

Adding and Subtracting Radicals

Example 1:

Evaluate:

a.) $\sqrt{3} + 2\sqrt{3}$

Since these terms are **like terms**, we simply add.

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

b.) $4\sqrt{2} + \sqrt{8}$

Since these terms are **NOT** like terms, we cannot combine them. We need to simplify each term completely to make sure they can't be written as like terms. If they can, then we will add!

$$\begin{aligned}4\sqrt{2} + \sqrt{8} &= 4\sqrt{2} + \sqrt{4 \cdot 2} \\ &= 4\sqrt{2} + \sqrt{4} \cdot \sqrt{2} \\ &= 4\sqrt{2} + 2\sqrt{2}\end{aligned}$$

Now they are like terms!

$$= 6\sqrt{2}$$

$$c.) \quad 5\sqrt{7} - 2\sqrt{28} + 6\sqrt{63}$$

We need to simplify each term except for $5\sqrt{7}$ as it cannot be further simplified.

$$\begin{aligned} 2\sqrt{28} &= 2\sqrt{4 \cdot 7} \\ &= 2\sqrt{4} \cdot \sqrt{7} \\ &= 2 \cdot 2\sqrt{7} \\ &= 4\sqrt{7} \end{aligned}$$

$$\begin{aligned} 6\sqrt{63} &= 6\sqrt{9 \cdot 7} \\ &= 6 \cdot \sqrt{9} \cdot \sqrt{7} \\ &= 6 \cdot 3\sqrt{7} \\ &= 18\sqrt{7} \end{aligned}$$

So our problem becomes:

$$\begin{aligned} &5\sqrt{7} - 4\sqrt{7} + 18\sqrt{7} \\ &= \sqrt{7} + 18\sqrt{7} \\ &= \boxed{19\sqrt{7}} \end{aligned}$$

$$d.) \quad 2\sqrt{125x^2z} + 8x\sqrt{80z}$$

$$\begin{aligned} &= 2\sqrt{25 \cdot 5 \cdot x^2 \cdot z} + 8x\sqrt{16 \cdot 5 \cdot z} \\ &= 2\sqrt{25} \cdot \sqrt{5} \cdot \sqrt{x^2} \cdot \sqrt{z} + 8x \cdot 4 \cdot \sqrt{5} \cdot \sqrt{z} \\ &= 2 \cdot 5 \cdot \sqrt{5} \cdot x \cdot \sqrt{z} + 8x \cdot 4 \cdot \sqrt{5} \cdot \sqrt{z} \\ &= 10x\sqrt{5z} + 32x\sqrt{5z} \\ &= \boxed{42x\sqrt{5z}} \end{aligned}$$

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Practice Problems

Evaluate

1. $4\sqrt{5} + \sqrt{5} - 2\sqrt{5}$

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

3. $\sqrt{2x^2} + 3x\sqrt{50}$

4. $\sqrt{20x^2} - 3x\sqrt{5}$