**Exploring Slope**

**Section 1**

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| 00:00:00 | TEACHER: The lesson question is, how are slopes different |
| 00:00:03 | from each other? Slopes can have an increasing or decreasing rate. And when you look at gradient road signs, there really is an observable difference between a 10% increase in rate versus a 10% decrease in rate. So in this lesson, we will look at observing positive and negative slopes from tables as well as from graphs. |

**Section 2**

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| 00:00:01 | TEACHER: The table represents the scenario of a change in |
| 00:00:03 | water temperature over time where x is the seconds and y is the Fahrenheit temperature. We want to determine from the table if the rate is increasing, decreasing or neither. So we'll choose two points on the table and plug them into the slope formula. The first point we'll choose will be 3, 70. So x1 is 3, and y1 is 70. |
| 00:00:26 | The second point we'll choose will be 9, 80. So x2 is 9, and y2 is 80. Substituting into the slope formula, we have slope is equal to-- y2 minus y1 is the order that we're subtracting. That's 80 minus 70 over-- x2 minus x1 is the order we are substituting. So we have 9 minus 3. |
| 00:00:54 | This gives us a slope of 10 over 6. Our slope is reduced, and we have a slope of 5 over 3. This is a positive slope. If we were to look at the graph and extend from left to right, the graph would be increasing. Next we'll learn how to find from a graph the slope by using rise over run. So what we've done is, we have placed two |
| 00:01:18 | graphs side by side. And we're going to find the slope, in the first case using the scales provided on the graph, and in the second case by counting the squares. And let's see what happens. So in the first case, what we want to do is find the slope by running the calculation rise over run. Now, notice the scales very carefully. |
| 00:01:43 | Along the x-axis, we're counting by what? It looks like 1.5. Along the y-axis, we're counting by what? It looks like 10. So when we look at rise, we're going up one unit. But that's really 10 units. And when we look at run, we're going over 4 units of 1.5-- that's 6. |
| 00:02:10 | So our rise over run is 5/3. Now, when we simply use the squares on the grid when we find rise over run, we'll go up one unit and right 4 units. And notice, we get 1/4, which is not the answer at all. So when you're trying to use rise over run, you want to make sure you absolutely use the scale. You want to never simply count the squares. Our slope is that of a positive slope. |
| 00:02:45 | So notice the graph as you extend from left to right increases. |

**Section 4**

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| 00:00:00 | TEACHER: In this table, x represents months and y |
| 00:00:03 | represents the value of a car. Let's determine from the table if the rate is increasing, decreasing or neither. So let's turn to the table and observe. As the x values, values of x, increase from 2 to 10, the corresponding values of y do what? Well, they decrease from 10,000 down to 6,000. So as the values of x increase, the values of y |
| 00:00:28 | decrease, and so we say the rate is decreasing. What does this have to do with slope? Well, let's determine the slope for this scenario. We'll choose two points from the table, and I'll choose 8 comma 7,000 and 2 comma 10,000, and substitute in these points to our slope formula, y2 minus y1 over x2 minus x1. So y2 minus y1 is the calculation 7,000 minus |
| 00:00:58 | 10,000, divided by x2 minus x1, or 8 minus 2. This gives us negative 3,000 over or divided by 6, which is negative 500. We have a negative slope, and this corresponds to the fact that our rate is decreasing. So the slope for this scenario is negative 500. Let's look at this concept by observing the graph. The graph of the value of the car represents a negative |
| 00:01:34 | slope of negative 500. What is the slope? Well, notice that these grid marks along the vertical axis if we count by 1 represent 1,000, or $1,000. Along the horizontal axis, the grid marks are counting by 1, meaning they'll represent one month. So if we look at the old rise over run, we would go up 1,000 and we would go left, or negative 2, units-- |
| 00:02:03 | 1,000 divided by negative 2. May be easier to think from left to right. So what we'll do is we'll look at, instead, fall over run. Pick any point on the graph. We fall 1,000 units. We have a run, or go to the right, two units. So we have negative 1,000 divided by 2, which is negative 500-- |
| 00:02:31 | the slope. When a graph falls from left to right, and this graph is the graph of a line, that line has a negative slope. |

