**Rate of Change/Intro Slope**

**Section 1**

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| 00:00:01 | TEACHER: The lesson question is, how can you find the slope |
| 00:00:04 | of a line and use it to solve problems? Do you like roller coasters? When you go up that first big hill, you're going up a positive slope, just like the positive slopes that we'll be studying. You have just reviewed how to find rates of change from a table of values. We're going to build on this concept to learn about slopes |
| 00:00:24 | from a graph. |

**Section 2**

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| 00:00:00 | TEACHER: When solving a problem, it's good to have a |
| 00:00:02 | clear process. Here is the process. Step one-- we will want to read and understand the question. Step two-- we will look for clues. Step three-- we will identify a strategy to solve the problem. |
| 00:00:19 | And step four-- always be certain to check your answer. The graph shows the distance Andrea bicycled over time. Is she traveling at a constant rate of change? Step one is to read and understand the question. Is she traveling at a constant rate of change? Step two is to look for clues. Notice this line increases as we go from left to right. |
| 00:00:47 | So we have a positive slope, hmm. Step three, we want to identify a strategy. Our strategy will be to determine a rate of change from two different intervals-- first interval from one hour to two hours, and the second interval from one hour to four hours. All right let's begin. Let us go ahead and say at one hour, the |
| 00:01:10 | distance traveled is 10. And at two hours, the distance traveled is 20. So to find the rate of change, we'll observe rise over run from the graph. We notice that we go up 10 and right 1. So our rise is 10 and our run is 1. So our rate of change is 10 over 1, or 10 miles per hour. Now let's find the rate of change over a different |
| 00:01:44 | interval, from one to four hours. So after one hour, she has traveled 10 miles. After four hours, she has traveled 40 miles. Now, the rise over the run will be examined. Rise over run would be a rise of 30 and a run of 3. So the rise is 30. We will divide by a run of 3. 30 divided by 3 is 10-- |
| 00:02:20 | 10 miles per hour. This means that she has the same rate of change-- 10 miles per hour-- over two different intervals. Is she traveling at a constant rate of change? Yes. Shortly, we will look at step four, which is to check your answer. |

**Section 4**

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| 00:00:01 | TEACHER: Step four-- |
| 00:00:02 | check your answer. What would you deduce Andrea's rate of change to be from four to seven hours? Now remember, on the interval from one to two hours, Andrea's rate of change-- which we'll abbreviate ROC-- was 10 miles per hour. And on the interval from one to four, Andrea's rate of |
| 00:00:26 | change was also-- that's right-- 10 miles per hour. So on the interval from four to seven, the question is, what is the rate of change? Well, at time four, this would correspond on the graph to the coordinate pair 4 comma 40. And at time seven, this would correspond on the graph to the |
| 00:00:49 | coordinate pair 7 comma 70. Rise over run would be read right off the graph. So it looks like we're looking at a rise of 70 minus 40-- that's 30-- and a run of 7 minus 4, which is 3. So we have a rise of 30 divided by a run of 3. And that gives us 10 miles per hour-- identical rate of change for the other two intervals that |
| 00:01:22 | we referenced. So does it matter what interval you use when finding the rate of change of a linear equation? No, it does not matter. It does not matter the interval you use, because the rate of change is constant. |

**Section 6**

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| 00:00:00 | TEACHER: The lesson question is, how can you find the slope |
| 00:00:03 | of a line and use it to solve problems? That first hill of a roller coaster is really steep. Steepness refers to a change of distance over a change of time. This is a rate of change. Now, you've looked at rate of changes from tables of value, as well as from graphs. Now we will learn to identify slopes from tables of values, |
| 00:00:26 | as well as from graphs. |

**Section 7**

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| 00:00:01 | TEACHER: When the rate of change is constant for every |
| 00:00:03 | segment on a graph, the graph has the same steepness throughout, and now we have the graph of a line. Well, the constant rate of change is called a slope of a line. And the slope of the line is nothing more than a ratio. It is the ratio of the change of y values, referred to as a rise, for a segment of the graph to the corresponding change in x values, which is referred to as a run. |
| 00:00:26 | Slope is given by the formula rise over run. To understand rise over run, I will find two points on the line. The first point, I will label the coordinates x1, y1. The second point, I'll label the coordinates x2, y2. The rise refers to the change in the vertical direction. It is found by subtracting the y-coordinates, y2 minus y1. The run is found by looking at the horizontal change. |
| 00:00:57 | This is found by subtracting the x-coordinates, x2 minus x1. We want to find the slope of a line. So what we will do is use our formula rise over run, which is y2 minus y1 over x2 minus x1. I will first locate two points on the line. Any two points on the line would do. But I will pick the x-intercept, which is at |
| 00:01:22 | negative 4, 0, and the y-intercept, which is at 0, 1. Now I'm going to label the x-intercept as x1, y1, and the y-intercept as x2, y2. The reason I'm doing this is because when I find my rise over my run-- this ratio-- I start by determining which point I'm starting at for my calculation. |
| 00:01:52 | In other words, if I want my rise, I'm going to look at my vertical change. I will subtract the y-coordinates. But I have to start with one of the points. So I'll start with x2, y2, or 0, 1. So my rise is 1 minus 0. When I calculate my run, I want to make certain to start with the same point. |
| 00:02:15 | So I will start with x2. So to find my horizontal change, I will subtract the x-coordinates x2 minus x1. So I will have 0 minus a negative 4. So my rise over run gives me the fraction 1/4. The slope of my line is 1/4. |

