Module 4: Symmetry and Transformations
Topic 4 Content: Symmetry Transcript

Hi, guys. Welcome to Geometry. This topic is going to focus on symmetry. Your knowledge of the coordinate plane and reflections and rotations is going to come in handy for you during this lesson. You ready to get started? Let's go.

Okay. The first type of symmetry that we're going to talk about is line symmetry. Now, if a figure has line symmetry, then what that means is that a line exists along which the figure can reflect right onto itself. That line, we call it a line of symmetry, actually splits the figure into two congruent halves, to congruent parts. Let's take a look at these three figures. I'm going to really show you what I mean.

All right. Let's get my pen here. Right here, I have a polygon. If I drew, and I'm free-handing it, so I'm going to try to make it as straight as I can ... If I drew a vertical line through, I tried to make it through the center, as close to the middle of that polygon as I could, it would split the polygon into two congruent halves. What I could say is that this figure has vertical line symmetry. If you drew a vertical line through the center of it, in this case, through the center, it would split the figure into two congruent halves. Those halves are reflections of each other. You could imagine yourself folding the figure along that line, the two halves, or the two parts would match. They would lie right on top of each other.

Let's get rid of that line. Let's look at another one. Get rid of that vertical line. Let's look at a horizontal line. Now, I'm free-handing it, so it's as straight as I can. That actually isn't too bad. I could draw this horizontal line, and it would also split my figure into two congruent halves. Those two parts, if I folded the figure, if you could visualize yourself folding it, they would match right onto each other. I could also say that this figure has horizontal line symmetry. There are also a few other lines that I could draw along this figure, and the figure would have line symmetry along those lines as well.

Let's move through a few other figures. Let's take a look at this arrow. Now, if I drew a vertical line ... Let's see. I'll try to do a vertical line right through the center. This one doesn't have vertical line symmetry. You see that I did not divide this figure into two congruent halves, and if you could visualize folding the figure along that line, those two parts would not match right on top of one another. Vertical line symmetry, not for the arrow. Let's get that eraser.

Okay. Let's see horizontal line symmetry. I think that it actually might have that, and it does. If you draw a horizontal line, it will split your figure into two congruent parts, and if you visualize folding along that horizontal line, those two parts would match right top of one another. They're reflections of each other. It did not have vertical line symmetry. The vertical line symmetry was a no. It does have horizontal line symmetry. That was a yes.

All right. Let's take a look at this arrow, or, sorry, this check mark. All right. Vertical line symmetry? Don't think so. Nope, it doesn't that does not split this check mark, that line, into two congruent parts. Now, let's check out horizontal line symmetry. Horizontal? Doesn't have that either. There does not exist ... A horizontal line does not exist along which it will split the figure into two congruent halves. The check mark doesn't have vertical line symmetry, and it doesn't have horizontal line symmetry either. I actually think there actually does not exist a line, or a line doesn't exist along which it would split this check mark into two congruent parts.

All right. Now that you're a little familiar with line symmetry, let's take a look at this first example. All right. Let's get the pen here. Here are the directions. I'm going to actually show you a figure drawn, or a figure graphed on a coordinate plane. I want you to figure out which of the equations of lines are lines of symmetry. Okay. Take a look at this triangle. You have $x = -4$, and you have $y = 1$. I want to know which of these lines are lines of symmetry. It may be one of them, or it may be both of them, or maybe neither one. We have to see.

Remember from Algebra I, if you have the equation of a line where it's x equals some value, some numerical value, in this case $x = -4$, then that's a vertical line that passes through the x-axis at that numerical value. In the case of $x = -4$, that means I have a vertical line that passes through the x-axis at −4. −1, −2, −3, −4. I've got the red ink so it stands out. I'm going to try to get it as straight as I can. Okay. That's not too bad. Here's the line $x = -4$. Is this line a line of symmetry for this triangle? Does it divide the triangle into two congruent parts? It does look like that it does. It does. Is $x = -4$ a line of symmetry? Yes it is. Those two parts, like I said, another way you could look at it is if you folded the figure along that line of symmetry, it would fold right onto itself. Those two congruent parts are reflections of each other. All right, so $x = -4$ is a yes.

