Hi, welcome back. My name is Anthony Varela. And this video is about solving linear inequalities. So we're going to talk about how solving equations is both similar to and different from solving inequalities. We'll talk about how to solve linear inequalities. And then we'll plot their solutions on number lines.

So first, let's talk about solving an equation versus solving an inequality. So here is a linear equation. And when we solve this equation, we want to isolate x. So first, what we do is we add 13 to both sides of our equation. So this gives us 6x equals 21.

And then we divide both sides of our equation by 6 to finally isolate x. And we could see that x equals 3.5. So this means if we were to plug in 3.5 in for x in our original equation, we would get a true statement. 6 times 3.5 minus 13 equals 8.

Well, now, let's compare this to an inequality. So I have the same numbers and same operations here. I just have an inequality symbol instead of our equals sign. But when we're solving this inequality, we actually follow the same steps. First, we add 13. So we get just an x term on one side of our inequality. And then we divide both sides by 6. So we can isolate x. And here, our solution is x is less than 3.5.

So really, their solutions are different, although the procedure is the same. We can interpret this solution as being all x values that are less than 3.5. So what we can do then is choose an x value that's less than 3.5. So I'm choosing 3. And let's go ahead and see if this yields then a true statement. So 6 times 3 is 18.

And when we take 13 away from 18, we get 5. And this is a true statement. 5 is less than 8. So our solution here represents all x values that are underneath 3.5. As soon as we reach 3.5, we're getting some values higher than 3.5 that won't be a solution to our inequality.

So let's go ahead then and solve this linear inequality. We have 18 minus 7x is greater than 4. So we're going to follow the same procedures that we do when solving equations. So the first thing that I want to do is subtract 18 from both sides of my inequality.

So now, I just have my x term negative 7x is greater than negative 14. Now, we need to divide by that coefficient in front of x. So I'm dividing by negative 7. So negative 7x divided by negative 7 is just x, and then negative 14 divided by negative 7 equals 2.

Now, did you notice anything else? You've noticed probably that our inequality sign has changed.

Here, we have greater than. And here, we have less than. And this is very important. When multiplying or dividing by a negative when you're solving for inequalities, that inequality sign flips.

And we'll revisit this in a moment. But what I'd like to do next is plot x is less than 2 on a number line. So here's our number line. We'll put in our 2. And then we want to highlight all x values that are less than 2. So I'm going to use this curved parenthesis to show that we're not including the exact value of 2. And these are all of the values underneath.

So what I want to do now is choose a value that fits within our solution region and a value that does not, plug them back into our original inequality, and see if we get true statements for our solution and a false statement for our nonsolution. So I'm going to choose the value 0 and 3. I like to choose 0 whenever I can just because it's easy to multiply by 0. It's easy to add things to 0. And then I'm choosing 3 just because it's on the other side of 2 here.

So let's go ahead and plug these then back into our original inequality and see if we get true statements for what we believe to be a solution and then a false statement for what we believe to not be a solution. So let's go ahead and evaluate this one. Well, 7 times 0 is just 0. So I have 18 is greater than 4. That is a true statement. So that means that if our x value is 0, that satisfies our inequality.

How about when x is 3? So 7 times 3 is 21. And now, 18 minus 21 is negative 3. And this is a false statement. Negative 3 is not greater than 4. So this confirms that a, we have our solution correct. And this also reminds us why flipping the sign is so important when we divide or multiply by a negative number.

If we hadn't done that step, we would have thought that 0 was not a solution. And we would have thought that 3 was. But we can clearly see that's not the case. So this is a very, very important step when solving linear inequalities.

Well, now, let's solve a compound inequality. So this is a compound inequality because we have more than one inequality sign. We actually have two of them. So our first inequality is at negative 13 is less than 6x plus 5.

And our second inequality is at 6x plus 5 is less than 17. So we can also interpret this compound inequality as saying that the quantity 6x plus 5 is in between negative 13 and 17. So we want to identify x values that would make this inequality statement true.

So the important thing here when solving compound inequalities is that we need to apply each step into each section. And you'll see what I mean as we go through this. So we want to isolate x. So what we want to do is subtract 5 from 6x plus 5. Well, that means we want to subtract 5 in our other parts. We want to subtract 5 here. And when I subtract 5 here.

So now, we have the inequality statement 18 is less than 6x, which is less than 12. So now, to isolate x in the middle here, we need to divide by 6. And we apply this step to every section. So we need to divide negative 18 by 6. We need to divide 12 by 6.

So now, we have just x in the middle. And x is in between negative 3 on one side and positive 2 on the other. Notice we didn't divide by a negative number. So we don't have to flip any of our inequality signs.

So now, let's go ahead and plot this then on the number line. So I have marked in negative 3 and 2. And these are x values in between but not including. So we're going to have open circles and then just highlight the range of values in between.

So here is our number line solution and then our original inequality. Let's choose a value that fits within the solution region and then a value that doesn't fit or fits outside of that and confirm that we've done this correctly. So once again, I'm going to choose 0. It's a nice number to work with. And then I'll choose 3. I like to choose a positive number whenever I can. It just makes things easier for me.

So I'm going to plug in 0 and 3 into our original inequality and confirm that this is a solution and then confirm that this is not a solution. So plugging in 0 first, so 6 times 0 equals 0. So I just have 13 or negative 13 is less than 5, which is less than 17. And that is a true statement. So that works in our favor.

Now, let's go ahead and evaluate when x equals 3. So 6 times 3 is 18, and then when we add 5, we get 23. So now, our inequality statement reads that negative 13 is less than 23, which is true so far. But then we have 23 is less than 17, which is not true. So that's a false statement. So we have confirmed that this region is outside of the solution region. We could choose a number here and walk through that process. But trust me. This isn't a solution either.

So let's review our notes for solving linear inequalities. When solving inequalities, procedurally it's no different than solving equations. You'll just have an inequality symbol, not our equals sign. But the important thing to remember is if you ever divide or multiply it by a negative number, you have to flip your inequality sign.

And with compound inequalities, you need to apply those steps in isolating your variable to every section. So thanks for watching this tutorial on solving linear inequalities. Hope to see you next time.