**Section 9**

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| 00:00:00 | TEACHER: Let's look at an example about finding slope |
| 00:00:03 | from a table. Find the slope of the line that runs through the points in the table. Well, let's look at the points. The first point has the coordinates negative 1, 6. And the second point has the coordinates negative 3, 0. To find the slope, we'll use our slope formula. To use our slope formula, we must decide which point is x1, |
| 00:00:27 | y1, and which point is x2, y2. So negative 1, 6 is x1, y1. Negative 3, 0 is x2, y2. Using the slope formula, we have our slope, which is represented as m, is equal to the change in the vertical direction, y2 minus y1, divided by the change in the horizontal direction, x2 minus x1. So we subtract y2, which is 0, minus y1, which is 6. |
| 00:01:01 | And in the denominator, we will subtract in the order negative 3 minus negative 1. You must have the same order for your first calculation-- must come from the exact same point in both the numerator and the denominator. So this gives us negative 6 divided by negative 2, which is 3. This means the slope of this line is 3. |
| 00:01:29 | Positive slope means that this line is increasing as we go from left to right. |

**Section 11**

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| 00:00:01 | TEACHER: The lesson question is, how can you find the slope |
| 00:00:03 | of a line and use it to solve problems? Once you knew the slope of a hill on a roller coaster, you can then compare to other roller coasters to see which one has a steeper incline. We have learned how to find the slope from lines on graphs or data from tables. Now we're going to take these slopes off of the graphs and the tables and use them to solve real-world problems. |

**Section 12**

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| 00:00:01 | TEACHER: The graph on the right represents the linear |
| 00:00:03 | relationship between Car 1's time and distance. What do you notice about the speed of the car? Well, since we have a linear relationship, then we have a constant rate of change. And so what's changing? Distance per time. So we have a constant speed. We know this because we have a straight line as our graph, |
| 00:00:24 | and we have a constant change of distance divided by a constant change in time. So if we want to find this speed, what we'll do is locate two points on the graph. The two points I'll choose have coordinates 1, 1 and 4, 4. And we'll use the slope formula. So we will look at the calculation y2 minus y1 |
| 00:00:45 | divided by x2 minus x1-- change in vertical distance over change in horizontal distance. When we subtract the y-coordinates, I'll start with the point 4, 4 in both calculations. In the numerator, we have 4 minus 1, and in the denominator-- oh, that's right, 4 minus 1. |
| 00:01:02 | So we end up with our slope represented as 3 over 3, or just 1. What does this 1 represent? The constant speed of 1 mile per minute. Now we have a table on the right. And this table represents a linear relationship between Car 2's time and distance. What do you notice about the speed of the car? |
| 00:01:26 | Well, because it's a linear relationship, we have a constant speed, constant rate of change. So we may find the speed of the car by finding the slope. To do that, we'll take two points from the data on the table. The first point I'll pick will be 1 comma 1/2. And I'll label that x1, y1. And the second point I'll pick will be 7 comma 3 and 1/2. |
| 00:01:55 | And I'll label that x2 comma y2. Again, using the slope formula, I will take the change in the vertical distance-- y2 minus 1-- divided by the change in the horizontal distance-- x2 minus x1. Starting with the point 7 comma 3 and a 1/2 in both calculations, when I subtract the y-coordinates, it'll be in |
| 00:02:18 | the order 3 and 1/2 minus 1/2. And then, when I subtract the x-coordinates, I will subtract 7 minus 1. Well, this gives me 3 over 6, which is 1/2. 1/2 mile per minute is the speed of Car 2. |

**Section 14**

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| 00:00:01 | TEACHER: The graph represents a linear relationship between |
| 00:00:04 | time and distance for both Car 1 and Car 2. Now, the slope for Car 1 is 1. And since slope represents a change of distance over time, the slope is speed. So the speed of Car 1 is 1 mile per minute. This means that since the slope of Car 2 is 1/2, the speed for Car 2 is 1/2 a mile per minute. Which car is traveling faster? |
| 00:00:30 | Car 1. Now we'll turn our attention to the graph. How can you determine by looking at the graph which car is moving at a faster rate? Well, the steeper the line, the greater the slope. And since slope represents speed, Car 1 is moving at a faster speed than Car 2. |