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SPEAKERS

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Hello and welcome. Today we're going to be looking at the elimination method. In a previous video, we looked at the substitution method where to solve a system of equations, we solve for one variable at a time. With the elimination method, what we're going to do is manipulate the equations themselves, and then add and subtract them together in order to eliminate all the unknown variables but one. And this is a useful method, students are not as comfortable with it, not as familiar as the substitution method. But I think it's one that you will find useful and helpful for you going forward. As the elimination method suggests, it's possible to add and subtract equations together and give us insight about what the value of these unknown variables might be. We also know that if as long as we perform an algebraic operation on both sides of the equation, both the left side and the right side, then we know that the equality will continue to hold. And so we can combine these two facts. And when we do combine these two facts, we get the elimination method. So let me demonstrate.

We've got equation one here, we've got equation two here. And we've got a couple variables. A couple ways to approach this problem, notice that equation one, we could multiply both sides of the equation by two. And if we did that, we will get 4X plus six Y is equal to six. Now if I rewrite the second equation beneath it, we have 6X plus six Y is equal to negative one. Now why did I multiply equation one by two? Well, I wanted my coefficient in front of the Y variables to be equal to each other. Since they're both equal to each other, they're also both positive, they're exactly equal to each other. I can subtract this new equation one. Well, I can subtract equation two from equation one. So I could sort of write it like this, minus there, and I'm going to subtract each term in the equation, new equation one, by each term in equation two. The result gives us negative 2X plus zero Y, there's no Y there, or, in fact, I'll just leave it as is zero is equal to seven. And if I solve for X, we're going to have X is equal to seven over two, or X is equal to 3.5. Now that we've got our X value, we can plug it into one of these expressions and solve for Y. So I can write equation one, we had 2X plus three, Y is equal to three.

Now I've got two got two times negative seven over two plus 3Y is equal to three. What's two times negative seven over two? Well, that's negative 14 over two or just negative seven. And 3Y is equal to three plus seven, Y is equal to 10 over three. Now if we want to be sure that we have the correct answer, we can use these values and plug them back into one of the expressions. So we have 6X plus

6Y is equal to negative one. So it'd be 6X negative 3.5 plus six times 10 over three. Now I'm mixing my fractions and my decimals. This is going to give us six times three, that's 18, this is going to be negative 21. Plus 20, 60 divided by three is going to be equal to 20, is equal to negative one. So it looks like we've got the right answer, I could check the other equation. But I'm confident that this is indeed the solution.

Now, you might be wondering why we can add and subtract equations like this, well, maybe if I rewrite the equation a little bit it will become clearer and give you some insight on the kinds of methods that your professors might be using to solve problems. Well, notice that we could rearrange these a little bit, so I could rewrite this as 2X plus 3Y minus three is equal to zero. And the bottom equation could write 6X plus 6Y plus one is equal to zero. And that's algebraically. That's allowable. Now, I guess I need to transform this equation one here by multiplying it by two, so we get what we had before.

If you don't like the idea of adding and subtracting equations, I can show you kind of where it's coming from, notice that both these equations are equal to zero. And since they're both equal to zero, they must be equal to each other. So it must be the case that 4X plus 6Y minus six is equal to 6X plus 6Y plus one. And if we want to move, then we can just move things around algebraically. And so if we subtract six Y on both sides of the expression, we're just going to be left with 4X minus six is equal to 6X plus one. Subtract 4X on both sides of the expression and minus one, so we've got minus seven is going to be equal to 2X. And we end up with what we had before which is X is going to be equal to negative seven over two.