Lesson #3 Adding and Subtracting Radical Expressions

In order to add and subtract radical expressions, the radicands must be alike. This is exactly like combining like terms! The only thing that changes is the coefficient of the radical.

Example 1

Simplify $3\sqrt{11} + 6\sqrt{11} - 2\sqrt{11}$.

$$7\sqrt{11}$$

Example 2

Simplify $9\sqrt{7} - 4\sqrt{2} + 3\sqrt{2} + 5\sqrt{7}$.

$$14\sqrt{7} - \sqrt{2}$$

Example 3

Simplify $8\sqrt{3} - 9\sqrt{6} - 7\sqrt{6} + 1\sqrt{3}$.

$$9\sqrt{3} - 16\sqrt{6}$$

Example 4

Simplify $-2\sqrt{8} + 5\sqrt{48} - 3\sqrt{32}$.

$$-2\sqrt{2\cdot 2\cdot 2} + 5\sqrt{2\cdot 2\, 2\cdot 2\, 3} - 3\sqrt{2\cdot 2\, 2\cdot 2\cdot 2}$$

$$-4\sqrt{2} \quad + \quad 20\sqrt{3} \quad -12\sqrt{2}$$

$$-16\sqrt{2} \quad + \quad 20\sqrt{3}$$

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2|8    2|48    2|32
2|4    2|24    2|16
  2    2|12    2|8
       2|6     2|4
         3       2
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Example 5

Simplify $4\sqrt{27} - 2\sqrt{48} + 2\sqrt{20}$.

$$4\sqrt{3\cdot 3\cdot 3} - 2\sqrt{2\cdot 2\, 2\cdot 2\, 3} + 2\sqrt{2\cdot 2\cdot 5}$$

$$12\sqrt{3} \quad - \quad 8\sqrt{3} \quad + 4\sqrt{5}$$

$$4\sqrt{3} \quad + \quad 4\sqrt{5}$$

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3|27   2|48    2|20
3|9    2|24    2|10
  3    2|12      5
       2|6
         3
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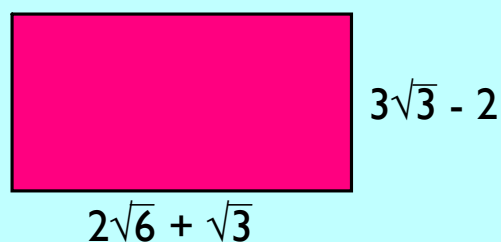
Example 6

Simplify $-6\sqrt{50} + 3\sqrt{32} - \sqrt{48}$.

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

$$-30\sqrt{2} \quad + \quad 12\sqrt{2} \quad -- \quad 4\sqrt{3}$$

$$-18\sqrt{2} - 4\sqrt{3}$$

Example 7

$$P = 2\ell + 2w$$

Find the exact measure of the perimeter of the rectangle.

$3\sqrt{3} - 2$

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

$$P = 2(2\sqrt{6} + \sqrt{3}) + 2(3\sqrt{3} - 2)$$

$$P = 4\sqrt{6} + 2\sqrt{3} + 6\sqrt{3} - 4$$

$$P = 4\sqrt{6} + 8\sqrt{3} - 4$$