Multiplying and Dividing Radicals

This is very similar to how you would treat x and y. x^2 and x^3.
We look for things the same...

$2x + x = 3x$ but $2x + y =$ $2x+y$

$x^2(x) =$ x^3 but $x^2(y) =$ x^2y

Let's do this but with radicals instead of x,y.

$2\sqrt{3} \bullet 4\sqrt{6}$ $= 2(4)\sqrt{3\cdot 6} = 8\sqrt{3\cdot 3\cdot 2}$

$= 8(3)\sqrt{2}$

$= 24\sqrt{2}$

Here are the steps that we always want to follow:

1. Simplify
2. Multiply
   - ➢ $a\sqrt{b} \bullet c\sqrt{d} = ac\sqrt{bd}$
3. Simplify
   - ➢ Nothing can come out of the radical.
   - ➢ No radicals in the denominator.

$3\sqrt{5} \bullet 2\sqrt{72}$

$= 3\sqrt{5}\cdot 2\sqrt{8\cdot 3^2}$

$= 3\sqrt{5}\cdot 6\sqrt{8}$

$= 3\sqrt{5}\cdot 12\sqrt{2}$

$= 36\sqrt{10}$

$3\sqrt[3]{2x} \bullet 7\sqrt[3]{5x^2}$

$= 21\sqrt[3]{10x^3}$

$= 21x\sqrt[3]{10}$

$2\sqrt{6}(\sqrt{5} - 2\sqrt{10})$

$= 2\sqrt{6 \cdot 5} - 2(2)\sqrt{6 \cdot 10}$

$= 2\sqrt{30} - 4\sqrt{60}$

$= 2\sqrt{30} - 8\sqrt{15}$

$\sqrt{60}$

$\sqrt{15 \cdot 4}$

$2\sqrt{15}$

$(\sqrt{3} - 4\sqrt{5})(2 + \sqrt{5})$

$= 2\sqrt{3} + \sqrt{15} - 8\sqrt{5} - 4\sqrt{25}$

$= 2\sqrt{3} + \sqrt{15} - 8\sqrt{5} - 20$

Dividing radicals works the same way. We can follow the same steps as above. Just divide instead.

$$\frac{8\sqrt{15}}{2\sqrt{3}} = 4\sqrt{\frac{15}{3}}$$

$$= 4\sqrt{5}$$

$$\frac{2\sqrt{20}}{8\sqrt{5}} = \frac{1\sqrt{4}}{4}$$

$$= \frac{2}{4} = \frac{1}{2}$$

$$\frac{\sqrt{24x^2}}{\sqrt{3x}} = \sqrt{8x}$$

$$= 2\sqrt{2x}$$

If we get a radical in the denominator, we have to ditch that .... Rationalize the denominator:

$$\frac{2\sqrt{5}}{\sqrt{10}} \cdot \frac{\sqrt{10}}{\sqrt{10}} = \frac{2\sqrt{5 \cdot 10}}{10}$$

$$= \frac{2\sqrt{5 \cdot 5 \cdot 2}}{10}$$

$$= \frac{2 \cdot 5\sqrt{2}}{10}$$

$$= \sqrt{2}$$

$$\frac{5}{2\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{5\sqrt{3}}{2(3)}$$

If there is more than just one term in the denominator, we need to bring out the conjugate!

Example:

$$\frac{5\sqrt{3}}{4-\sqrt{6}} \cdot \frac{4+\sqrt{6}}{4+\sqrt{6}}$$

$$\frac{20\sqrt{3} + 5\sqrt{18}}{16 + 4\sqrt{6} - 4\sqrt{6} - 6}$$

$$= \frac{20\sqrt{3} + 5\sqrt{18}}{10}$$

$$= \frac{4\sqrt{3} + 3\sqrt{2}}{2}$$

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

$$= \frac{6\sqrt{5} - 12\sqrt{2}}{5 \cancel{- 2\sqrt{10}} \cancel{+ 2\sqrt{10}} - 4(2)}$$

$$= \frac{6\sqrt{5} - 12\sqrt{2}}{5 - 8} = \frac{6\sqrt{5} - 12\sqrt{2}}{-3}$$

$$= \frac{\cancel{-3}(-2\sqrt{5} + 4\sqrt{2})}{\cancel{-3}}$$

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

HW: pg 289

#1abcd,2,3,4,5ab,6,8ab,9ab,10