

Rationalizing Higher Root Denominators

$$\sqrt[4]{\frac{2b^{10}}{3a}}$$

$$\frac{\sqrt[4]{2b^{10}}}{\sqrt[4]{3a}}$$

Radical goes on numerator & denominator.

$$\frac{\sqrt[4]{2b^{10}}}{\sqrt[4]{3a}} \cdot \frac{\sqrt[4]{3^3a^3}}{\sqrt[4]{3^3a^3}}$$

We are allowed to multiply by the number 1. The yellow box is 1.

How did I pick $\sqrt[4]{3^3a^3}$?

Look at what is currently in the denominator:

$$\sqrt[4]{3^1a^1}$$

We need to build the powers under the fourth root up to fourth power.

$$\sqrt[4]{3^1a^1} \cdot \sqrt[4]{3^3a^3}$$

$\swarrow \quad \searrow$
 $3^1 \cdot 3^3$
 3^4

Like wise
 $a^1 \cdot a^3 = a^4$

$$\frac{\sqrt[4]{2b^{10}}}{\sqrt[4]{3^1a^1}} \cdot \frac{\sqrt[4]{3^3a^3}}{\sqrt[4]{3^3a^3}}$$

Because the roots & powers must match.

$$\frac{\sqrt[4]{2b^{10} \cdot 3^3a^3}}{\sqrt[4]{3^1a^1 \cdot 3^3a^3}}$$

Put one big radical sign on top & on bottom.

$$\frac{\sqrt[4]{2 \cdot 3^3 a^3 b^{10}}}{\sqrt[4]{3^1 \cdot 3^3 \cdot a^1 \cdot a^3}}$$

Rearrange. Put numbers next to numbers, variables next to variables

$$\sqrt[4]{54a^3b^{10}}$$

multiply under each radical.

$$\sqrt[4]{3^4a^4}$$

$$\sqrt[4]{54a^3b^8b^2}$$

$$\sqrt[4]{3^4} \sqrt[4]{a^4}$$

Simplify

Notice $\sqrt[4]{b^8} = b^2$

NOT under radical.

Notice $\sqrt[4]{3^4} = 3$

Notice $\sqrt[4]{a^4} = a$.

$$\frac{b^2 \sqrt[4]{54a^3b^2}}{3a}$$