Laws of Exponents

Laws of exponents are one of the most essential skills you need to know in Algebra 1. Make sure you know these laws really well!

There are 7 laws of exponents that you will learn in Algebra 1. Let's get started!

1) Product of Powers Rule

$$\mathbf{X^2 \cdot X^3 = X^{2+3} \text{ or } X^5}$$

The Product of Powers Rule allows us to add exponents when multiplying 2 terms with the same base.

For instance, in the problem above, both terms have the same base of x and are being multiplied together. We can add the exponents on each term while keeping the same base to get the right answer.

Examples:

$2^3 \cdot 2^4 = 2^7$ $\quad 6^6 \cdot 6^4 = 6^{10}$ $\quad 5^0 \cdot 5^2 = 5^2$

2) Quotient of Powers Rule

$$\frac{x^6}{x^3} = x^{6-3} \text{ or } x^3$$

The Quotient of Powers Rule allows us to subtract exponents when dividing 2 terms with the same base.

For instance, in the problem above, 2 terms with the same base of x were being divided, so we can subtract the exponents of both terms while keeping the same base of x to get the right answer.

Examples:

$$\frac{10^8}{10^3} = 10^5$$

$$\frac{12^{14}}{12^5} = 12^9$$

$$\frac{5^4}{5^1} = 5^3$$

3) Power of a Power Rule

$(x^3)^4 = x^{(3*4)} \text{ or } x^{12}$

The Power of a Power Rule allows us to multiply exponents when we raise a term with an exponent to a higher exponent.

For instance, in the problem above, we had a term with an exponent and we raised it to a higher power. This allows us to multiply the 2 exponents while keeping the same base of x to get the right answer.

Examples:

$(4^9)^5 = 4^{45}$ $(18^3)^9 = 18^{27}$ $(3^5)^8 = 3^{40}$

4) Power of a Product Rule

$$(x \cdot y)^5 = x^5 \cdot y^5$$

The Power of a Product Rule allows us to distribute an exponent to each term in parentheses.

For instance, in the problem above, 2 terms (x and y) are in parentheses and both are raised to the 5th power. Using the power of a product rule, we can distribute the exponent 5 to each term in the parentheses, allowing us to get the right answer of $x^5 \cdot y^5$.

Examples:

$(5 \cdot 10)^2 = 5^2 \cdot 10^2$ $(3 \cdot 8)^9 = 3^9 \cdot 8^9$

5) Power of a Quotient Rule

$$\frac{(x)^6}{(y)^6} = \frac{x^6}{y^6}$$

The Power of a Quotient Rule allows us to distribute an exponent to the numerator and the denominator of a fraction.

For instance, in the problem above, x divided by y is being raised to the 6th power. Using the power of a quotient rule, we can raise x and y both to the 6th power, allowing us to get the right answer.

Examples:

$\frac{(5)^3}{(6)^3} = \frac{5^3}{6^3}$ $\frac{(8)^7}{(2)^7} = \frac{8^7}{2^7}$ $\frac{(10)^5}{(4)^5} = \frac{10^5}{4^5}$

6) Zero Power Rule

$$x^0 = 1$$

The Zero Power Rule allows us to assign a value of 1 to any number raised to the power of 0.

For instance, in the problem above, we raised x to the 0th power, so the answer is 1 because anything raised to the power of 0 is 1.

Examples:

$2^0 = 1$ $4^0 = 1$ $250^0 = 1$ $7^0 = 1$

7) Negative Exponent Rule

$$x^{-4} = \frac{1}{x^4}$$

The Negative Exponent Rule allows us to rewrite negative exponents in terms of positive exponents in the denominator (or if the negative exponent is in the denominator, then you rewrite the positive exponent in the numerator).

For instance, in the problem above, x was raised to the -4th power. Using the negative exponent rule, we can move this term to the denominator to make the exponent positive.

Examples:

$\frac{1}{x^{-8}} = x^8$ $\quad$ $x^{-2} = \frac{1}{x^2}$ $\quad$ $\frac{1}{x^{-3}} = x^3$

Tips for Solving Problems:

1. Make sure you know these rules well as you use them a lot in Algebra 1, whether you are working on operations with polynomials or even quadratic equations.

2. Remember that when dealing with the same base, depending on the operation, you are going to manipulate the exponents to get your answer. If you are dealing with the same exponent on different bases, you would distribute the exponent to each base (following the operation you are given) to get your answer.

3. Remember if you have negative exponents in the numerator (if you see a term with a negative exponent by itself, it is really over a denominator of 1, but we do not write that because anything over 1 is itself), move the term to the denominator so it can be positive. If there are negative exponents in the denominator, move it to the numerator so the exponents can be positive.