**Section 6**

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| 00:00:01 | TEACHER: Examples of positive and negative slopes can be |
| 00:00:03 | found everywhere in the world around us. Look at these pictures. For slopes that are positive, those lines will increase, or go up, as you move from left to right. If I draw a line through these steps, I have an increasing line, a line that goes up as I move from left to right. For slopes that are negative, then the line is decreasing, or it goes down as you extend from left to right. |
| 00:00:25 | If I drew a line through the slide, this is a decreasing line. Look around you. Do you see evidence of slopes? |

**Section 8**

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| 00:00:00 | TEACHER: The lesson question is, how are slopes different |
| 00:00:03 | from each other? In real-world situations, there's a difference between positive slopes, negative slopes, 0 slopes, and no slope. We will look at 0 slopes and no slopes using data from a table or a graph. |

**Section 9**

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| 00:00:01 | TEACHER: In the table, x represents hours and y |
| 00:00:04 | represents the speed of a car. We will determine from the values in the table if the rate is increasing, decreasing or neither. Well, first let us observe the table and see if we see a trend. If we increase the values of x, notice the y values stay constant. All right, let us find the slope. |
| 00:00:23 | To find the slope, we'll use the slope formula by choosing two points from the data on the table. The first point we'll choose is 1, 55. So x1 will be 1, and y1 will be 55. The second point we'll choose will be 5, 55. So x2 will be 5, and y2 will be 55. Substituting into the slope formula, we have slope is equal to y2 minus y1-- |
| 00:00:53 | so that would be 55 minus 55-- over x2 minus x1-- 5 minus 1. So the slope is 0 over 4, which is 0. Lines that have a slope of 0, as you extend from left to right, are horizontal. Now let's see if we can determine this slope using rise over run. |
| 00:01:19 | Look at the graph. Again, we have along the y-axis, speed, and along the x-axis, time. We want to determine the slope, and we'll use rise over run. So we'll look at two points. The first point is 2 comma 55. And the second point we'll use will be 4 comma 55. |
| 00:01:43 | But observe-- when we calculate rise over run, the rise is 0, because all we do is extend to the right two units. Our run is 2. So our slope is 0 over 2, which is 0. 0 divided by any number is 0 as a matter of fact. All horizontal lines as you extend from left to right have a slope of 0. |

**Section 11**

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| 00:00:01 | TEACHER: In the table, x represents the time in |
| 00:00:03 | seconds, y represents the distance in feet a ball is from the ground. We're going to ask the question, what is the slope? Well, first let us observe the table and notice that all the x values, they stay the same. The y values, they increase. Now, to find the slope, we're going to plug into our slope formula. |
| 00:00:25 | So our first point will be 2, 8. We'll label x1 2, y1 8. The second point will be 2, 13. We'll label x2 2 and y2 13. By substituting into the slope formula, we get, for y2 minus y1, 13 minus 8 over, for x2 minus x1, 2 minus 2. So the result is 5 over 0. Now, we can never divide a number by 0, |
| 00:01:03 | so we have no slope. Does this make sense to you that we have no slope? What is this saying? Remember, x represents the time in seconds. So at 2 seconds, we are saying the ball is two different distances off of the ground. Does that make sense to you that that could possibly happen? |
| 00:01:24 | No. Let's turn to the graph. When we look at the graph and we try to determine slope, we'll use rise over run. So the two points that we will choose will be the point 2, 8 and 2, 13. And when we look at rise over run, notice that our rise would be the vertical change-- |
| 00:01:52 | this would be 5-- and the horizontal change -- well, that would be 0. And again, what we find is that we have no slope. Any vertical line that may be drawn has no slope, or we can say the slope is undefined. |