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1.3 Rules of Exponents

N.RN.1 *I CAN... rewrite expressions involving rational exponents using the properties of exponents.*

vocabulary:

Monomial A number, a variable, or a product of a number and one or more variables
Examples: $34xy$, $7a^2b$

Power 5^2 — Exponent, Base

rules of exponents:

2 Bases 2 exponents

Product of Powers: $a^m \cdot a^n = a^{m+n}$

If multiplying two numbers with the **same base**, ADD the exponents

$5^2 \cdot 5^6$ $5^{2+6} = 5^8$	$y^4 \cdot y^3 \cdot y$ $y^{4+3+1} = y^8$
$(7y^5)(6y)$ $42y^{5+1} = 42y^6$	$(-3x^2y^7)(5xy^6)$ $-15x^3y^{13}$

Quotient of Powers: $\frac{a^m}{a^n} = a^{m-n}$

If dividing two numbers with the **same base**, SUBTRACT the exponents

$\frac{y^6}{y}$ $y^{6-1} = y^5$	$\frac{6^{13}}{6^2}$ $6^{13-2} = 6^{11}$	$\frac{10a^7b^9}{15a^5b^9}$ $\frac{2a^2}{3}$

$\frac{10 \div 5}{15 \div 5} = \frac{2}{3}$

$\frac{b^9}{b^9} = b^{9-9} = b^0 = 1$

Rules of Exponents

Zero Exponent: $a^0 = 1$

Any nonzero number with an exponent of zero is equivalent to 1.

WHY?? Let's explore $1 = \frac{8^2}{8^2}$ ..... $8^{2-2} = 8^0$

$(-3x+7)^0$ $= 1$	$8x^0 + 5$ $8(1) + 5$ $= 13$	$5(-3x)^0$ $5(1)$ $= 5$

Negative Exponent $a^{-n} = \frac{1}{a^n}$

For any nonzero number "a" raised to a negative exponent, place the power in the denominator to rewrite the power with a positive exponent

WHY?? Let's Explore $\frac{b^2}{b^5}$ ..... $b^{2-5} = b^{-3} = \frac{1}{b^3}$

$\frac{b \cdot b}{b \cdot b \cdot b \cdot b \cdot b} = \frac{1}{b^3}$

2^{-3} $= \frac{1}{2^3} = \frac{1}{8}$	$(-3)^{-3} = \frac{1}{(-3)^3} = \frac{1}{-27}$

$\frac{1}{a^{-2}} = a^2$

Rules of Exponents 1 BASE 2. EXPONENTS

Power of a Power: $(a^m)^n = a^{m \cdot n}$

If raising a power to a power, **multiply** the exponents

Examples: *Simplify. Write each answer using only positive exponents:*

$(x^2)^8$

$x^{2 \times 8} = x^{16}$

$(y^{-3})^{-4}$

Power of a Product: $(ab)^m = a^m b^m$

Find the power of **each** factor in the parenthesis and multiply.

$(4x^3y^1z^1)^3$

$4^{1 \times 3}\ x^{3 \times 3}\ y^{1 \times 3}\ z^{1 \times 3}$

$64x^9y^3z^3$

$(7xy^{-2})^{-2}$

$(6x^{-6}y^{-7}z^0)^{-2}$

Power of a Quotient: $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$

For any numbers "a" and "b" where $b \neq 0$, if the quotient of a and b is raised to a power, raise both the numerator and the denominator to the given power

$\left(\frac{3}{5}\right)^2$

$\left(\frac{2a^5}{b^7}\right)^2$

$\left(\frac{3a^{-4}}{b^7}\right)^3$

$\left(\frac{a^{-2}b^{-5}}{c^{-11}}\right)^{-6}$