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 $\sqrt{3}\sqrt{6}$, we get $\sqrt{18}$, 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: $\begin{aligned}\sqrt{6}\sqrt{15} &= \sqrt{90} \\ &= \sqrt{9}\sqrt{10} \\ &= 3\sqrt{10}\end{aligned}$

Example 3: $\begin{aligned}\sqrt{7}\sqrt{28} &= \sqrt{196} \\ &= 14\end{aligned}$

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:		**Answers:**	
1.	$\sqrt{9}\sqrt{4}$	1.	6
2.	$\sqrt{8}\sqrt{32}$	2.	16
3.	$\sqrt{6}\sqrt{10}$	3.	$2\sqrt{15}$
4.	$\sqrt{27}\sqrt{50}$	4.	$15\sqrt{6}$
5.	$\sqrt{5}\left(\sqrt{3}+\sqrt{7}\right)$	5.	$\sqrt{15}+\sqrt{35}$
6.	$\sqrt{7}\left(\sqrt{10}+\sqrt{21}\right)$	6.	$\sqrt{70}+7\sqrt{3}$
7.	$\sqrt{3}\left(\sqrt{24}-\sqrt{3}\right)$	7.	$6\sqrt{2}-3$
8.	$\sqrt{8}\left(\sqrt{6}+\sqrt{18}\right)$	8.	$4\sqrt{3}+12$
9.	$\sqrt{5}\left(\sqrt{15}-\sqrt{10}\right)$	9.	$5\sqrt{3}-5\sqrt{2}$
10.	$\sqrt{2}\left(\sqrt{8}-\sqrt{32}\right)$	10.	-4