Writing Systems of Linear Inequalities Using A Graph

Just as we can look at a line on a graph and determine its corresponding equation, we can also look at a graphed system of inequalities and from that graph determine the system of linear inequalities that it represents. The steps for this process are first, choose one inequality and write the equation of the boundary line. Next, determine which inequality symbol to use. If the line is dashed, then this is a strict inequality, and you will use less than or greater than. If the line is solid, then this is a non-strict inequality, and you will use less than or equal or greater than or equal symbols. Remember that the two inequalities may use different symbols from each other. Next, repeat steps 1 and 2 for the second linear inequality. And finally, write the system of linear inequalities. Let's look at an example of this process.

Here we have a graphed system of linear inequalities. Let's start our process by examining the inequality graphed in purple. We begin by finding the equation for the boundary line. The line has a slope of negative one third, and a y-intercept of negative 2, so the equation for the boundary line is y equals negative one third x minus 2. Since the graph of this line is solid, this is a non-strict inequality, meaning that values on the line are part of the solution set, so we will use either the greater than or equal or less than or equal symbol. Since the shaded area is above the line, we are going to use the greater than or equal symbol. When we substitute that in for the equal sign in our boundary line equation here, we have our first inequality: y is greater than or equal to negative one third x minus 2.

Now let's do the same process for the inequality graphed in red. The boundary line here has a slope of 2 and a y-intercept of negative 3, so the equation for this line is y equals 2x minus 3. Since this line is dashed, this represents a strict inequality, so we are either going to use the greater than or less than symbol. Since the area shaded is below the boundary line, we are going to use the less than symbol here. When we substitute that in for the equal sign in our boundary line equation, we get this inequality here: y is less than 2x minus 3. And this is our system of linear inequalities that is graphed here.

Alright, let's head over to the whiteboard to look at a few more examples.

This first question reads, "Write the system of linear inequalities shown on the graph." Well let's start with this blue inequality. First, let's find the equation for the boundary line. That would be y equals 2. So this is an equation and we want an inequality, so let's figure out what inequality symbol we're going to use. That the boundary line is dotted tells us that this is going to be a strict inequality, so it's either going to be a greater than symbol or less than symbol, and we can tell which one it's going to be based on which side of the line is shaded. Since it's the area above the line, it's going to be a greater than symbol. So the inequality in blue is y is greater than 2. Now let's do the same process for the green inequality. The boundary line has a slope of negative 1 and a y-intercept of 2. So the equation for that boundary line would be y equals negative x plus 2. Now we need to determine what inequality symbol we're going to substitute in for this equals sign. Just like our other inequality, this line is dotted, and so that tells us this is going to be a strict inequality, so it's either going to be greater than or less than. And just like the inequality in blue, because we shaded the top side of this line, it's going to be greater than. So that inequality will be y is greater than negative x plus 2. So the system of inequalities graphed here is y is greater than 2, and y is greater than negative x plus 2. Let's look at another one.

Again, we want to write the system of linear inequality is shown on the graph, and again, let's start with the blue inequality. The boundary line for the blue inequality has a slope of 2, we go up 2 and over 1,

and a y-intercept of 1. So the equation for that boundary line would be y equals 2x plus 1. Now we need to determine what inequality symbol we're going to substitute in for this equals sign here. Because the boundary line is solid, we know that this is going to be a non-strict inequality, so it's either going to be greater than or equal or less than or equal, and because the area above the line is shaded, it's going to be greater than or equal. So the inequality shown in blue is y is greater than or equal to 2x plus 1. Now let's do the same process for the green inequality. The boundary line there has a slope of negative 1 and a y-intercept of 1. So the equation for the boundary line would be y equals negative x plus 1. Now we need to determine what our inequality symbol is going to be. Because this is a dotted boundary line, that tells us that this is going to be a strict inequality, so either greater than or less than. And because the area above the boundary line is what's shaded, it's going to be greater than. So the inequality shown in green is y is greater than negative x plus 1. So the linear system of inequalities graphed here is y is greater than or equal to 2x plus 1, and y is greater than negative x plus 1. Alright, let's look at one more example.

Again, we want to find the system of linear inequalities shown on the graph. So let's start with the blue inequality. This boundary line has a slope of 1 and a y-intercept of negative 3. So the equation for that boundary line would be y equals x minus 3. And now we need to determine the inequality symbol we'll use. Because this is a solid line, the line is included in the solution set, so this is a non-strict inequality, meaning it's either going to be greater than or equal or less than or equal. And because it's the area above the line that is shaded, it's going to be greater than or equal. So the inequality shown in blue is y is greater than or equal to x minus 3. Now let's do the inequality shown in black. This boundary line has a slope of negative 1 and a y-intercept of negative 1. So the equation for that boundary line is y equals negative x minus 1. Because the boundary line is solid, we know it's going to be a non-strict inequality, and because it's the area above the line that is shaded, it's going to be greater than or equal. So this inequality is y is greater than or equal to negative x minus 1. So the system of linear inequalities graphed here is y is greater than or equal to x minus 3 and y is greater than or equal to negative x minus 1.