Math-2A

Lesson 3-4
Rational Exponents

Radicals CAN be written as Powers

$$6\sqrt[5]{x}$$

Index

Coefficient

Radicand

$$6(x)^{1/5}$$

Exponent
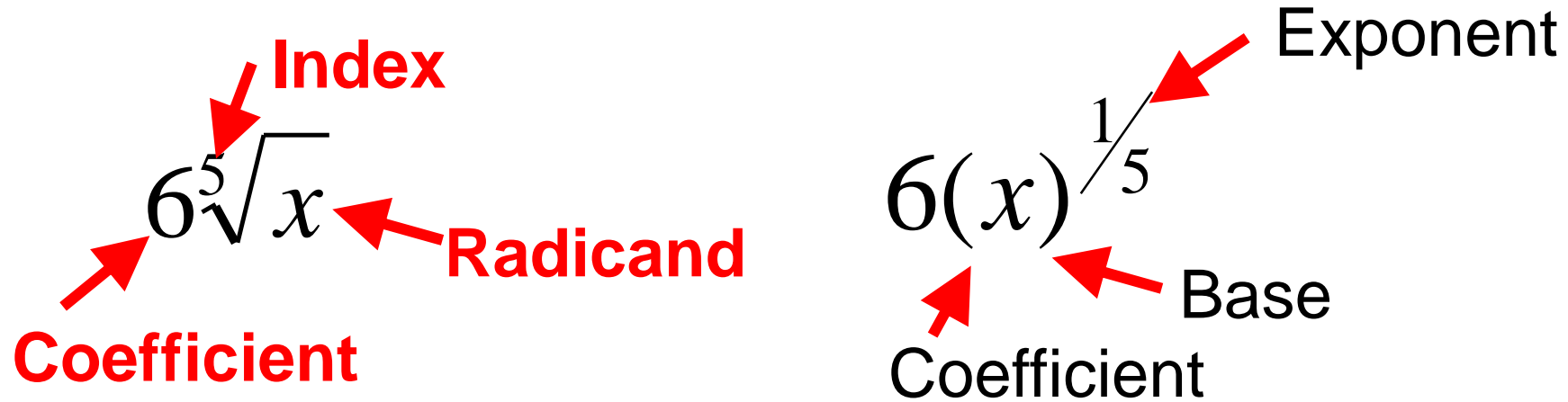
Base

Coefficient

Coefficient $\longrightarrow$ Coefficient

Radicand $\longrightarrow$ Base

Index $\longrightarrow$ Denominator of the Exponent

The _index number_ is the _denominator of the exponent_.

Are <u>radicals</u> related to <u>powers</u>?

$$3^{1/2} = \sqrt[2]{3}$$

$$5^{1/3} = \sqrt[3]{5}$$

$$\sqrt[2]{x} = x^{1/2}$$

$$\sqrt[3]{7} = 7^{1/3}$$

None of these have coefficients!

$$3\sqrt[2]{y} = 3y^{1/2}$$

$$5\sqrt[3]{7} = 5(7)^{1/3}$$

Use multiplication (by a coefficient) is "repeated addition" to explain why coefficients of radicals become coefficients of powers.

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

$$3y^{1/2} = y^{1/2} + y^{1/2} + y^{1/2}$$

$$\sqrt{y} = y^{1/2}$$

Write the following radicals as powers.

$$\sqrt[2]{3m} \rightarrow (3m)^{1/2}$$

$$4\sqrt[3]{5y} \rightarrow 4(5y)^{1/3}$$

$$3m\sqrt[4]{6n} \rightarrow 3m(6n)^{1/4}$$

$$\sqrt[5]{x^3 y^2} \rightarrow (x^3 y^2)^{1/5} \rightarrow x^{3/5} y^{2/5}$$

$$5\sqrt[4]{3m^2} \rightarrow 5(3m^2)^{1/3} \rightarrow 5(3^{1/3})m^{2/3}$$

Rewrite in "radical form"

$$m^{1/5} \rightarrow \sqrt[5]{m}$$

$$3nm^{1/4} \rightarrow 3n\sqrt[4]{m}$$

$$2(18n^2)^{1/6} \rightarrow 2\sqrt[6]{18n^2}$$

$$5(4x^2y^6)^{1/3} \rightarrow 5\sqrt[6]{4*x^2*y^6} \rightarrow 5y\sqrt[3]{4x^2}$$

Multiply Powers Property   Add exponents

$$x^{\frac{1}{5}} * x^{\frac{3}{5}} \quad \rightarrow \quad x^{\frac{1}{5}+\frac{3}{5}} \quad \rightarrow \quad x^{\frac{4}{5}}$$

What if the exponents are fractions <u>and</u> they have unlike denominators?

$$x^{\frac{2}{5}} * x^{\frac{3}{4}}$$

Use the *Identity Property of Multiplication* to obtain common denominators.

$$\rightarrow x^{\frac{2}{5}*\frac{4}{4}} * x^{\frac{3}{4}*\frac{5}{5}} \quad \rightarrow \quad x^{\frac{8}{20}} * x^{\frac{15}{20}} \quad \rightarrow \quad x^{\frac{8}{20}+\frac{15}{20}} \quad \rightarrow \quad x^{\frac{23}{20}}$$

Exponent of a Power Property

Multiply exponents

$$3x\left(y^{1/5}\right)^{2/3} \rightarrow 3xy^{\frac{1}{5}*\frac{2}{3}} \rightarrow 3xy^{\frac{2}{15}}$$

Negative Exponent Property

Grab and drag same-based powers to be <u>next to each other.</u>

$$\frac{x^2 y^{2/3}}{y^{-1/2}} \rightarrow x^2 y^{2/3} y^{1/2} \rightarrow x^2 y^{\frac{2}{3}+\frac{1}{2}} \rightarrow x^2 y^{\frac{2}{3}*\frac{2}{2}+\frac{1}{2}*\frac{3}{3}}$$

$$\rightarrow x^2 y^{\frac{4}{6}+\frac{3}{6}} \qquad \boxed{\rightarrow x^2 \, y^{\frac{7}{6}}}$$