Hi, my name is Anthony Varela. And today, I'm going to talk about properties of addition and multiplication. So first, we're going to start off by talking about the identity and inverse properties. Then we'll get into commutative and associative properties. And then we'll finish by talking about distribution and basic factoring.

So, first, let's talk about the identity property. And when I think about identity, I think about the self. So we're going to look at the identity of property with both addition and multiplication.

So let's start with an addition example first. And, basically, we're looking for then, in this example, 13.5 plus some number will equal itself, 13.5. So what do I add to 13.5 so that it doesn't change its value? It remains 13.5.

Well, that seems pretty easy. We add 0. And that's the identity property of addition. Adding 0 doesn't change the value.

With multiplication, we can look at this example of 7/3. What do we multiply by 7/3 so that it will remain 7/3? We will multiply that by 1. And that's what the identity property of multiplication says.

So, with addition, we add 0 to keep a value the same. And with multiplication we multiply it by 1 to keep the value the same. So we're going to write that down as the identity property.

Well, now how about inverse property? Well, I like to think of opposite when I think of inverse. So let's see how this works again with addition and multiplication.

So let's take our example of 13.5 again. Now what do we add to 13.5 to get 0? Well, we have to add its opposite. We have to add negative 13.5 to get 0.

How about multiplication? Let's take our 7/3 example. What do we multiply by 7/3 to equal 1? Well, we don't multiply its opposite because that would be negative 7/3.

But we multiply what's called it's "reciprocal," which is just the fraction flipped upside down. We have 3/7 now. So when we multiply that through, we get 1.

So that's we're talking about with the inverse property. And we say that the additive inverse is adding in numbers opposite. And the multiplicative inverse is multiplying the number's reciprocal. Or we can imagine this a as being over 1, so its reciprocal is 1/a. So that's our inverse property for addition and multiplication.

Now let's get into the commutative property. And when I think about commutative, I always think of commuting. So I'm going to use a commuting example.

If I'm going from point A to point B, I know that I'm driving first eight miles, then making a turn, and driving three more miles. So from A to B, it's 8 plus 3 for a total of 11 miles.

Now if I'm going from B to A, at first I drive three miles, and then I drive eight miles. So I can say 3 plus 8, which is also a total of 11 miles. So here, the order in which we add doesn't matter. We're still going to get the same total.

This works for multiplication as well. So here I have a picnic blanket with lots of different checkered squares. It's a 4 by 8 blanket. Now how many small squares do we see in this picture? One way to figure this out is to multiply 4 by 8 to get a total of 32. Or I can multiply 8 by 4 and get 32, as well. So even with multiplication, the order in which I multiply those two numbers does not matter.

So our commutative property states, "This is a property of addition that allows terms to be added in any order. It's also a property of multiplication that allows factors to be multiplied in any order." So we can do this in any order we wish.

And so there is our commutative addition and commutative multiplication formulas. And, you know, this works for more than two numbers. So although our formulas only have a and b, here we have 7 plus 3 plus 4. The commutative property says I can add in whatever order I want. So I could save 3 plus 4 plus 7. That's A-OK. Same with multiplication. 2 times 3 times 5 is the same as 3 times 5 times 2, multiplying in any order I want.

All right. Now let's talk about the associative properties. So we have this expression here-- 8 plus (2 plus 9). And we have the 2 and the 9 in parentheses here. So order of operations tells me to do those first. So this is 8 plus (11), or 19.

Well, associative property lets you group these differently. So I could say that this is (8 plus 2) grouped together, plus 9. And I might prefer this because I can match up two numbers that equal 10. Adding 10 is just easy to do in my head. I get the same answer.

Does this work for more than three numbers? And it sure does. I have 6 plus (4 plus 3) plus 5. You know, I could say then that this is 6 plus 7 plus 5, which would be 13 plus 5, which would lead me to 18.

Or I might decide to regroup so that I can first get a 10. So (6 plus 4) is 10. And I can add 3 and 5. I still get 18 at the very end.

And this works for multiplication, as well. Here I have 2 times (4 times 7). And so with these parentheses, order of operations tells me to multiply 4 and 7 first. And now I have to double 28, which might take a second or two longer in my head to get 56.

Which is why the associative property might be nice. Because multiplying 2 and 4 together first, 8 times 7 is a basic multiplication fact. I can get to 56 just a little bit quicker.

So our associative property is a property of addition that allows terms to be grouped in any order and a property of multiplication that allows factors to be grouped in any order. So with the associative property, we can group these in any order we wish to make things a little bit easier, a little bit quicker in our heads.

All right. Lastly, I'd like to talk about distribution and factoring. And this is probably one of my favorites. So you might also hear this as distributing multiplication over addition.

So here is an area. It has a length of 5 and a width of 8 plus 3. So think of this is being 8 and then this is 3. And one way to find the area of this rectangle to multiply those two dimensions, 5 times the quantity, 8, plus 3. And I know another way I can write this is 5 times 11, so I should get 55.

But let's use the distributive property here. And so what the distributive property says is we can write 5 times the quantity of (8 plus 3). We can distribute 5 into 8 and 3.

So what that looks like is distributing 5 into 8, so (5 times 8). And then we're going to add (5 times 3). And so what I get then is 40 plus 15, which is also 55. That's pretty cool.

Now, factoring is the reverse process of distribution. So this is what it would look like. Here we have a very basic subtraction problem-- 27 minus 15. Well, I know that equals 12. But let's go ahead and do this using factoring. So what I'm going to do is find the greatest common factor of 27 and 15.

So let's list out the factors of 27. That would be 1, 3, 9, and 27. Let's list out the factors of 15, which would be 1, 3, 5, and 15. So I see that the greatest common factor is three. It's the largest number that appears in both of those sets.

So I am going to factor out of 3 from both 27 and 15. So I'm going to write this as 3 times-- let's see, that would be 9, because 3 times 9 is 27. And then I'm going to subtract (3 times 5) because (3 times 5) is 15. Well, now that I have a three, which is a common factor in both of these, I can factor that out. So I have 3 times (9 minus 5). And you can apply distribution to get back to this.

So the distributive property is a property of multiplication that states that "a sum multiplied by a factor can be expressed as a sum of the products of each original addend and that factor." It's a little bit wordy. So refer to this card. It might make more sense, that we can distribute this a into both B and c. And then basic factoring is just the opposite of that, or the reverse process.

All right. So what did we talk about today? We talked about some properties of addition and multiplication, the identity property, and the inverse property. We talked about commutative property, which lets you add in any order or multiply in any order. Associative property lets you regroup. And then we talked about the distributive property and basic factoring as a reverse process of distribution.

Well, thanks for watching this video on properties of addition and multiplication. Helped to catch you next time.