Math Exponent Rules!

Here you will learn the rules of exponents while we do math! But first you must learn what everything is.

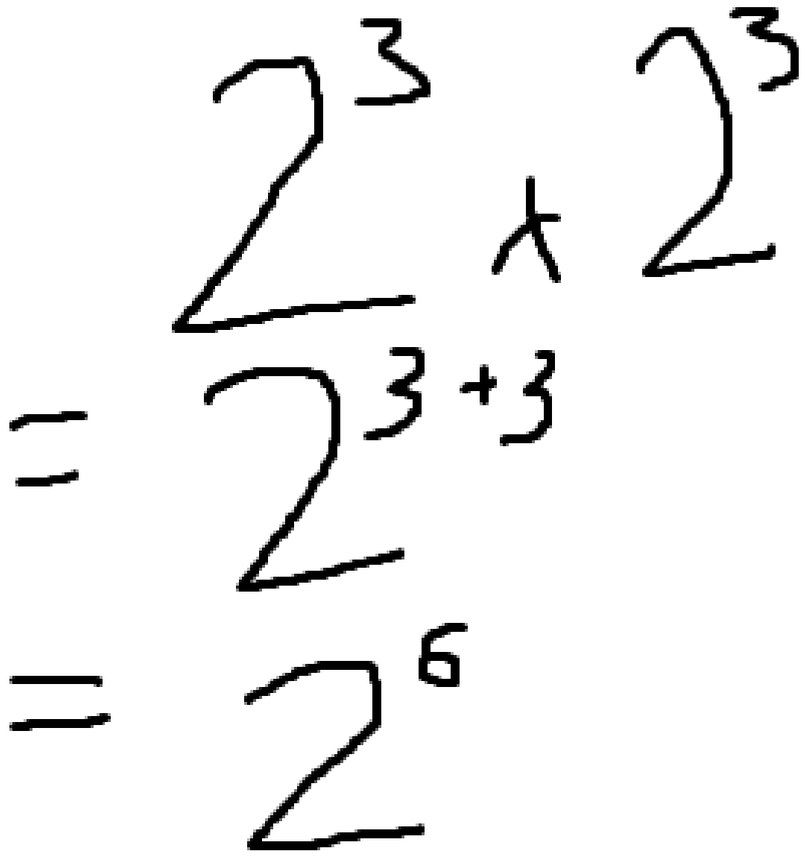
Definition of base.

The base is the part of the power that is being multiplied. If we write the power as y x y x y, y would be the base as it is the number being multiplied by itself 3 times. If we write the base with the exponent that would be y^3. Ex: 4^4 = 4 x 4 x 4 x 4. In this equation we can clearly see that 4 is the number being multiplied by itself 4 times therefore four is going to bet the base of this equation.

