

Exponents in Algebra

I love in algebra when you can find a quick way to do something or a quick way to write something. And you can do that with exponents. Here we have a problem where we have to multiply 4 times 4 times 4 times 4 times 4. And to me, that's a lot of 4's to have to say in a row and to write in a row. And you can use something called exponential form and rewrite that as 4 to the 5th power.

We're using 5 because if you count, we have one, two, three, four, five 4's. So the number of 4's that you have is going to be the number that you have in your exponent. If you break down that 4 to the 5th power, the 4 is referred to as the base, and the exponent, or the 5, is your exponent.

It's going to be important for you to be able to talk about the different parts of your exponential forms. The original 4 times 4 times 4 times 4 times 4 is actually called expanded form. And when you actually write the answer, which would be when you multiply 4 times 4 times 4 times 4 times 4, the answer itself is 1,024. And that is referred to as standard form.

Exponents are most useful when you have to multiply the same number multiple times. But you can use it when you have just two numbers that you're multiplying as well. So if we have 5 to the 2nd power, which we said was the same as 5 times 5, the answer is very simple. It's 25. And you can do that in your head. You don't need a calculator for that. But what's interesting is when we use the exponent of 2, you can say that 5 to the 2nd power, or you can say that as 5 squared. You can do that with any base with an exponent of 2. It's 8 to the 2nd power, 8 squared. 9 to the 2nd power, 9 squared. Or 110 to the 2nd power, or 110 squared.

Likewise, you can do that with an exponent of 3. So you can save out as 4 to the 3rd power, or you can say it as 4 cubed. And you can do that with any base with an exponent of 3. So 10 to the 3rd power, you can say it 10 to the 3rd power, or 10 cubed. 2 and 3 are the only exponents that you can do this with. Anything higher than 3, you use the notation to the 5th power. So there's no shortcut for saying to the 5th power or to the 8th power or to the 10th power.

Another nice little trick-- at least I think it's a nice little trick-- is when you deal with powers of 10. And powers of 10 are something that you're going to deal with a lot I'm going to write down my powers of 10 in order here. And I want to examine what they look like in expanded form and then in standard form. So expanded form we said was simply writing out the base the number of times the exponent tells us to. So 10 squared is 10 times 10. 10 to the 3rd is 10 times 10 times 10. 10 to the 4th would be 10 four times.

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And I'm going to also write this in standard form where I have my solution. So 10 times 10 is 100. 10 times 10 times 10 is 1,000. 10 times 10 times 10 times 10 is 10,000. See if you can take a look at the exponent here and notice any pattern between the exponent and your standard form. An exponent of 3, there is my standard form, and exponent of 4, and there's my standard form. This trick only works for powers of 10.

But when you have an exponent with a base of 10, it's very simple to write out in standard form because you simply need to write however many 0's are in that exponent. So here I have 8 in my exponent, or as my exponent. So I'm going to put eight 0's. So 10 to the 8th power is a really big number. It's 100 million. This trick only works for powers of 10, where 10 is the base. It will not work if you have 2 or 5 or 15 as a base. It only works for powers of 10.

Let's take a look at just a few examples. You guys can try these along on your note paper. And we're going to start with a simple one of 9 squared. And let's take a look at what that looks like in standard form and expanded form. Expanded form is where you simply multiply the base times however many times the exponent tells you to. And here we have to the 2nd, or squared. So we're multiplying it twice. And 9 times 9 is 81.

We're going to take 5 to the 3rd power, meaning we're going multiply our base three times. And that would be my expanded form. And 5 times 5 is 25, times another 5 is 125, which would be my standard form.

We'll try another nice little number here, 4 to the 3rd. It means I'm gonna multiply my base, 4 times 4 times 4. Gonna multiply it three times. 4 times 4 is 16, times 4 is-- what is that-- 64. Did I do that right? OK, what you want to do with multiplying by exponents is you want to be really careful not to confuse the exponent with multiplication. This is a common mistake. And I just want to point it out because it's something to look for.

When you see 4 to the 3rd power as an example, that 3rd power is raised up so it doesn't look like 4 times 3. It's not 4 times 3. It's 4 to the 3rd power. So you have to be very careful. 4 to the 3rd power, as we saw when we multiplied it out, gives us 64. And 4 times 3 is 12. So clearly, they are not the same

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numbers. It is not the same operation. So you just want to be very careful when you multiply that you are taking it to the exponent or to the power and multiplying it out in expanded form.

You can also use a calculator for this if you happen to have a calculator, the calculator is going to have on it a symbol most likely that looks like x to the y power. You'll have to check your calculators directions. But quite often, you would type in the number first, and then hit the x to the y power button, and then you would hit your exponent. So this would translate to 3 to the 2nd power. But you will have to give it a try because all calculators are different.
