

# More Multiplying with Radicals

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Example 1:

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Evaluate

a.)  $\sqrt{5}(\sqrt{7} + \sqrt{3})$

Since we cannot simplify the parenthesis, we must distribute.

$$\begin{aligned}\sqrt{5}(\sqrt{7} + \sqrt{3}) &= \sqrt{5} \cdot \sqrt{7} + \sqrt{5} \cdot \sqrt{3} \\ &= \boxed{\sqrt{35} + \sqrt{15}}\end{aligned}$$

Since neither term can be simplified, this is our final answer.

b.)  $\sqrt{6}(\sqrt{2} + \sqrt{3})$

$$\begin{aligned}&= \sqrt{6} \cdot \sqrt{2} + \sqrt{6} \cdot \sqrt{3} \\ &= \sqrt{12} + \sqrt{18} \\ &= \sqrt{4 \cdot 3} + \sqrt{9 \cdot 2} \\ &= \sqrt{4} \cdot \sqrt{3} + \sqrt{9} \cdot \sqrt{2} \\ &= \boxed{2\sqrt{3} + 3\sqrt{2}}\end{aligned}$$

Since these are not like terms, this is our final answer.

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Example 2:

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Multiply

a.)  $(\sqrt{2} + \sqrt{3})(\sqrt{5} + \sqrt{7})$

We multiply these two in the same way we multiply binomials.

Recall:  $(x + 3)(x + 4)$   
 $= x(x + 3) + (x + 3)$   
 $= x^2 + 3x + 4x + 12$   
 $= x^2 + 7x + 12$

$$\begin{aligned} &(\sqrt{2} + \sqrt{3})(\sqrt{5} + \sqrt{7}) \\ &= \sqrt{5}(\sqrt{2} + \sqrt{3}) + \sqrt{7}(\sqrt{2} + \sqrt{3}) \\ &= \sqrt{5} \cdot \sqrt{2} + \sqrt{5} \cdot \sqrt{3} + \sqrt{7} \cdot \sqrt{2} + \sqrt{7} \cdot \sqrt{3} \\ &= \boxed{\sqrt{10} + \sqrt{15} + \sqrt{14} + \sqrt{21}} \end{aligned}$$

b.)  $(\sqrt{2} + \sqrt{3})(\sqrt{2} - \sqrt{3})$

Recall: These two factors are *conjugates* of each other and are multiplied the same way conjugate binomials are:

$$\begin{aligned} (x + 2)(x - 2) &= x^2 - 2^2 \\ &= x^2 - 4 \end{aligned}$$

$$\begin{aligned} &(\sqrt{2} + \sqrt{3})(\sqrt{2} - \sqrt{3}) \\ &= (\sqrt{2})^2 - (\sqrt{3})^2 \\ &= 2 - 3 \\ &= \boxed{-1} \end{aligned}$$

$$\begin{aligned}c.) \quad & (\sqrt{2} + \sqrt{3})(\sqrt{2} + \sqrt{3}) \\ &= \sqrt{2}(\sqrt{2} + \sqrt{3}) + \sqrt{3}(\sqrt{2} + \sqrt{3}) \\ &= \sqrt{4} + \sqrt{6} + \sqrt{6} + \sqrt{9} \\ &= 2 + 2\sqrt{6} + 3 \\ &= \boxed{5 + 2\sqrt{6}}\end{aligned}$$

$$\begin{aligned}d.) \quad & (x + \sqrt{5})^2 \\ &= (x + \sqrt{5})(x + \sqrt{5}) \\ &= x(x + \sqrt{5}) + \sqrt{5}(x + \sqrt{5}) \\ &= x^2 + x\sqrt{5} + x\sqrt{5} + \sqrt{25} \\ &= \boxed{x^2 + 2\sqrt{5}x + 5}\end{aligned}$$

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## Practice Problems

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Evaluate:

1.  $\sqrt{16}(\sqrt{3} - \sqrt{2})$

2.  $(\sqrt{6} + \sqrt{2})(\sqrt{6} - \sqrt{2})$

3.  $(\sqrt{8} + 2)^2$