Definition of Exponent

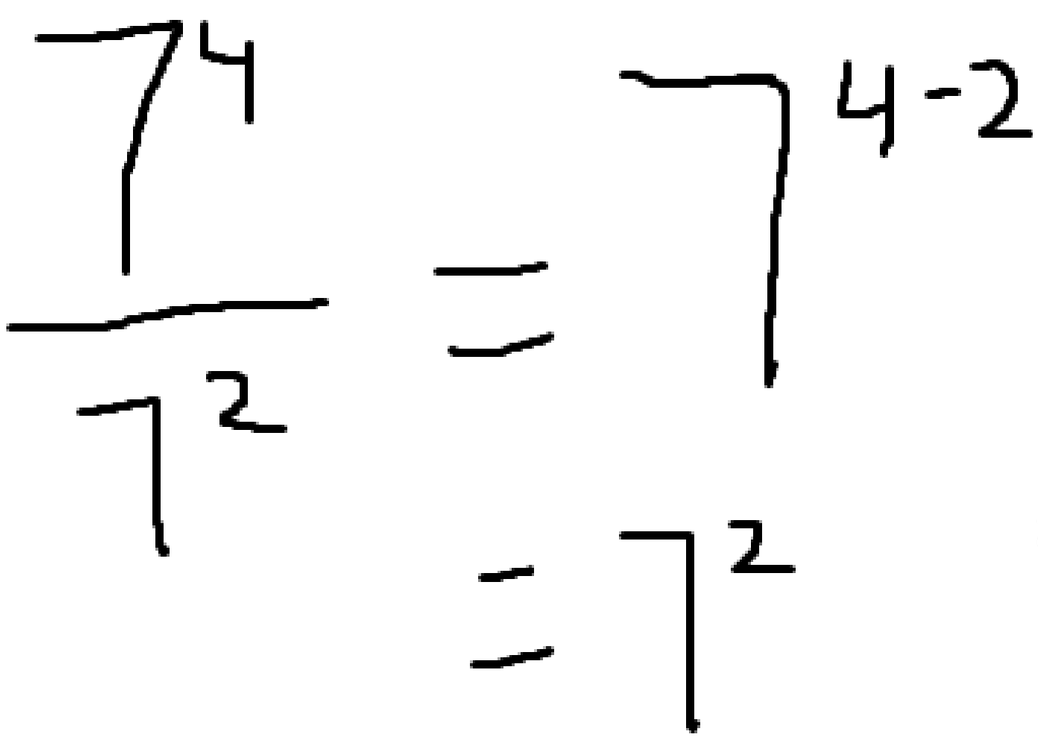
The exponent is the number of times that the base is going to be multiplied. Say we have y x y x y x y, by counting how many times y is being multiplied, or counting the y's, we will know to what exponent the why is to the power of. By counting the y's, we get y ^4, so in this case the four is the exponent. Ex: 5^4 = 5 x 5 x 5 x 5. As we can see in both equations 5 is to the power of 4. We can see this by counting the amount of fives in the multiplication or by looking at the small number at the top right of the five that dictates how many times the base is multiplied by.

Product Rule



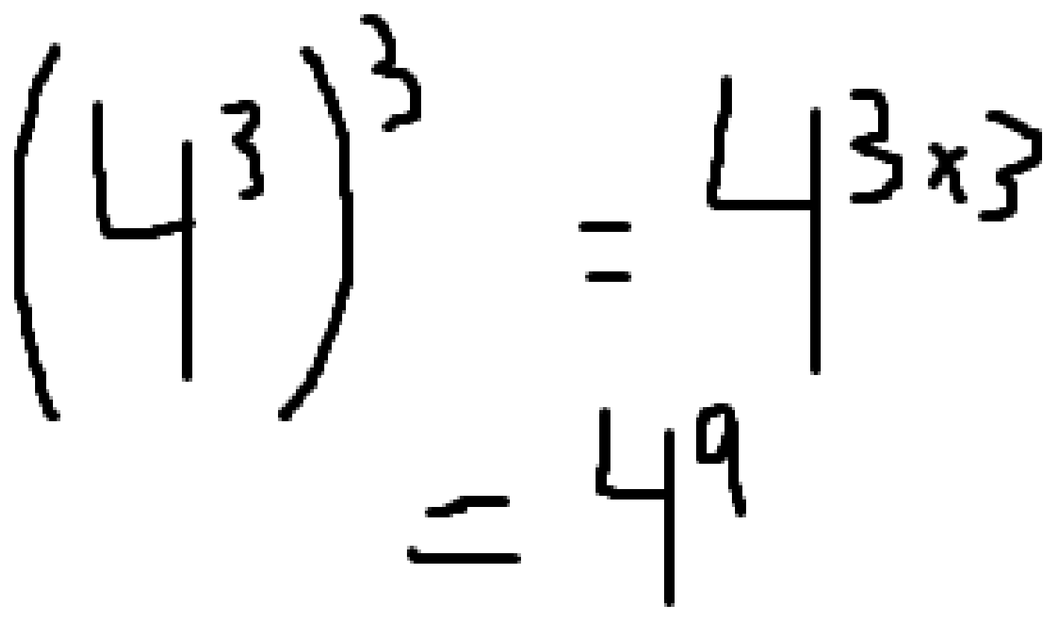
The product rule occurs when we multiply two or more powers together, although the bases of these powers must be the same. Look at the equation y^7 x y^5= x, we can simplify this equation by adding the exponents together. What this will look like is y^7+5= x. As we know 7+5 is 12, so our new power is y^12 which is going to be equal to both sides of the equation we had before, it is equal to x and to y^7 +y^5. Another way to solve this or to write this equation as one power would be to write the equation in the form of a repeated multiplication. Y x y x y x y x y x y x y x y x y x y x y x y. By looking at this and using how we find exponents in the last rule, we can see that we have y^12. Ex: 2^3 x 2^3 = a. If we look at this equation, we can see that both powers have the same base, therefore, we can apply the product rule. 2^3+3 = 2^6. We can verify this by, again, writing it as a repeated multiplication, 2 x 2 x 2 x 2 x 2 x 2. If we count the two's, we have six, therefore our answer of 2^6 was correct.

