Warmup:

Simplify the following radicals:

$\sqrt{72} = \sqrt{24 \cdot 3}$

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

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

$3 \cdot 2\sqrt{2}$

$6\sqrt{2}$

$\sqrt{384}$

$\sqrt{64 \cdot 6}$

$\sqrt{\underbrace{8 \cdot 8}} \cdot 3 \cdot 2$

$\boxed{8\sqrt{6}}$

Simplify the following:

$$-\sqrt{18}-3\sqrt{8}-\sqrt{24}$$

$$\underbrace{-3\sqrt{2}-6\sqrt{2}}-2\sqrt{6}$$

$$\boxed{-9\sqrt{2}-2\sqrt{6}}$$

$$2\sqrt{18}+3\sqrt{6}-\sqrt{72}$$

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

$$3\sqrt{6}$$

Simplify the following:

$\sqrt{14} \cdot \sqrt{35} = \sqrt{14 \cdot 35}$

$= \sqrt{7 \cdot 2 \cdot 7 \cdot 5}$

✓ $= 7\sqrt{10}$

$3\sqrt{12} \cdot \sqrt{6}$

$3\sqrt{12 \cdot 6}$

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

$3 \cdot 6\sqrt{2}$

$18\sqrt{2}$

Simplify the following:

$$4\sqrt{2}\left(\sqrt{2}+\sqrt{3}\right)$$

$$4\sqrt{2}\cdot\left(\sqrt{2}+\sqrt{3}\right)$$

$$4\sqrt{2\cdot2} + 4\sqrt{6}$$

$$4\cdot2$$

$$8+4\sqrt{6}$$

$$-2\sqrt{3}\left(\sqrt{15}+3\sqrt{8}\right)$$

$$-2\sqrt{3}\left(\sqrt{15}+3\sqrt{8}\right)$$

$$-2\sqrt{3\cdot15} + -6\sqrt{3\cdot8}$$

$$-2\sqrt{3\cdot3\cdot5} + -6\sqrt{3\cdot2\cdot\underline{2\cdot2}}$$

$$-2\cdot3\sqrt{5} + -6\cdot2\sqrt{3\cdot2}$$

$$-6\sqrt{5} \quad -12\sqrt{6}$$

Dividing with Radicals:

Like multiplication, you are allowed to divide underneath a radical symbol:

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

$$\frac{\sqrt{8}}{\sqrt{2}} = \sqrt{\frac{8}{2}}$$

$$= \sqrt{4}$$

$$= 2$$

You are not allowed to leave a radical in the denominator of a fraction though:

What we do is rationalize the denominator by multiplying by that radical on top and on bottom.

$$\frac{\sqrt{8}}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{16}}{\sqrt{4}} = \frac{4}{2} = 2$$

"Rationalize the denominator"

$$\frac{\sqrt{8}}{\sqrt{2}} \left(\cdot \frac{\sqrt{2}}{\sqrt{2}} \right) = \frac{\sqrt{16}}{2} = \frac{4}{2} = 2$$

$$\frac{\sqrt{8}}{\sqrt{2}} \cdot 1$$

$$\frac{\sqrt{8}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{24}}{3} = \frac{2\sqrt{6}}{3}$$

$$\sqrt{3} \cdot \sqrt{3} = \sqrt{9} = 3$$

$2\sqrt{18} = 6\sqrt{2}$

You try:

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

$$\frac{2\sqrt{6}}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{18}}{3}$$

$$\Downarrow$$

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

$$= 2\sqrt{2}$$

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

Simplifying with variables:

$$\sqrt{x^3} = \underbrace{x\sqrt{x}}$$

$\sqrt{x \cdot x \cdot x}$

$\boxed{x\sqrt{x}}$

$$\sqrt{x^5y^6z^7} = \underbrace{x^2y^3z^3\sqrt{xz}}$$

$\boxed{x^2y^3z^3\sqrt{xz}}$

$\sqrt{x\,x\,x\,x\,x\,y\,y\,y\,y\,y\,y\,z\,z\,z\,z\,z\,z\,z}$

$$\sqrt{8x^{10}y^9} = \underbrace{2x^5y^4\sqrt{2y}}$$

$\sqrt{8} = 2\sqrt{2}$

$\boxed{2x^5y^4\sqrt{2y}}$

$$\sqrt{x^{\underline{22}}\, y^{\underline{45}}\, z^{\underline{101}}}$$

$$x^{11}\, y^{22}\, z^{50}\sqrt{y^{1} z^{1}}$$

You try:

$\sqrt{50} = 5\sqrt{2}$

$$\sqrt{a^{11}b^{13}c^{17}}$$

$a^5 b^6 c^8 \sqrt{abc}$

$$\sqrt{50x^5y^{21}z^3}$$

$$\boxed{5x^2y^{10}z\sqrt{2xyz}}$$

Practice simplifying
Radicals