Hi. This is Anthony Varela, and today, I'm going to talk about absolute value inequalities. So we're going to look at absolute value expressions that are less than a certain value, we'll look at absolute value of expressions that are greater than a certain value, and then we're going to be relating these absolute value inequalities to compound inequalities. But first, let's review absolute value.

Recall that the absolute value of a number is its distance from 0 on the number line, and it's always non-negative. So here's our number line, and we have 0 in the center. So I could say that the absolute value of 5 equals 5, because it's 5 units away from 0 on the number line. Well, I could also say that the absolute value of negative 5 is also 5, because it, too, is 5 units away from 0 on the number line, just in the other direction.

So now, let's talk about absolute value inequalities. And the first type that I'd like to talk about, I'm calling less than absolute value inequalities. And here, we have the absolute value of x is less than 7. So thinking about what this looks like on the number line, this means that I can have x values that are no greater than 7 units away from zero on our number line. So I could say that my x values can be between 0 and 7, but I can also say that x can be between 0 and negative 7, so on the other side of 0.

So taking a look at my solution range, it ranges from negative 7 to positive 7. And notice we're not including the exact values, because our inequality symbol doesn't allow that. So writing out, then, this range using inequality symbols, I could say that x ranges from negative 7 to positive 7. And I could use this compound inequality to write my solution in set notation, and I can write this in interval notation as well, going from negative 7 to positive 7. So with our less than absolute value inequalities, I could say that the absolute value of x is less than a, can be rewritten as x being in between negative and positive a.

Well, let's take a look at a more complex absolute value inequality. Here, we have the absolute value of 5 x plus 2 is less than 12. So I know that I can rewrite this without my absolute value bars, following this general rule right here. So I have my expression that I'm putting in between negative 12 and positive 12. So I'm going to write down for other types of expressions that we have in absolute value bars that can be sandwiched in between negative c and positive c.

Well, how can we find then the solution set to this inequality? So what we're going to do is first subtract 2 from all parts. So we're going to subtract 2 here, subtract 2 here, and subtract 2 here. So now, we have something that looks like 5x is in between negative 14 and positive 10. Well, now, to get

x by itself, we're going to divide by 5 in all parts. So negative 14 divided by 5, 5x divided by 5, and 10 divided by 5.

So this gets us, then, that x is in between negative 2.8 and positive 2. So there's our solution expressed as a compound inequality. And this is actually an and compound inequality. X is in between negative 2.8 and positive 2.

So let's write this on the number line. So I'm going to put down our negative 2.8 and our positive 2, and our x values can be anywhere in between, but not including the exact values of negative 2.8 and positive 2. So here's that solution written in set notation, and here's our solution written in interval notation.

All right. Well, now, I'd like to talk about greater than absolute value inequalities. And here, we have the absolute value of x is greater than 3. So how would we write this on our number line? So this means that the distance away from 0 has to be greater than 3 units. So I could have all x values that are greater than 3. I could also have all x values that are less than negative 3. So this number line highlights all of the x values that have a distance that's greater than 3 from 0 on our number line.

So with our greater than absolute value inequalities, notice that we have-- our absolute value of x is greater than a is going to be expressed as x is less than negative a or greater than positive a. So here is that written in set notation, and then we can also express this in interval notation, where we have negative infinity to-- that should be a negative 3. That's my mistake, there. And then we can also say from positive 3 all the way over to positive infinity.

So now let's take a look at a more complicated greater than absolute value inequality. So here we have the absolute value of 3 x minus 4 is greater than 11. So I know how to write this, then, without absolute value bars, because I'm going off of this general description. So this is going to be our expression. 3x minus 4 is less than negative 11, or it's greater than positive 11. So here's another way that we can write out our greater than absolute value inequalities without our absolute value bars.

Well, how are we going to figure out our solutions set of what x can be? Well, we're going to solve for x in all parts of these inequalities here. So I'm going to add 4 to both sides of this inequality here and I'm going to add 4 to both sides of our inequality here. So what we end up with is 3x is less than negative 7, or 3x is greater than 15. Well, now, I'm going to divide by 3 in all parts here. So now I have that x is less than negative 7/3, or x is greater than 5.

So there is our solution. Let's go ahead and draw this on the number line. So looking at x is less then

negative 7/3. So here is that drawn on the number line. Well, x could also be greater than 5, so here is that on our number line. And writing this and set notation, we have x such that x is less than negative 7/3, or x is greater than 5. And in interval notation, here we have from negative infinity to negative 7/3, and then we're going to union that with 5 to positive infinity.

So let's review absolute value inequalities. We talked about less then and greater than. And here's how we write that using our absolute value bars. But we can also write that without our absolute value bars. With our less than inequalities, we're sandwiching that expression between negative c and positive c, and with our greater than inequalities, we have our expression is less than negative c or greater than positive c.

And we call the less than absolute value inequalities and compound inequalities, and our greater than absolute value inequalities have our or compound inequalities. And then here's what it might look like on a number line with our less than absolute value inequalities. We have a range of values. And with our greater than absolute value inequalities, we have sort of the full number line, just a section that's not part of the solution set. So either this or this.

Well, thanks for watching this tutorial on absolute value inequalities. Hope to see you next time.