Quotient Rule



The quotient rule happens when we divide two or more powers together, but again the bases of the powers must be the same or this rule will not work. Say we have the equation j^8/j^5. As we can see this is a quotient meaning division, and we can simplify this quotient by doing the opposite that we did with the multiplication. As division is the opposite of multiplication and when we calculate the product of two or more powers, we added the exponents, we will do the opposite here and subtract the exponents. Using this we will get j^8-5= j^3. This will simplify our equation to the fullest, another way we can do this is by putting both sides of the division in repeated multiplication form. J x j x j x j x j x j x j x j / j x j x j x j x j. By looking at this we can cancel out the J's and take the remaining j's and get the quotient we had before of j^3. Ex: 7^4 / 7^2. We can take this equation and simplify to 7^4-2 and our new simplified answer will be 7^2.

Power to Power Rule

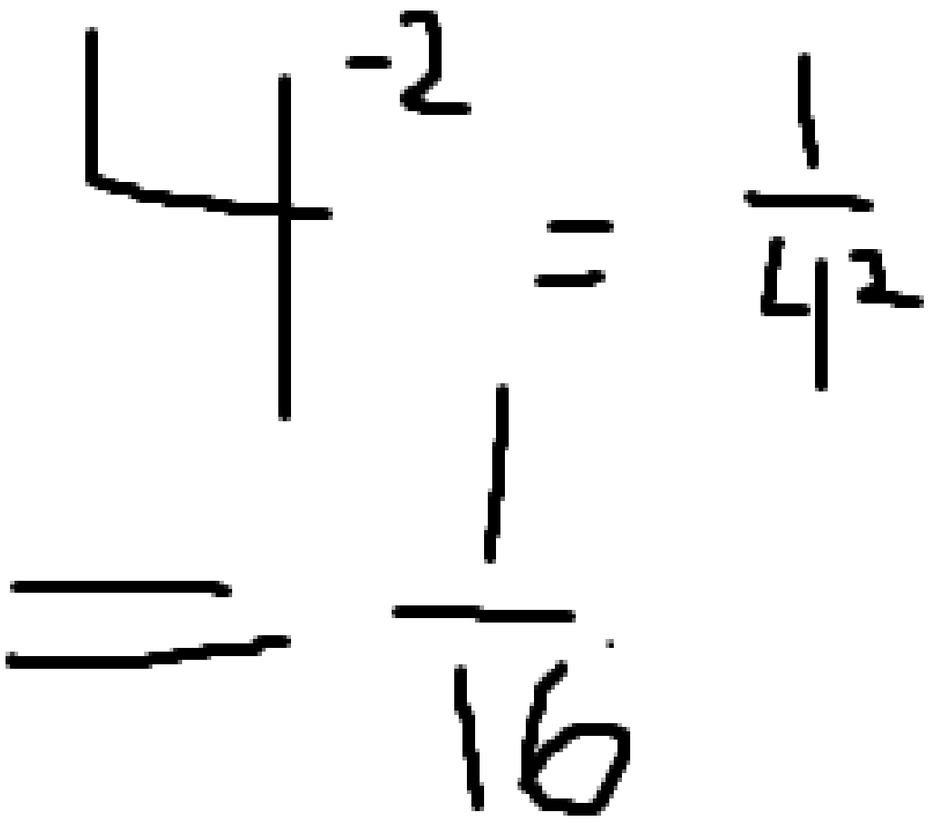


You may encounter problems that look like (f^3)^5. This is when a power is to another power, there is a rule that we can use for this to simplify this equation to a single power. We can do this by multiplying the exponents of the power. Our equation will look like f^3 x 5. This will give us our new and simplified power of f^15, but there is also another way to do this. We can write this in repeated multiplication form again like (f x f x f) (f x f x f) (f x f x f) (f x f x f) (f x f x f). This is written in brackets because this equation is basically telling us that it is f^3 five times. Now, all we must do is count the number of f's and as there are 15 of the, our simplified equation is f^15. Ex: (4^3)^3. By applying the rule we used before, we get 4^ 3 x 3= 4^9.

