

Objective

- **Write an explanation**, using a sequence of supporting exponent rules, the simplification of an expression with rational exponents
 - A) using a flow chart/graphic organizer
 - B) using sentence stems. “First, I used the _____ rule to change _____ to _____”
 - C) using complete sentences
- **Success Criteria**
 - Define the product rule and identify when it applies to an expression
 - Define the quotient rule and identify when it applies to an expression
 - Define the power rule and identify when it applies to an expression
- **Vocabulary:** base, exponent, power rule, quotient rule, product rule

Let a be a real number,
variable, or algebraic expression
and n a positive integer. Then

$$a^n = \underbrace{a \cdot a \cdot a \cdots a}_{n \text{ factors}},$$

where n is the **exponent**, a is the **base**,
and a^n is the **n th power of a** ,
read as " a to the n th power."

Let u and v be a real numbers, variables, or algebraic expressions and m and n be **rational numbers**.

All bases are assumed to be nonzero.

Property

product

$$1. u^m u^n = u^{m+n}$$

quotient

$$2. \frac{u^m}{u^n} = u^{m-n}$$

$$3. u^0 = 1$$

negative exponent

$$4. u^{-n} = \frac{1}{u^n}$$

What is the relationship to u^n ?

like reciprocal $\frac{1}{x^9}$

Example

$$(x-1)^{\frac{1}{2}} (x-1)^{\frac{3}{4}} = (x-1)^{\frac{5}{4}}$$

$$\frac{x^{7/10}}{x^{5/2}} = x^{-9}$$

Let u and v be a real numbers, variables, or algebraic expressions and m and n be **rational numbers**.

All bases are assumed to be nonzero.

Property

Example

$$5. (uv)^m = u^m v^m$$

$$(2x)^3 = 2^3 \cdot x^3 = 8x^3$$

$$6. (u^m)^n = u^{mn}$$

$$(g^{1/3})^{12} = g^4$$

$$7. \left(\frac{u}{v}\right)^m = \frac{u^m}{v^m}$$

$$\left(\frac{x}{y}\right)^{2/5} = \frac{x^{2/5}}{y^{2/5}}$$

Properties of Exponents

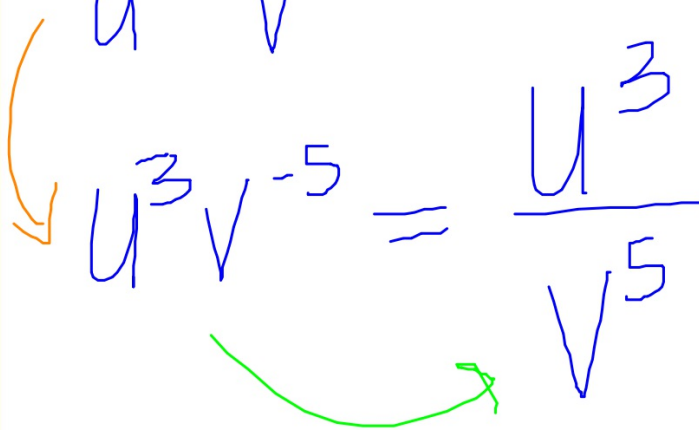
Example Simplifying Expressions Involving Powers

Simplify $\frac{u^2 v^{-3}}{u^{-1} v^2}$.

① Quotient

② Negative
Exponent

$$u^{2-(-1)} v^{-3-2}$$

$$u^3 v^{-5} = \frac{u^3}{v^5}$$


AM: Simplify expressions with rational exponents

Simplify:

1. $x^{-1/5} \cdot x^{-2/3}$



$$x^{-13/15}$$



$$\frac{1}{x^{13/15}}$$

[A] $\frac{1}{x^{13/15}}$

[B] $\frac{1}{x^{2/15}}$

[C] $x^{13/15}$

[D] $x^{2/15}$

product

negative exponent

$$\begin{array}{r} \frac{1}{5} \\ - \frac{2}{3} \\ \hline \frac{-3}{15} + \frac{-10}{15} \end{array} \downarrow \times 5$$

AM: Simplify expressions with rational exponents

2. $\left(\frac{x^{-1/3}}{x^{-6}}\right)^{1/6}$

[A] $\frac{1}{x^{17/18}}$

[B] $x^{17/18}$

[C] $\frac{1}{x^{19/18}}$

[D] $x^{19/18}$

power

$$\frac{x^{-1/3 \cdot \frac{1}{6}}}{x^{-6 \cdot \frac{1}{6}}} = \frac{x^{-1/18}}{x^{-1}}$$

quotient

$$x^{-1/18 - (-1)} = x^{17/18}$$

$$-\frac{1}{18} - \frac{-18}{18} = \frac{17}{18}$$

AM: Simplify expressions with rational exponents

$$3. \quad x^{-1/2} \cdot x^{-5/7} = x^{-7/14 - 10/14} = x^{-17/14} = \frac{1}{x^{17/14}}$$

$$4. \quad \left(\frac{f^{16}}{g^{12}} \right)^{3/4} = \frac{f^{12}}{g^9}$$