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

Exponential Notation

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

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

where n is the **exponent**, a is the **base**, and a^n is the ***n*th power of a**, read as "a to the nth 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	Example
product 1. $u^m u^n = u^{m+n}$	$(x-1)^{\frac{1}{2}}(x-1)^{\frac{3}{4}} = (x-1)^{5/4}$
quotient 2. $\frac{u^m}{u^n} = u^{m-n}$	$\frac{x^{7/10}}{x^{5/2}} = x^{-9}$
3. $u^0 = 1$	
negative exponent 4. $u^{-n} = \frac{1}{u^n}$	$\frac{1}{x^9}$

What is the relationship to u^n?

like reciprocal

Properties of Exponents

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.

Properties of Exponents

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

power

Example Simplifying Expressions Involving Powers

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

① Quotient

② Negative Exponent

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

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

AM: Simplify expressions with rational exponents

Simplify:

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

[A] $\frac{1}{x^{13/15}}$ [B] $\frac{1}{x^{2/15}}$ [C] $x^{13/15}$ [D] $x^{2/15}$

$x^{-13/15}$

product

negative exponent

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

$-\frac{1}{5} \quad -\frac{2}{3}$

$\frac{-3}{15} + \frac{-10}{15}$ ×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

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

QUOTIENT

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

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

AM: Simplify expressions with rational exponents

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

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