8th Grade Math

Parent Clear Expectations Letter

This document is created to give parents and students a better understanding of the math concepts, material that is taught in the classroom.

Module 1: Integer Exponents and Scientific Notation:

Builds on exponential notation with integer exponents and transforming expressions in order to perform operations including numbers in scientific notation as well as judging the magnitude of a number.

Integer Exponents

Words to Know:

Whole number — the numbers 0,1,2,3,4,5, on the number line

Integer -the numbers...,-3,-2,-1,0,1,2,3,... on the number line

Base - the number being raised to a power (or exponent)

Exponent - the number of times a number is to be used as a factor in a multiplication expression

Power- another name for exponent

Squaring a number- multiplying a number by itself; raising a number to the second power

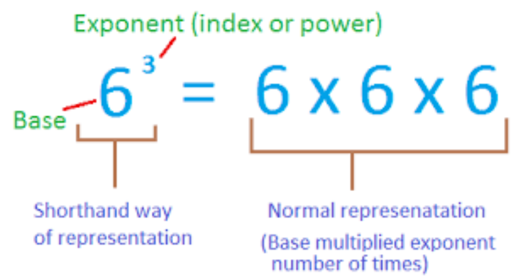
Cubing a number- multiplying a number by itself 3 times; raising a number to the third power

Exponential notation- a method that allows the representation of numbers in shorter form that aids in mathematical calculations. (Example: $8 = 2 \times 2 \times 2 = 2^3$ So, 2^3 is considered exponential notation. The base of the exponential notation is 2 and the exponent (or power) is 3

Reciprocal- a multiplicative inverse; the reciprocal of a number is the result when you divide a 1 by that number (example: $\frac{1}{2}$ is the reciprocal of 2 because $1 \div 2 = \frac{1}{2}$)

Expanded form of a decimal- shows how much each digit is worth and that the number is the total of those values added together (Example: 432.56 written in expanded form is $(4 \times 10^2) + (3 \times 10^1) + (2 \times 10^0) + (5 \times 10^{-1}) + (6 \times 10^{-2})$

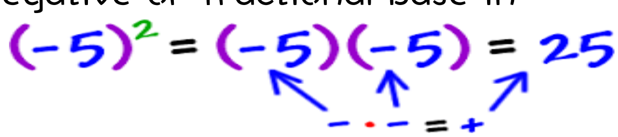
Focus Area Topic: Students will learn the precise definition of exponential notation and how to use this definition to prove the properties of exponents.



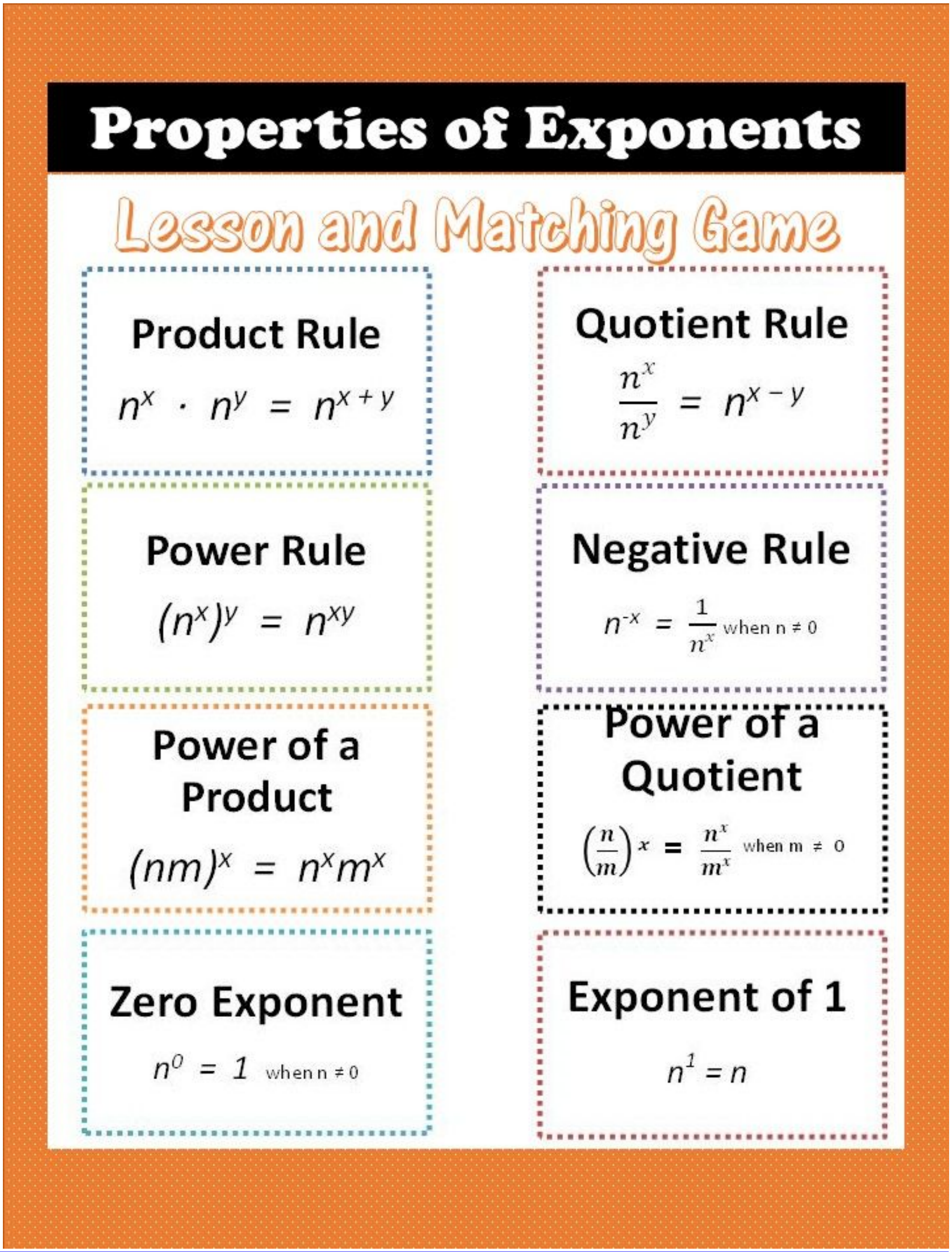
6×6 means 6^2 which is read as "6 squared"

