Simplify Radicals with Variables

* #'s in front we simplify the same

* We divide the exponents by the index (root) and make the quotient (whole #) the exponent outside the radical, and the remainder the exponent inside the radical.

index (2)   index   index

Ex: $\sqrt[2]{\quad}$, $\sqrt[3]{\quad}$, $\sqrt[4]{\quad}$, ...

Ex: $\sqrt[2]{x^9} = \underline{\underline{x^4}}\sqrt{x}$

$$2\overline{)9}\quad 4\ r\ 1$$

2, 2, 2, 2, $\underline{\underline{1}}$

* Divide exponent by index (whole #) outside the radical
* Remainder (1) is the exponent under the radical

$\sqrt{x^{\cancel{2}}} \cdot \sqrt{x^{\cancel{2}}}\ \sqrt{x^{\cancel{2}}}\ \sqrt{x^{\cancel{2}}}\ \sqrt{x}$

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

index (2) →

Ex: $\sqrt{x^6 y^{13}} = \underline{x}^3 y^6 \sqrt{y}$

$2\overline{)6}$ → 3

$2\overline{)13}$ → 6 r 1

* Divide exponents by index
(No remainder means __no__ variable under radical)

Perfect Cubes

Simplify

$$2^3 = 8$$
$$3^3 = 27$$
$$4^3 = 64$$
$$5^3 = 125$$

$\sqrt[3]{24} = \sqrt[3]{8}\,\sqrt[3]{3}$

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

$\sqrt[3]{54} = \sqrt[3]{27}\,\sqrt[3]{2}$

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

$$\sqrt[3]{x^7} = \boxed{x^2 \sqrt[3]{x^1}}$$

$$3\overline{)7}^{\,2\,r\,1}$$

$$\sqrt[3]{x^3}\,\sqrt[3]{x^3}\,\sqrt[3]{x}$$

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

$$x^2 \sqrt[3]{x}$$

$$\sqrt[5]{g^{18}} = \boxed{g^{3} \sqrt[5]{g^{3}}}$$

exponent outside

$$5 \overline{)18}^{\,3.3} =$$

$5 \cdot 5 \cdot 5 \cdot 3 =$ remainder exponent inside

Ex: $\sqrt[2]{x^4 y^9} = \boxed{x^2 y^4 \sqrt{y}}$

Ex: $\sqrt[2]{x^3 y^1} = \boxed{x \sqrt{xy}}$