Multiplying and Dividing Radicals

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

$\sqrt{8}$ → $\frac{2}{4}$

$2\sqrt{2}$ $\frac{3}{-1}$

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

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

Here are the steps that we always want to follow:

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

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

$2(4)\sqrt{3(6)}$

$8\sqrt{18} = 8(3)\sqrt{2}$

$= 24\sqrt{2}$

9 2

3 3

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

$3(2)\sqrt{5(72)} \to 6\sqrt{360} \Rightarrow 6\sqrt{36(10)}$

6 6

$= 36\sqrt{10}$

$2\sqrt{2} \cdot 2\sqrt[3]{2}$

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

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

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

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

$\sqrt[3]{8}$

$= \sqrt[3]{2 \cdot 2 \cdot 2}$

$= 2$

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

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

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

5 6

3 2

30 2

6 5

3 2

$4\sqrt{60}$

$= 4(2)\sqrt{15}$

$= 8\sqrt{15}$

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

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

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

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

$$\frac{8\sqrt{15}}{2\sqrt{3}} = 4\sqrt{\frac{15}{3}} = 4\sqrt{5}$$

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

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

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

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

$$\sqrt{\frac{5(2^2)}{10}} = \frac{\sqrt{20}}{\sqrt{10}} \quad \frac{2\sqrt{5}}{\sqrt{10}} = 2\sqrt{\frac{5}{10}} = 2\sqrt{\frac{1}{2}} = 2\frac{\sqrt{1}}{\sqrt{2}}$$

$$= 2\left(\frac{1}{\boxed{\sqrt{2}}}\right)\cdot\frac{\sqrt{2}}{\sqrt{2}} = \frac{\cancel{2}\sqrt{2}}{\cancel{2}} = \sqrt{2}$$

$$\boxed{\frac{\sqrt{15}}{6}} = .6455 \neq 1.44$$

$$\frac{5}{2\sqrt{3}}\cdot\frac{\sqrt{3}}{\sqrt{3}} = \frac{5\sqrt{3}}{2(3)} = \frac{5\sqrt{3}}{6}$$

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

Example:

my Demoninator has two terms!

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

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

$$= \frac{20\sqrt{3} + 5(3)\sqrt{2}}{10} = \frac{20\sqrt{3} + 15\sqrt{2}}{10}$$

Yay

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

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

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

Yay

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

HW: pg 289
#1abcd,2,3,4,5ab,6,8ab,9ab,10