**Applying Linear Function**

**Section 1**

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| 00:00:00 | TEACHER: Our lesson question is, how can you represent a |
| 00:00:03 | real-world situation with a linear function? Think of this taxicab, which charges a constant rate for each mile traveled. We can use a linear function to represent this situation and calculate the cost of a taxi ride of a certain number of miles. In this part of the lesson, you'll apply concepts of linear functions to real-world situations using data from a |
| 00:00:28 | graph or from a table. |

**Section 2**

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| 00:00:01 | TEACHER: Let's look at this example of writing a linear |
| 00:00:03 | function from a table. In the table below, x represents miles driven. y represents the cost to travel by taxi. Miles, represented by x, is also known as the input. And cost, represented by y, is also known as the output. Now in order to write this linear function from the table, the first thing we need to do is find the slope. And in order to find the slope, we need to use the |
| 00:00:27 | slope formula, slope equals y2 minus y1 over x2 minus x1. We need to identify x1, y1, x2, y2. So let's go back to the table and choose two ordered pairs. I'm going to choose these two at the bottom. Here, we're going to say x1, y1, x2, y2. Now that we've identified these ordered pairs, let's substitute them into the slope formula. So slope is going to equal y2 is 24 minus y1, 17, over x2, |
| 00:01:00 | which is 12, minus x1, which is 8. Let's go ahead and simplify. 24 minus 17, that's 7. 12 minus 8, that's 4. Let's take 7 divided by 4, so our slope is going to equal 1.75. Now that we figured out our slope, let's move on to step two, find the y-intercept. |
| 00:01:21 | In order to find the y-intercept, we need to use the slope-intercept form of y equals mx plus b. We're going to just use one of the two ordered pairs that we identified in the table in order to find the y-intercept. Let's use x1, y1. So y1, or y, is going to be 17. The slope we just figured it out to be is 1.75. x1 is 8, plus b. |
| 00:01:44 | We're going to solve for b, because that's the y-intercept. So 17 is going to equal 1.75 times 8, which is 14 plus b. In order to get b by itself, we need to subtract 14 from both sides, because we need to use the inverse operation. So 17 minus 14 is 3. And that's going to equal b, because these two cancel each other out. |
| 00:02:04 | Now we have the y-intercept. We're ready to move on to the last step, write the equation in slope-intercept form. Remember, that form is y equals mx plus b. We're going to substitute in the slope and the y-intercept, which we've already found. So y equals the slope is 1.75, and then we have x plus the y-intercept, which is 3. |
| 00:02:25 | So here is that linear equation or linear function that we can write from the table. Now let's move on to interpret this linear function. The cost of a taxi can be expressed by the linear function, y equals 1.75x plus 3. We're going to interpret this equation. But don't forget, in this equation, this is the slope. This is the y-intercept. |
| 00:02:48 | So the first question is, what does the slope represent? Well, the slope is equal to 1.75. So what does this represent? Well, it represents the cost for each mile traveled. So each mile that we travel in the taxi is going to cost us $1.75. Next question, what does the y-intercept represent? The y-intercept is b equals 3. |
| 00:03:17 | Well, what that represents is this is the cost when you enter the taxi. So just for getting into the taxi for your taxi ride, before you go anywhere, it's going to automatically cost you $3 just to get in the taxi. And then it will cost you $1.75 for each mile that you travel. So this is how to interpret a linear function. |

