrt{63}+\sqrt{9}$

$=\sqrt{9}\sqrt{7}+\sqrt{9}$

$=3\sqrt{7}+3$

Example 5: $\sqrt{2}\left(\sqrt{2}-\sqrt{5}\right)=\sqrt{2}\sqrt{2}-\sqrt{2}\sqrt{5}$

$=\sqrt{4}-\sqrt{10}$

$=2-\sqrt{10}$

Example 6: $\sqrt{3}\left(\sqrt{27}-\sqrt{12}\right)=\sqrt{3}\sqrt{27}-\sqrt{3}\sqrt{12}$

$=\sqrt{81}-\sqrt{36}$

$=9-6$

$=3$

Exercises:

$\sqrt{9}\sqrt{4}$ 1.

$\sqrt{8}\sqrt{32}$ 2.

$\sqrt{6}\sqrt{10}$ 3.

$\sqrt{27}\sqrt{50}$

5. 5. $\sqrt{5}\left(\sqrt{3}+\sqrt{7}\right)$ 6. 6.

$\sqrt{7}\left(\sqrt{10}+\sqrt{21}\right)$ 7.

$\sqrt{3}\left(\sqrt{24}-\sqrt{3}\right)$ 8.

$\sqrt{8}\left(\sqrt{6}+\sqrt{18}\right)$ 9.

$\sqrt{5}\left(\sqrt{15}-\sqrt{10}\right)$ 10.

$\sqrt{2}\left(\sqrt{8}-\sqrt{32}\right)$

Answers:

1. 6

2. 16

3. 4. $2\sqrt{15}$

4. $15\sqrt{6}$

$\sqrt{15}+\sqrt{35}$

7. $\sqrt{70}+7\sqrt{3}$

8. $6\sqrt{2}-3$

9. $4\sqrt{3}+12$

10. $5\sqrt{3}-5\sqrt{2}$

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