Let's try out $y = 1$ and see if that's a line of symmetry for this triangle. Remember from Algebra 1, if you have y equals some numerical value, then that line is a horizontal line and it passes through the y-axis at that numerical value. $y = 1$, horizontal line, straight as I can, that will pass through the y-axis at 1. This one you could probably see right away, it's not a line of symmetry for this figure. If you folded that figure along that line $y = 1$, it would not match right onto itself. Those two parts of the triangle that were made by sketching that line are not congruent parts, so $y = 1$ is not a line of symmetry for this triangle. The first equation was a yes, but the second one was a no.

Okay. I think it's time for you to try one. Go ahead and press pause, and take a few minutes, and work your way through this example. See if one of these, or neither one of them, or both of them may be lines of symmetry for this figure. When you're ready to check your answer, go ahead and press play. All right. Let's see how you did. $x = 3$, so that's a vertical line that passes through the x-axis at 3. There we go. It does look like it is. $x = 3$ is a line of symmetry for this line of figure. It splits the figure into two congruent parts, and those parts are reflections of one another, so $x = 3$, that's a definite yes.

All right. Let's try out $y = 2$. Let's get that line out of the way. $y = 2$, horizontal line, passes through 2 on the y-axis, and it looks like that actually is also a line of symmetry for this figure. It divides the figure into two congruent parts, and those parts are reflections of one another. If you could picture yourself folding that figure along that line, those two parts would match perfectly right onto one another, so $y = 2$ was also a yes. All right. Good job on that.

Now, before we leave symmetry, there's one more type of symmetry you need to be familiar with, and that's point symmetry. Point symmetry actually involves rotations. If a figure has point symmetry, then that means that after a 180 degree rotation, the figure maps right onto itself. In other words, how you think about is if you turned the figure upside down, it would look exactly the same way as it does right side up. Let me show you with the magic computers what I mean by that.

I'm going to actually copy and paste, or clone these figures. I'm going to lay that right on top of itself. Let's perform this 180-degree rotation, and see does this hexagon actually just look like it does upside down and right side up? Is it the same image? Okay, let's see. That's 90 degrees, 180 degrees, and it does. After a 180-degree rotation, that figure maps right onto itself. This figure does have point symmetry. Go ahead and give it a yes.

Let's take a look at this arrow and see does it have point symmetry? You might be able to just visualize it and do it in your head, but I'm going to show you with the computer, just to make sure. Let's clone that so we've got it right on top of itself. Let's perform that rotation. Here's 90 degrees, here's 180 degrees. That figure does not map right onto itself. We would say for this one, it's a no. It does not have point symmetry. All right. How about the check mark? Like I said, you probably can tell without even performing the actual rotation. Just to stress what you're doing here, let's clone that. Let's perform the rotation. Here's 90 degrees, and 180 degrees. You can see that's another no. This figure does not have point symmetry. After that 180-degree rotation, it does not map right onto itself.

Okay. Now that you've got a handle on point symmetry, I want you to try one on your own. I'm going to give you a set of figures, and I want you to determine if they do or don't have point symmetry. All right. Here you go. Press pause, work through this, press play when you're ready to check your answers. All right. Let's see how you did. Let's clone these, just to show you how we got these answers. Let's see. After a 180-degree rotation ... There's 90, there's 180. It doesn't map onto itself. This one's a no.

Okay. Let's try this one out, this quadrilateral over here. All right. Let's clone that, just copying and pasting. Here we go. All right. 180-degree rotation, 1 and 2 turns, and it does. We would say here, this one's a yes. That figure does have point symmetry. All right. Last one. Let's try this semicircle out. Let's clone that. 2 turns, 90 degrees, 180 degrees. It doesn't map onto itself, so it's a no. It did not have point symmetry. All right. Good job on that. You've reached the conclusion of this lesson on symmetry. I hope you saw how your knowledge of reflections and rotations and the coordinate plane helped you get through this lesson. Bye.