

Simplifying a hard radical problem

Here's a hard problem in #7(e) on page 1.10 - 10:

$$\text{Simplify } \frac{\sqrt{3}}{\sqrt{2}} + \sqrt{24} \quad \left\{ \begin{array}{l} \text{We need to do two things separately before we can put} \\ \text{it all together. We need to rationalize the denominator} \\ \text{in the fraction and we need to simplify } \sqrt{24}. \end{array} \right.$$

$$\text{First, let's simplify: } \sqrt{24} = \sqrt{4 \cdot 6} = \sqrt{4} \cdot \sqrt{6} = 2\sqrt{6}$$

Next, let's rationalize the denominator of the fraction. Multiply both numerator and denominator by $\sqrt{2}$, which creates a perfect square in the denominator:

$$\frac{\sqrt{3}}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{6}}{\sqrt{4}} = \frac{\sqrt{6}}{2}$$

$$\text{So, this is what we have so far: } \frac{\sqrt{3}}{\sqrt{2}} + \sqrt{24} = \frac{\sqrt{6}}{2} + 2\sqrt{6}$$

Next, we have to get a common denominator of 2; think of $2\sqrt{6}$ as $\frac{2\sqrt{6}}{1}$ and multiply it by $\frac{2}{2}$:

$$\frac{\sqrt{6}}{2} + 2\sqrt{6} = \frac{\sqrt{6}}{2} + \frac{2\sqrt{6}}{1} \cdot \frac{2}{2} = \frac{\sqrt{6}}{2} + \frac{4\sqrt{6}}{2}$$

Now that they have a common denominator, we can add the two fractions;

$$\frac{\sqrt{6}}{2} + \frac{4\sqrt{6}}{2} = \frac{\sqrt{6} + 4\sqrt{6}}{2}$$

Lastly, since the radicals are *like* we can combine them:

$$\frac{\sqrt{6} + 4\sqrt{6}}{2} = \frac{5\sqrt{6}}{2}$$

Whew!!! Why did I put that in the book?