4.2 Adding and Subtracting Radicals

Very Important: To add or subtract we must have like radicals

→ like radicals have same index and same radicand (the number in front of radical does not matter)

Ex: $3\sqrt{2}$ $5\sqrt{2}$ $17\sqrt{2}$ $-\frac{1}{2}\sqrt{2}$ $\frac{3}{4}\sqrt{2}$

are all like radicals

Ex: $5\sqrt{2}$ and $5\sqrt[3]{2}$ are not like radicals

Ex: $7\sqrt{3}$ and $7\sqrt{2}$ are not like radicals

If we do have like radicals, we think of the radical part as a variable (object) and add or subtract the numbers in front (coefficients)

Ex: $7\sqrt{2} + 5\sqrt{2} = 12\sqrt{2}$ (Do not add the radicands.)

$(7+5)\sqrt{2}$

Ex: $8\sqrt[3]{5} - 4\sqrt[3]{5} = 4\sqrt[3]{5}$

Sometimes we may have some like radicals, but not all. Group the like radicals and add/subtract those.

Ex: $4\sqrt{3} + 2\sqrt{5} - 3\sqrt{3}$

$= 4\sqrt{3} - 3\sqrt{3} + 2\sqrt{5}$

$= 1\sqrt{3} + 2\sqrt{5}$

$= \sqrt{3} + 2\sqrt{5}$

Ex: $3\sqrt{2} + 5\sqrt{3} - 2\sqrt{2} - 7\sqrt{3}$

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

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

Sometimes it may appear as though we do not have like terms but we may be able to simplify the individual radicals

Ex: $\sqrt{48} + \sqrt{75}$ (not like terms)

$\sqrt{16 \cdot 3} + \sqrt{25 \cdot 3}$

$4\sqrt{3} + 5\sqrt{3}$ (like terms)

$9\sqrt{3}$

Ex: $\frac{1}{2}\sqrt{40} - 5\sqrt{28} + \frac{2}{3}\sqrt{360} - \frac{1}{3}\sqrt{63}$

$\frac{1}{2}\sqrt{4 \cdot 10} - 5\sqrt{4 \cdot 7} + \frac{2}{3}\sqrt{36 \cdot 10} - \frac{1}{3}\sqrt{9 \cdot 7}$

$\frac{1}{2} \cdot 2\sqrt{10} - 5 \cdot 2\sqrt{7} + \frac{2}{3} \cdot 6\sqrt{10} - \frac{1}{3} \cdot 3\sqrt{7}$

$1\sqrt{10} - 10\sqrt{7} + 4\sqrt{10} - 1\sqrt{7}$

$1\sqrt{10} + 4\sqrt{10} - 10\sqrt{7} - 1\sqrt{7}$

$5\sqrt{10} - 11\sqrt{7}$

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