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SPEAKERS

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Hello everyone. In this video, we're going to be working through some more difficult systems of equation problems and solving for the unknown variables. We're going to be using the substitution method and the elimination method. You might wonder, why are we why, you know, why should I, why should you, solve these problems by hand? Couldn't I just use a sophisticated calculator or an online program? And while you could certainly do that, the reason why you want to practice these yourselves is one, to become more comfortable with algebra, more comfortable with rearranging algebraic expressions, so that you can understand what your professors are talking about, but more broadly, so you can be better working with mathematics. When in your life, you start working for a business or government and you start working with spreadsheets, and other numeric software. So it's good to practice these things. And it's good to see that there's often more than one way to represent an equality. And that's where the insights really come in when you start using a program like Excel.

Now, today, I also want you to try the problems yourself before you watch me solve it, and we can then solve it together. The reason why is to test yourself and see how good you are how much you understand. And if you get stuck, that's fine. That's good for you. That'll help you actively learn. And remember where you had a problem. And next time you have that same problem, after watching the solution, you'll be better able to solve it and get yourself through to the correct solution. So if you're ready, keep watching. And we'll get started.

We have a system of equations here. And there are decimal places. So we've got a numbers that all of which are specifically coefficient numbers that are all less than one. Go ahead, try this yourself. See if you can solve for R, see if you can solve for S or solve for S and then solve for R. When you're ready, well press pause. When you're ready, press play, and we'll solve it together.

Now to solve this, you could use the substitution method, but I am going to use the elimination method, just because I think it might be a little bit easier, I'm going to multiply this first equation by 25. Maybe the X is sort of confusing. That's going to give me 0.25 R plus 21 times 25. You might want

to use a calculator for that one, I get 5.25. Don't forget my S, my unknown variable S, and 0.042 times 25, that gives me 1.05. The second equation, I don't need to change it. Notice that right here, I've got point two five, and my coefficient. One is positive one's negative. Okay? It's kind of what I want.

Now I will add these two together. So I'm adding. And when I add them together, put a little plus sign there and then brackets around this thing. I'm going to add them together, I get zero plus 5.80 is equal to 0.58. And I forgot my S right in there. There we go. Now I want to solve for S. What's S equal to, well S is going to be equal to 0.58 divided by 5.8. I'll divide both both sides of the equation by 5.8. And I ended up with, well maybe you can see the answer. In fact, we can divide that by 1/10. There's 1/10 of a 5.8 in a 0.58. So 0.1. Now, we're going to use this value of S that we calculated. And we're going to plug it into one of our equations and solve for R. So why don't we use our top equation here, we had 0.01 R plus 0.21 S is equal to 0.042. And we've got 0.01 R, plus now plugging in this S value, so we're gonna have 0.21 times 0.01. Or I should say, not quite right, point one is equal to 0.042. Now there's a few things we could do going forward, we could multiply everything by 100. So if we multiply each term by 100, we get R plus 0.21 times 10 is equal to 4.2. And if we multiply those two brackets together, we get 2.1. And if we subtract 2.1, on both sides of the expression, we get R is equal to 2.1.

Now we can see if this is actually the right answer if it works, so let's go call this a little proof or just going to show if these two values for S and R are correct, I'm going to take this equation right here. And I'm going to plug in our values for R and S that we found. So we get negative 0.25 times 2.1 plus 0.55 times 0.1. And this whole thing should be equal to 0.47. Well negative 0.47 if our values are correct. So starting off here, I get negative 0.525 plus 0.055. And that should be equal to negative zero point, and it is equal to zero while negative 0.47. So both sides are in agreement with each other. And we can be pretty sure we found the right answer.

Here's a tricky problem. Try it on your own. I like giving my students this problem. But keep in mind, it's a tricky one. So when you're ready, and you want to watch the solution, I'll show you a little trick that can help you with problems like this. But go ahead, especially if you're brave. Try yourself when you're ready, unpause the video, continue watching and we'll solve it together. It can be hard working with these fractions. When you're trying to solve these by hand, it's natural to make mistakes. Once you have fractions involved, it's easier to make a mistake. And so one trick we can do if we've got something awkward to deal with is to replace it with an unknown variable we made up. So for example, we could say well, let's let so let V equal one over X and let W equal one over Y.

And maybe I'll just move these out of the way a little bit. So we've made this problem a little easier to work with a little more tractable, look more tractable. Now, we still need to do some work here. So why don't we use the substitution method? And I'm going to start with the top equation. And let's rearrange it so we have to the plus three W equals four. And let's solve for V. So we're gonna have 2V is equal to four minus 3W, V is equal to four minus 3W over two. Now we've got an expression for B. And we got it from this top expression here. And since we got it from the top expression, let's plug it in to the bottom one.

So we want to make sure that we're using both equations to solve for V and W variables. So I'm going

So we want to make sure that we're using both equations to solve for V and W variables. So I'm going to plug this into the second equation. So now we've got the other equation is 3V minus 2Y equals 19, plug in our V values, so we've got three times four, minus 3W over two, that's not supposed to be a Y up there, that's supposed to be a W, let's get rid of these Y's, they don't, not in our equation anymore, we got rid of them, minus 2W is equal to 19. Maybe we can multiply to this entire expression, let's multiply it by two. So we're going to be left with three, four minus 3W minus 4W equals 38. And finally, we'll break up this bracket right here, we get 12 minus 9W minus 4W is equal to 38. And if we work through this, we're gonna get 13, negative 13W is equal to 26 and W is equal to negative two.

Now we use both equations to get W is equal to negative two, we can now sub it into either the top equation or the bottom equation and solve for V. So let's do that next, put a line right here. And we know that 2V plus 3W is equal to four. And now we know that W is equal to negative two. And we end up with 2V is equal to four plus six is 10. And V is equal to five. So we move this over there by adding six to both sides of the equation, and then we divide both sides of the equation by two. So we've got V is equal to five. But of course, we're not done yet. Because if we go back up, and we look, remember the question's asking us, well, what are the values of X and Y, we've solved for the variables that we created V and W. But now we need to convert them back into their X and Y form. And to do that, we know that we've got V is equal to five. And we know that V is equal to one over X. So that means we're going to have one over X is equal to five. And X is going to be equal to one over five. Now I did a little cross multiplication there, multiply both sides by X, and then I divided both sides by five. Similarly, we can solve for W, we know that W is equal to negative two. And we know that W is equal to one over Y. And so combining these two we have one over Y is equal to negative two. And Y is going to be equal to negative one half.

Here are our answers, let's make sure that they're correct. So If I sub in my X and Y values, and I add them together, we should get the value four, the number four. So let's do that we've got two divided by one over five, plus three divided by negative one half, it's equal to four, or it should be equal to four. Now, if we're dividing by a fraction, that's like taking the inverse of the fraction and multiplying. So we're going to, we can rewrite this as two times five divided by one plus three times two. Leave it as a negative one in the denominator down there, it's equal to four. We're going to get 10 minus six, the negatives in the denominator, it doesn't matter. This value here is going to be negative. And it's going to or you can think of it as turning this plus sign into a negative which is equal to four and we get, we get four is equal to four. So we got the right answer.