Project_INSPIRE_Course_4_Lesson_2

SPEAKER: Welcome to Geometry and Tactile Graphics for Students in Grades 3 to 8. This is "Lesson 2, The Five-Step Rule and Exceptions." So we go on to slide 2, the objectives are that you're going to be able to read and write modified expressions that we create using the five-step rule. And you're going to learn two very important exceptions.

You're also going to be able to read and write Nemeth symbols for parallel, perpendicular, not parallel, and not perpendicular. And finally, you're going to be able to read and write sentences containing modified expressions. So let's get started on slide 3 and talk about modifying expressions.

So a modifier is defined as a symbol or a combination of symbols placed directly over or under. And it relates to that expression. What does this mean in English? Well, I always like to think of my ray AB.

Notice, in print, I have capital A, capital B, and there is a line over that with a right-pointing arrow. So I have AB, and I'm modifying it. I'm saying, hey, check this out. I've got a line over it. My particular line happens to have an arrow, and that happens to be a ray.

Now, of course, folks, we don't get out our puff paint and start putting little tactual lines over our braille symbols. We let the braille reader know what's going on by using a combination of braille cells that have meaning. So what do I mean here? Well, first, I mean that I start my modified expression with my dot 5, that multipurpose indicator.

I tell the braille reader whether we're going directly over or directly under with using dots 1-2-6 for directly over, my directly-over indicator, or dots 1-4-6, which is my directly-under indicator. And once I've modified something, in this case, it would be AB in my example, I then terminate to let the braille reader know we are done. And that termination indicator is dots 1-2-4-5-6.

Let's get a better idea of what I'm talking about here by going on to slide 4 and learning about some common modifiers and how to actually read them because it's important that you read these properly to your students. So the first one I want to talk about is the horizontal bar. And this is dots 1-5-6. Hey, it looks just like the line, doesn't it?

And when I'm reading this, I would say, line segment PQ in my example. So I have capital P, capital Q with a line over it. And the way I read this to my braille reader is line segment PQ.

Look at my next example. This time I've taken that horizontal line or bar. And I've placed it over two numbers, in this case, 3 and 7 in 1.37 with 3,7 repeating. So this is a repeating decimal. My 3,7 is repeating.

When I have a line that has an arrow on each end, that's actually called a barbed arrow at both ends, very formal, barbed arrow at both ends. And this symbol over the X and Y in my example is then read as line XY. And finally, when I have the contracted right arrow, so that's the line with the arrow going to the right, that I'm going to read as a ray, so ray AB in my example.

Now, I want you to look at how we actually braille these. So to braille that horizontal bar, it's dots 1-5-6. To braille that barbed arrow at both ends, I'm going to start out with my shape indicator, then dots 2-4-6, two cells of dots 2-5, and dots 1-3-5. So that's how I braille the barbed arrow at both ends.

And then to braille my ray, it's shape indicator, dots 1-3-5. So you can see, I have to use the proper braille symbols to be able to tell the braille reader how I am modifying the expression. Let's go ahead on to slide 5.

So remember, we have this five-step rule that we're going to be using. Multipurpose indicator, dot 5, my expression, so, for example, AB, directly over, I'm either going to use the 1-2-6 or if I'm doing directly under, I'm going to use 1-4-6, then what I'm modifying, so cap AB, and then my terminator. So I want to show you some examples on slide 6.

So what I've done on the right-hand side, I've given you that five-step rule again. I've also given you the symbols for the bar, dots 1-5-6, the barbed arrow on both ends, which is that five cells, shape indicator, 2-4-6, two cells of 2-5, and 1-3-5, and that contracted right arrow that I use for a ray, 1-2-4-6, my shape indicator, 1-3-5. So you'll want to refer to these as we look at our examples.

So the first example is line segment PQ. So we do my multipurpose indicator, cap P, cap Q. I've got my directly-over indicator, 1-2-6. Then I've got-- well, what is it that I've got? 1-5-6 for a bar and terminate.

My next example is ray AB. So I'm going to do multipurpose indicator, cap A, cap B, dot 1-2-6 to show you that it's directly over. What is it that I'm putting directly over? I'm putting the right contracted arrow for my ray, so 1-2-4-6, 1-3-5, and terminator.

Next, I have line segment XY. Dot 5, multipurpose indicator, cap X, cap Y, again, I'm going over, so 1-2-6 for my directly-over indicator, and then those five cells that it takes to write a barbed arrow on both ends, shape indicator, 2-4-6, two cells of 2-5, 1-3-5, and my terminator.

