

Adding and Subtracting Radicals

When we are adding and subtracting radicals we have to be VERY CAREFUL. Adding and subtracting radicals is like adding and subtracting x's or y's—we cannot combine them if they are not alike.

Example: $4x + 2x = 6x$ ***Notice how the coefficient changes, but not the x.

$4\sqrt{3} + 2\sqrt{3} = 6\sqrt{3}$ ***Notice how the coefficient changes, but not the root

$4x + 5y$ cannot be simplified $4\sqrt{2} + 5\sqrt{3}$...cannot be simplified

RADICAL RULE #1: Only "like" radicals can be added and subtracted.

Let's practice adding "Like Radicals"

1. $2\sqrt{5} + 6\sqrt{5}$

$8\sqrt{5}$

2. $4\sqrt{3} - 7\sqrt{3}$

$-3\sqrt{3}$

4. $5\sqrt{10} + 8\sqrt{10} - \sqrt{5}$

$13\sqrt{10} - \sqrt{5}$

4. $7\sqrt{15} - 6\sqrt{3} + 8\sqrt{15} + 2\sqrt{3}$

$15\sqrt{15} - 4\sqrt{3}$

5. $11\sqrt{30} + \sqrt{6} + \sqrt{6} - 12\sqrt{30}$

$-\sqrt{30} + 2\sqrt{6}$

6. $12\sqrt{6} - 8\sqrt{6}$

$4\sqrt{6}$

7. $3\sqrt{7} - 5\sqrt{7} + 2\sqrt{7}$

0

8. $\sqrt{2} + \sqrt{2} - 8\sqrt{5}$

$2\sqrt{2} - 8\sqrt{5}$

Sometimes we will have to use factor trees to see if we have "LIKE RADICALS".

RADICAL RULE #2: Always simplify your radicals before you add or subtract.

$$1. 8\sqrt{5} + \sqrt{125}$$

$\begin{array}{c} 25 \text{ } 5 \\ \wedge \\ 5 \text{ } 5 \\ \wedge \\ 5 \text{ } 5 \end{array}$

$$8\sqrt{5} + 5\sqrt{5}$$

$$\boxed{13\sqrt{5}}$$

$$2. \sqrt{20} - \sqrt{150}$$

$\begin{array}{c} 4 \text{ } 5 \\ \wedge \\ 2 \text{ } 2 \\ \wedge \\ 2 \text{ } 2 \end{array} \quad \begin{array}{c} 25 \text{ } 6 \\ \wedge \\ 5 \text{ } 5 \\ \wedge \\ 5 \text{ } 5 \end{array}$

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

$$\boxed{2\sqrt{5} - 5\sqrt{6}}$$

$$3. 2\sqrt{2} - \sqrt{27} + \sqrt{200}$$

$\begin{array}{c} 3 \text{ } 9 \\ \wedge \\ 3 \text{ } 3 \\ \wedge \\ 3 \text{ } 3 \end{array} \quad \begin{array}{c} 100 \text{ } 2 \\ \wedge \\ 10 \text{ } 10 \\ \wedge \\ 10 \text{ } 10 \end{array}$

$$2\sqrt{2} - 3\sqrt{3} + 10\sqrt{2}$$

$$\boxed{12\sqrt{2} - 3\sqrt{3}}$$

$$4. \sqrt{8} + \sqrt{18} - 12\sqrt{2}$$

$\begin{array}{c} 4 \text{ } 2 \\ \wedge \\ 2 \text{ } 2 \\ \wedge \\ 2 \text{ } 2 \end{array} \quad \begin{array}{c} 9 \text{ } 2 \\ \wedge \\ 3 \text{ } 3 \\ \wedge \\ 3 \text{ } 3 \end{array}$

$$2\sqrt{2} + 3\sqrt{2} - 12\sqrt{2}$$

$$\boxed{-7\sqrt{2}}$$

$$5. \sqrt{27} + \sqrt{50} - \sqrt{243}$$

$\begin{array}{c} 9 \text{ } 3 \\ \wedge \\ 3 \text{ } 3 \\ \wedge \\ 3 \text{ } 3 \end{array} \quad \begin{array}{c} 25 \text{ } 2 \\ \wedge \\ 5 \text{ } 5 \\ \wedge \\ 5 \text{ } 5 \end{array} \quad \begin{array}{c} 81 \text{ } 3 \\ \wedge \\ 9 \text{ } 9 \\ \wedge \\ 9 \text{ } 9 \end{array}$

$$3\sqrt{3} + 5\sqrt{2} - 9\sqrt{3}$$

$$\boxed{-6\sqrt{3} + 5\sqrt{2}}$$

$$6. 2\sqrt{20} + 6\sqrt{5} - \sqrt{80}$$

$\begin{array}{c} 5 \text{ } 4 \\ \wedge \\ 2 \text{ } 2 \\ \wedge \\ 2 \text{ } 2 \end{array} \quad \begin{array}{c} 16 \text{ } 5 \\ \wedge \\ 4 \text{ } 4 \\ \wedge \\ 4 \text{ } 4 \end{array}$

$$2 \cdot 2\sqrt{5}$$

$$4\sqrt{5} + 6\sqrt{5} - 4\sqrt{5}$$

$$\boxed{6\sqrt{5}}$$

$$7. \sqrt{63} - \sqrt{25} + \sqrt{175} - \sqrt{16}$$

$\begin{array}{c} 9 \text{ } 7 \\ \wedge \\ 3 \text{ } 3 \\ \wedge \\ 3 \text{ } 3 \end{array} \quad \begin{array}{c} 25 \text{ } 7 \\ \wedge \\ 5 \text{ } 5 \\ \wedge \\ 5 \text{ } 5 \end{array}$

$$3\sqrt{7} - 5 + 5\sqrt{7} - 4$$

$$\boxed{8\sqrt{7} - 9}$$

$$8. \sqrt{36} - \sqrt{49} + \sqrt{18} - 2\sqrt{27}$$

$\begin{array}{c} 9 \text{ } 2 \\ \wedge \\ 3 \text{ } 3 \\ \wedge \\ 3 \text{ } 3 \end{array} \quad \begin{array}{c} 9 \text{ } 3 \\ \wedge \\ 3 \text{ } 3 \\ \wedge \\ 3 \text{ } 3 \end{array}$

$$6 - 7 + 3\sqrt{2} - 2 \cdot 3\sqrt{3}$$

$$6 - 7 + 3\sqrt{2} - 6\sqrt{3}$$

$$\boxed{-1 + 3\sqrt{2} - 6\sqrt{3}}$$

$$9. 9\sqrt{2} + 4\sqrt{12} - 3\sqrt{8}$$

$\begin{array}{c} 4 \text{ } 3 \\ \wedge \\ 2 \text{ } 2 \\ \wedge \\ 2 \text{ } 2 \end{array} \quad \begin{array}{c} 4 \text{ } 2 \\ \wedge \\ 2 \text{ } 2 \\ \wedge \\ 2 \text{ } 2 \end{array}$

$$9\sqrt{2} + 4 \cdot 2\sqrt{3} - 3 \cdot 2\sqrt{2}$$

$$9\sqrt{2} + 8\sqrt{3} - 6\sqrt{2}$$

$$\boxed{3\sqrt{2} + 8\sqrt{3}}$$