**3.4 - Operations with Radicals**

MCR3U Name:

**Goals:**

* Identify what a radical, mixed radical, and entire radical are.
* Reduce and simplify a single radical
* Multiply mixed and entire radicals (using the distributive property for polynomials)
* Add and Subtract Radicals

A radical is a square, cube or higher root. Ex:

The radical symbol is:

An entire radical is a radical with coefficient 1, such as:

A mixed radical is a radical with coefficient other than 1, such as:

|  |  |
| --- | --- |
| $\sqrt{4}×\sqrt{4}=$ $\sqrt{81}×\sqrt{81}=$ $\sqrt{225}×\sqrt{225}=$ $\sqrt{25}×\sqrt{4}=$ $\sqrt{12}×\sqrt{9}=$ $\sqrt{23}×\sqrt{121}=$   | $\sqrt{4×4}=$ $\sqrt{81×81}=$ $\sqrt{225×225}= $ $\sqrt{25×4}=$ $\sqrt{12×9}=$ $\sqrt{23×121}=$   |

What do you notice about the result in each row? What conclusion can you make about your observations?

**Properties of Radicals:**

**Reducing/Simplifying a Radical**

Steps:

1. Find the largest perfect square that is a factor of the # under the radical sign
2. Write the # under the radical as a product of the perfect square
3. Give each number under the radical its own radical sign
4. Reduce the perfect square radical

Ex. Simplify:

1. $\sqrt{8}$ b) $\sqrt{50}$ c) $\sqrt{180}$

**Multiplying Radicals**

Strategy:

Multiply as though a radical were a variable. For example, consider how you would multiply $(2x)(3y)$ and compare to example a) below.

Ex. Simplify fully:

1. $\left(2\sqrt{3}\right)\left(3\sqrt{6}\right)$ b) $2\sqrt{3}\left(4+5\sqrt{3}\right)$ c) $\left(2\sqrt{2}+3\sqrt{3}\right)(2\sqrt{2}-3\sqrt{3})$

**Adding and Subtracting Radicals**

**Like Radicals:** radicals that have the same # under the radical symbol.

Only like radicals can be added or subtracted from each other. You can NOT combine radicals that do not simplify to have the same value under the radical.

**Property:**

Example. Simplify:

1. $9\sqrt{7}-3\sqrt{7}$ b) $5\sqrt{8}+3\sqrt{18}-2\sqrt{2}$