Got that repeating decimal with 1.37, okay, with that 3,7 going on indefinitely, so take a look at what I do here. I start out with my 1, numeric indicator, 1, decimal point. Now, I want to say to the braille reader, there is a bar directly over the 3,7.

So I'm going to do dot 5, my multipurpose indicator, my expression, which is 3, 7. What am I doing to that expression? I'm going directly over, so 1-2-6. I'm putting a bar, 1-5-6. And I'm terminating.

And that last example I have here is 4.5729, with that 29 being my repeating decimal. So again, I start out brailling the number the way I normally would, 4.57. Now, I want to tell the braille reader that I have an expression, the 29 that has the bar over it to show my repeating decimal, so dot 5, 2, 9 1,2,6, which is my directly-over indicator, my bar symbol, 1-5-6, and my terminator.

So take a moment to study these and get familiar with them. You may even want to braille them. Slide 7 gives you the opportunity, in Activity 2A, to transcribe the following expressions. And I give you four of them. When you're ready, please come back and check your answers on slide 8.

Slide 8 is the answer key for Activity 2A. If you missed anything, please go back and check to make sure you understand where your error was. Slide 9, sometimes we have exceptions in braille, as you well know. And the first one has to do with contracted form of a modified expression.

So if I have just a single digit or single letter that's modified with the horizontal bar directly over it, so that's the only thing that we have going on here, I'm going to put the symbol for the bar after the digit or letter. I'm going to not have to use my five-step rule. So this is a short way of doing things. So if I have 0.3 and that 3 is a repeating decimal, numeric indicator, 0, decimal point, 3, and then my bar symbol, 1-5-6. The same thing with 0.416, with that 6 being my repeated decimal, I'm going to braille numeric indicator, 0, decimal point, 4, 1, 6, and then my symbol, 1-5-6, which is my bar.

Slide 10, my second exception, they just love those exceptions, don't they? This is when I have a single digit or a letter again, so just one thing that I'm modifying with a horizontal bar underneath it, not over it, but underneath it, and I use the directly-under indicator and the bar. So it's going to take me two cells to show the braille reader that that line is drawn under.

So if I have 36, and I want to show the braille reader, hey, pay attention to the 6, we're working on place value, so I'm going to do numeric indicator, 3,6, my directly-under symbol, 1-4-6, and my bar symbol, 1-5-6. My next example, 4.57, it's the 5 that has the bar under it. So numeric indicator, 4.5, directly-under symbol, 1-4-6, bar, 1-5-6, and then my 7. The braille reader knows that when they see 1-4-6, the directly-under symbol followed by the bar symbol, 1-5-6, that bar underneath applies to the digit that they just went past, not to the 7, in this case, but to the 5.

Our third example is 9,128. I want to show the braille reader that the 9 has a line drawn under it representing thousands. And so I do numeric indicator, 9, my directly under, which is 1-4-6, my bar, which is 1-5-6, and then I continue on with my comma, 1, 2, 8. Alright, make sure you understand this exception.

Let's go ahead and go on to slide 11. I'm going to ask you to do some transcribing. Pay attention to whether your bar is over or under. When you're done with Activity 2B, please come back and check your work.

Slide 12 has the answer key for Activity 2B. Make sure that you brailled everything properly. If you need to go back and review, please do. Slide 13, I like parallel and perpendicular. So let's take a look at these signs, and they are signs of comparison.

And we know with signs of comparison, like an equals sign, that there's a space on either side. It's the same thing with parallel and perpendicular. So the symbol for parallel is shape indicator, l. And that sure looks like a parallel line to me. And the symbol for perpendicular is shape indicator, p.

So the way I do this with parallel and perpendicular is the same way I would do an equals sign. So my first example is line segment AB is parallel to line segment CD. So I'm going to do my dot 5, my multipurpose indicator, cap A, cap B.

I'm going to do my directly-over symbol, 1-2-6. What's over? It's a bar, 1-5-6, terminate, space, parallel, so shape indicator, l, space. How am I going to do line segment CD? Same way I did line segment AB, dot 5, cap C, cap D, directly-over symbol 1-2-6, bar, 1-5-6, terminate.

