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: $34ab$ $7ab$

Power: 5^2 — Exponent (the 2), Base (the 5)

rules of exponents

Product of Powers: $a^m \cdot a^n = a^{m+n}$ ADD the exponents
If multiplying two numbers with the same base, ADD the exponents

$5^2 \cdot 5^6$	$y^4 \cdot y^3 \cdot y^1$
5^8	y^8

$(7y^5)(6y)$	$(-3x^2y^7)(5xy^6)$
$42y^6$	$-15x^3y^{13}$

Quotient of Powers: $\dfrac{a^m}{a^n} = a^{m-n}$ SUBTRACT the exponents
If dividing two numbers with the same base, SUBTRACT the exponents

$\dfrac{y^8}{y^3}$	$\dfrac{6^{13}}{6^2}$
y^5	6^{11}

$\dfrac{10a^7b^9}{15a^5b^8}$
$\dfrac{2a^2}{3}$

Zero Exponent: $a^0 = 1$
Any nonzero number with an exponent of zero is equivalent to 1

WHY?? Let's explore $\dfrac{8^2}{8^2}$ ......

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

Negative Exponent $a^{-n} = \dfrac{1}{a^n}$
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 $\dfrac{b^2}{b^5}$ ...... $\dfrac{b \cdot b}{b \cdot b \cdot b \cdot b \cdot b} = \dfrac{1}{b^3} = b^{-3}$

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

Rules of Exponents

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

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

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

$(x^2)^8$

$$x^{16}$$

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

$$y^{12}$$

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

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

$(4x^3yz)^3$

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

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

$$\frac{1}{(7xy^{-2})^2} = \frac{1}{49x^2y^{-4}} = \frac{y^4}{49x^2}$$

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

$$6^{-2}x^{12}y^{14}z^0$$
$$\frac{x^{12}y^{14}}{36}$$

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

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

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

$$\frac{9}{25}$$

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

$$\frac{4a^{10}}{b^{14}}$$

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

$$\frac{9a^{-12}}{b^{21}} = \frac{9}{a^{12}b^{21}}$$

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

$$\frac{a^{12}b^{30}}{c^{66}}$$