Zero Exponent Rule

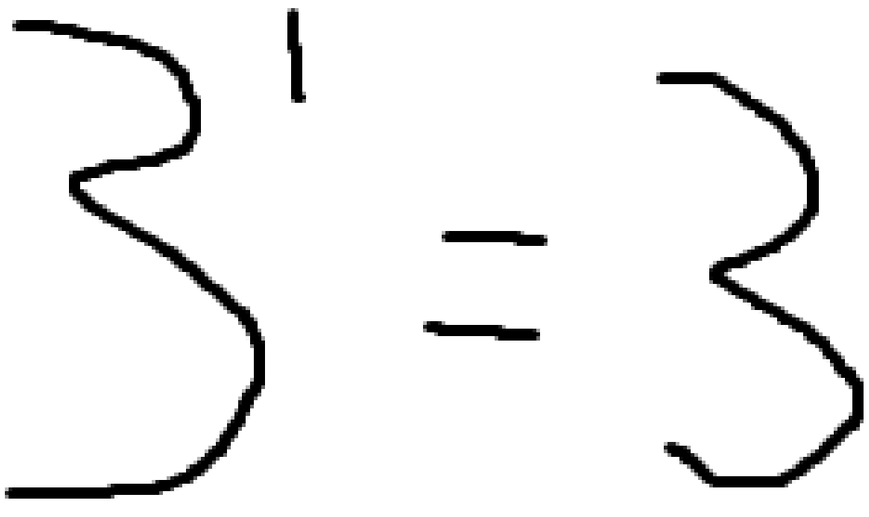
Having an equation like x^0 might seem hard at first but it is quite simple. Anything to the power of 0 is going to be equal to 1. We can prove this to be true by looking at this patter with the exponents. 2^3 = 8 2^2= 4 2^1= 2. As we can here with these examples, since the base is two and we are simply multiplying to by its self each time we can see that if we want to go down an exponent we can divide by the base. Meaning if we want to go from 2^1 to 2^0 we can by dividing 2^1 by two. Anything divided by itself is equal to one therefore bringing our answer to 2^0 = 1.

Negative Exponent Rule



If the exponent in an equation is negative, there is a rule that we can use to make it easier to solve. Say we have b^-k. We can put this in the form of a positive fraction. The way we do this is we take 1 as the numerator and change the b^-k to positive and then we can take that as the denominator. So, our answer would be 1/b^k. Ex: 4^-2. We know 1 is our denominator, and we switch it to positive and keep it as the denominator, so we get 1 /4^2. Since these are integers, we can solve even further, we know 4^2 is 16 therefore our answer is 1/16.

One Exponent Rule



The one exponent rule states that anything to the power of 1 will be equal to itself. We know not only by the example that was used with the zero exponent rule but also because if we have say 3^1, it's just 3 one time meaning 3^1 equals 3. We can also think about as anything divided by one is itself.