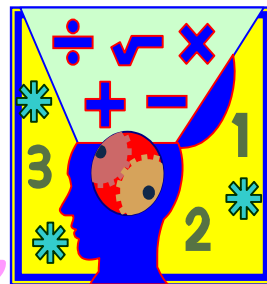


Algebra Connections



Mr. Breitsprecher's Edition

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Web: www.clubtnt.org/my_algebra

Feel the POWER: Exponents!



Working with exponents is an important part of algebra and other classes. Let's go over the procedures of exponent rules in detail and review some examples.

Rules of 1

There are two simple "rules of 1" to remember.

First, any number raised to the power of "one" equals itself. This makes sense, because the power shows how many times the base is multiplied by itself. If it's only multiplied one time, then it's logical that it equals itself.

Secondly, one raised to any power is one. This, too, is logical, because one times one times one, as many times as you multiply it, is always equal to one.

$$\begin{aligned} x^1 &= x \\ 3^1 &= 3 \\ 1^m &= 1 \\ 1^4 &= 1 * 1 * 1 * 1 = 1 \end{aligned}$$

Product Rule

The exponent "product rule" tells us that, when multiplying two powers that have the same base, you can add the exponents. In this example, you can see how it works.

Adding the exponents is just a short cut!

$$\begin{aligned} x^m * x^n &= x^{m+n} \\ 4^2 * 4^3 &= 4 * 4 * 4 * 4 * 4 \\ 4^{2+5} &= 4^5 \end{aligned}$$

Power Rule

The "power rule" tells us that to raise a power to a power, just multiply the exponents. Here you see that 5^2 raised to the 3rd power is equal to 5^6 .

$$\begin{aligned} (x^m)^n &= x^{m*n} \\ (5^2)^3 &= 5^6 \end{aligned}$$

Note: This is really where the **Power of a Quotient** rule comes from. Numbers without exponents are assumed to be to the power of 1.

$$(a/b)^m = a^m/b^m, b \neq 0$$

Quotient Rule

The quotient rule tells us that we can divide two powers with the same base by subtracting the exponents. You can see why this works if you study the example shown.

$$\begin{aligned} x^m \div x^n &= x^{m-n}, x \neq 0 \\ 4^5 \div 4^2 &= \cancel{4} * \cancel{4} * \cancel{4} * 4 * 4 * 4 / \cancel{4} * \cancel{4} \\ 4^{5-2} &= 4^3 \end{aligned}$$

Zero Rule

According to the "zero rule," any nonzero number raised to the power of zero equals 1.

$$x^0 = 1, x \neq 0$$

Negative Exponents

The last rule in this lesson tells us that any nonzero number raised to a negative power equals its reciprocal raised to the opposite positive power.

$$\begin{aligned} x^{-n} &= 1/x^n \\ 4^{-2} &= 1/4^2 = 1/16 \end{aligned}$$

Source: www.math.com

Common Errors With Exponent Rules

With practice, we can all apply and work with these rules. Sometimes, we learn how to do things by making mistakes. Here are some common errors with exponents. Please review the following examples of how **NOT** to work with exponents.

- The exponent next to a number applies **ONLY** to that number unless there are parenthesis (grouping) that indicate another number or sign is actually part of the base.

$$\begin{aligned} -5^2 &\neq (-5)^2 \\ -(-5)(5) &\neq (-5)(-5) \\ -25 &\neq 25 \end{aligned}$$

- The product rule ($x^m * x^n = x^{m+n}$) only applies to expressions with the same base.

$$\begin{aligned} 4^2 * 2^3 &\neq 8^{2+3} \\ (4)(4)(2)(2)(2) &\neq 8^5 \\ 128 &\neq 32,768 \end{aligned}$$

- The product rule ($(x^m * x^n = x^{m+n})$) applies to the product, not the sum of 2 numbers

$$\begin{aligned} 2^2 + 2^3 &\neq 2^{2+3} \\ (2)(2) + (2)(2)(2) &\neq 2^5 \\ 4+8 &\neq (2)(2)(2)(2)(2) \\ 12 &\neq 32 \end{aligned}$$

Math.com has a variety of online lessons and interactive tutorials to help students master many of the concepts in our math. Check out the "workout" of 10 interactive exponent examples with solution and helpful tips at:

<http://www.math.com/school/subject2/practice/S2U2L2/S2U2L2Pract.html>