Let's take a look at line segment EF is perpendicular to line segment GH. So again, I'm going to begin with my multipurpose indicator, cap E, cap F, my horizontal over, 1-2-6, my bar, 1-5-6, my terminator, space, shape indicator, p, space, multipurpose indicator, cap G, cap H, my directly over, 1-2-6, my bar, 1-5-6, and then that terminator 1-2-4-5-6. So I'm following a pattern.

Now, you're going to see, when I go on to slide 14 and I introduce you to not parallel and not perpendicular, that it's the same pattern. So let's go ahead and take a look at how I do not parallel and not perpendicular on slide 14. The only real change here is with the parallel and perpendicular symbols. I'm going to put a dot 3-4 in front of each of those to represent the not.

So not parallel is brailled in three cells, 3-4, 1-2-4-6, l. It's still a sign of comparison. I'd do the same thing for not perpendicular, dots 3-4, shape indicator, p. Let's look at my first example, line AB is not parallel to line CD.

So to braille line AB, it's dot 5, cap A, cap B. I need to show the braille reader that we are over, so dots 1-2-6. What's over? It's a barbed arrow at both ends. That takes 5 cells, dots 1-2-4-6, dot 2-4-6, dot 2-5, dot 2-5, dots 1-3-5, and my terminator, dots 1-2-4-5-6.

I'm going to put a space, my not parallel symbol, dots 3-4, dots 1-2-4-6, l, space. And then I'm repeating the pattern for line CD, so dot 5, cap C, cap D, my directly-over indicator, my barbed arrow at both ends, and my terminator. On to the second example, which is line EF is not parallel to line GH following my same pattern, so dot 5, cap E, cap F, directly-over symbol, my barbed arrow at both ends symbol, my terminator, space.

I braille not parallel as dots 3-4, shape indicator, p, space, and then to show line GH, it's dot 5, cap G, cap H, directly-over indicator, my barbed arrow at both ends, and my terminator. These aren't hard. You just have to know the pattern.

Slide 15 is examples of modified expressions within mathematical sentences and word problems. So it's time to combine UEB and Nemeth. Let's look at my first example, which reads, "1 period If line segment EF is parallel to line segment GH, then measure of angle A equals question mark." And we'll replace that question mark with the general omission symbol because something is missing.

I begin with "1 period, If". I open Nemeth with my opening Nemeth indicator. I'm going to go ahead and braille my line segment EF, so dot 5, cap E, cap F, directly over, bar, terminator,

space, parallel, space, going to braille my line segment GH, dot 5, cap G, cap H, directly over, bar, terminator. See, I use my Nemeth comma because we're in math.

I have a choice with the word then. I can either write it out, t-h-e-n, letter for the letter, or in this case, I chose to use my one-word-switch indicator, dot 6, dot 3, to use the contracted form. I, then, do my measure of angle A equals question mark, with that general omission symbol replacing the question mark, space, and I terminate Nemeth, 4-5-6, 1-5-6.

My second example uses a fraction. So I have "2 period 6/11 = .54". And that .54 is a repeating decimal. So I begin with my numeric indicator, 2, period in UEB. I need to open up Nemeth for my problem, so opening Nemeth indicator, my fraction, 6/11, space, equals, space, and then I'm going to do my numeric indicator, my decimal point.

I need to show the brailled reader that the 5,4 is a repeating decimal. So I do dot 5, 5,4, directly-over indicator, bar, terminator, and then I will close Nemeth. My third example is "3 period Identify the value of the underlined digit in 3.124, period" And that 1 in the hundreds place has an underline under it.

So I begin in UEB. I braille everything until I get to the number. So I'm going to open up Nemeth. I'm going to braille numeric indicator, 3, comma, 1. I need to show the braille reader that that 1 has a bar under it.

So I'm going to use my directly-under indicator, 1-4-6, my bar symbol, 1-5-6 24, space, terminate Nemeth, and then my period because that period is part of the sentence. It has no mathematical meaning. So it comes after I terminate Nemeth.

Slide 16, it's your turn, go ahead and transcribe the following in Activity 2C. When you're ready, come on back. Slide 17 is the answer key to Activity 2C. Check all your work carefully. Slide 18 is that last part of the answer key, so make sure that you brailled number 4 properly.

And congratulations, you are at the end of lesson 2. This concludes what we're going to teach you about geometry braille symbols for grades 3 to 8. In lesson 3, we're going to start talking about materials and teaching strategies. So when you're ready, continue on. Thank you.