$2 \times 2 \times 2$ means 2^3 which is read as "2 cubed"

It is important to use parentheses when writing numbers with a negative or fractional base in



Laws of Exponents



Product Rule: Bases are the same, keep the base and add the exponents.

$$x^2 \cdot x^3 = \underbrace{x \cdot x \cdot x \cdot x \cdot x}_{5 \text{ of them}} = x^5$$

Quotient Rule: If bases are the same, keep the base and subtract the exponents.

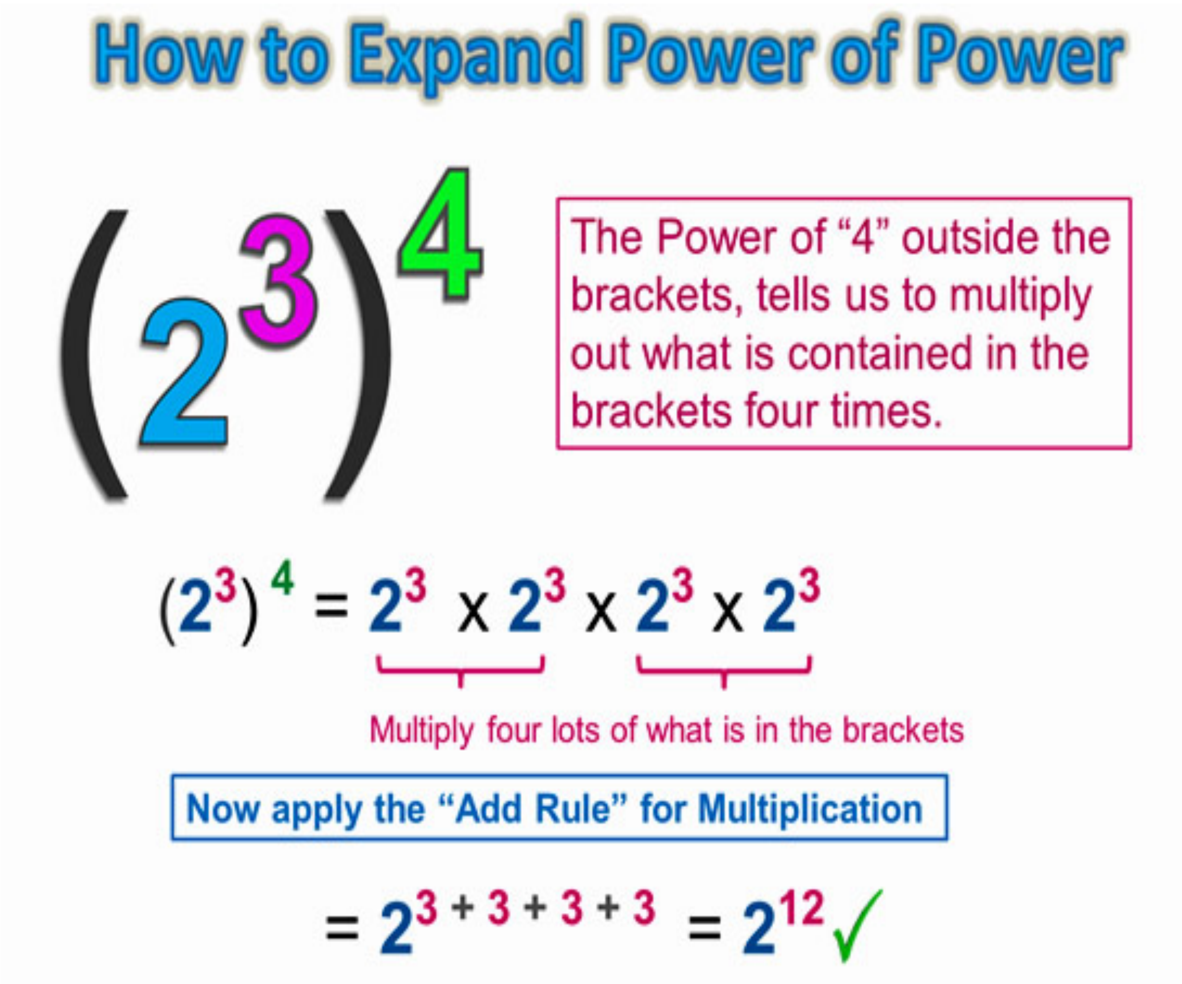
Quotient Law or Quotient Rule:

$$\frac{x^m}{x^n} = x^m \div x^n = x^{m-n}$$

Example: $\frac{5^4}{5^3} = 5^4 \div 5^3 = 5^{4-3} = 5^1 = 5$

Proof: $\frac{5^4}{5^3} = \frac{\cancel{5} \cdot \cancel{5} \cdot \cancel{5} \cdot 5}{\cancel{5} \cdot \cancel{5} \cdot \cancel{5}} = 5$

Power to a Power Rule: A power raise to a power — multiplied by another power.



Zero Exponent Rule:

Any number raise to the zero power is 1.

Power of Zero Exponent

$$\frac{2^3}{2^3} = \frac{2 \times 2 \times 2}{2 \times 2 \times 2} = \frac{8}{8} = 1 \checkmark$$

$$\frac{2^3}{2^3} = 2^{3-3} = 2^0 \checkmark$$

We have two correct answers, but they are different to each other. This means that the following must be true:

$$\boxed{2^0 = 1}$$

Dividing with Exponents

- To **divide** powers of the same base, keep the base and **subtract the exponents**.

$$\frac{7^{10} \cdot 5^{12}}{7^6 \cdot 5^4} = \frac{7^{10}}{7^6} \cdot \frac{5^{12}}{5^4}$$

$$= 7^{10-6} \cdot 5^{12-4} = 7^4 \cdot 5^8$$

Keep 7, subtract 10-6

Keep 5, subtract 12-4

Negative Exponents RULE

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

A Negative exponent means we have to re-write our Power term as a 1/ Fraction.

Negative Exponents are Positive Fractions.

Note "a" cannot be zero, because 1/0 is not possible .

Negative Exponents – Full Story

Due to the way flipped over fractions called "Reciprocals" work:

An item in the **TOP** with a Negative Index Power moves to the BOTTOM , where it becomes a POSITIVE Index Power.

An item in the **BOTTOM** with a Negative Index Power moves to the TOP, where it becomes a POSITIVE Index Power.

$5^{-2} = 1/5^2 = \mathbf{1/25}$ but $1/5^{-2} = 5^2/1 = \mathbf{25}$

$$\frac{2^{-3}}{5^{-4}} = \frac{5^4}{2^3} \checkmark$$

$$\frac{2^2}{3^{-2}} = 2^2 \times 3^2 = 4 \times 9 = \mathbf{36} \checkmark$$

A quotient of powers with the same base can be found by writing the powers in a factored form and dividing out common factors.

$$\frac{3^5}{3^3} = \frac{\cancel{3}\cdot\cancel{3}\cdot\cancel{3}\cdot 3\cdot 3}{\cancel{3}\cdot\cancel{3}\cdot\cancel{3}} = 3\cdot 3 = 3^2$$

Notice the relationship between the exponents in the original quotient and the exponent in the final answer: 5 – 3 = 2.

7-4 Division Properties of Exponents

Check It Out! Example 2

Simplify $(3.3 \times 10^6) \div (3 \times 10^8)$ and write the answer in scientific notation.

$(3.3 \times 10^6) \div (3 \times 10^8) = \dfrac{3.3 \times 10^6}{3 \times 10^8}$

$= \dfrac{3.3 \times 10^6}{3 \times 10^8}$ *Write as a product of quotients.*

Simplify each quotient.

$= 1.1 \times 10^{6-8}$ *Simplify the exponent.*

$= 1.1 \times 10^{-2}$ *Write 1.1 in scientific notation as 11 x 10^{-1}.*

$= 11 \times 10^{-1} \times 10^{-2}$ *The second two terms have the same base, so add the exponents.*

$= 11 \times 10^{-1-2}$

$= 11 \times 10^{-3}$ *Simplify the exponent.*

Holt Algebra 1
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