**Section 4**

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| 00:00:01 | TEACHER: Now let's look at this example of finding the |
| 00:00:02 | slope and y-intercept of a line. The graph shows the membership of a student group, where x represents the number of years since the group was formed, and y represents the number of members. We need to find the slope and the y-intercept. Now, we need to find those in order to write an equation for the line you see on the graph. Now, remember that x in this situation is |
| 00:00:24 | going to be the input. And y is going to be the output. So let's go ahead and start with the first step, which is to find the slope. Here we have two points on the graph. Now in order to find the slope, we need to use the slope formula, where m equals y2 minus y1 over x2 minus x1. Let's identify the x1, y1, and the x2, y2. |
| 00:00:48 | We'll call this x1, y1, x2, y2. We'll use the points on the graph. Let's go ahead and substitute these into the slope formula. So y2 is going to be 80. y1 is going to be 38, over x2, which is going to be 5 minus x1, which is 2. Let's go ahead and simplify. 80 minus 38? |
| 00:01:16 | Well, what does that equal? That equals 42 divided by 5 minus 2, which is 3. Divide it out one more time. 42 divided by 3, that is 14. So here's our slope right here. It's equal to 14. The next step in the process is to find the y-intercept. Well, how do we find the y-intercept? |
| 00:01:34 | It's y equals mx plus b. And we substitute into the equation. Well, we're just going to use this point right here for our coordinates of x and y. So y is going to be 38. 38 is going to equal the slope we just found, 14 times x, which is 2, plus b. Let's go ahead and simplify. |
| 00:01:53 | 38 equals 14 times 2 is 28 plus b. Subtract 28 from each side. 38 minus 28 is 10. These two cancel, so 10 equals b. We now have the slope here. We have the y-intercept here. Let's go ahead and write the equation. It's in y equals mx plus b form, so y is going to equal-- |
| 00:02:16 | well, what's the slope? Slope is 14x plus the y-intercept of 10. So here is the equation that represents this graph right here. It's y equals 14x plus 10. So this is how you find the slope and y-intercept of a line in order to write the equation of a graph. |

**Section 6**

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| 00:00:01 | TEACHER: Let's look at |
| 00:00:01 | interpreting a linear function. Here we have the same example that we looked at earlier in the lesson. The membership of a student group is expressed by the equation y equals 14x plus 10, where x represents the number of years since the group was formed and y represents the number of members. The first thing we're going to interpret is the y-intercept. |
| 00:00:21 | The y-intercept is when x equals 0, and where the line on a graph crosses the y-axis. So we see x is represented by the years since the group was formed. So when x equals 0, the y-coordinate is going to be the y-intercept. So that's going to be 10. So that's what it says right here. |
| 00:00:39 | The y-intercept when x equals 0 shows that the initial membership was 10. We could also look at the y-intercept in the equation. See? It's also 10. So we can use the graph or the equation to figure out the initial membership, or the y-intercept in this case, of this group. |
| 00:00:56 | Now let's try and answer the question, how many members did the group have after 4 years? We're going to use the equation in order to solve this. The equation is y equals 14x plus 10. We're going to substitute into the equation. We're going to put in an input, or the x. Well, it's 4 years. |
| 00:01:17 | Well, years is the x, so that's going to go in the x slot. So y equals 14 times 4, plus 10. So y is going to equal 14 times 4, 56, plus 10. So y is going to equal to 66. So this tells us that after 4 years, there would be 66 members in this student group. Well, let's go ahead and verify it on the graph. |
| 00:01:39 | Year 4, let's go up to the y-axis and across. And there it is. Yes, you can see that it's verified. After 4 years, the group did have 66 members. This is how we can interpret this linear function. |

**Section 8**

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| 00:00:01 | TEACHER: Have you ever noticed that the prices for |
| 00:00:02 | electronics often go down instead of up? For example, the price of a new camera was $199.99 12 weeks after it was released, and $149.99 26 weeks after its release. We're trying to answer the lesson question, how can you represent real-world situations like the one I just talked about with a linear function? In the first part of this lesson, you learned how to |
| 00:00:30 | write a linear equation from a table or graph. Next, in this part of the lesson, you'll apply linear functions to real-world scenarios by using two points of given information. |

**Section 9**

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| 00:00:00 | TEACHER: Let's look at this example of input and output in |
| 00:00:03 | real-world relationships. Here we have Justin, who bought a share of stock in a cell phone company. 4 weeks after his purchase, the price for the share was $78.61. 14 weeks after his purchase, the price was $71.71. The first question we're trying to answer is, what is the input? |
| 00:00:22 | Well, the input values are the values you plug into a function. And time is usually an input value. So let's see if there's any reference to time in this example. Here we have 4 weeks. That's related to time. And 14 weeks, that's also related to time. |
| 00:00:38 | So what is the input? The input is represented by x, so x is going to equal the number of weeks since the stock purchase. Now let's move onto the next question, what is the output? Well, the output values are the results and are affected by the input values. So let's go ahead and look for the output. The output would be the $78.61 and the $71.71. |
| 00:01:13 | These values are going to be affected by the number of weeks that have gone by. So what does the output represent? Well, it's represented by y, so y equals the price of the stock. Now the last thing we need to do is list the ordered pairs, based on the information in the problem. So remember, the input is x, or the number of weeks, and |
| 00:01:38 | the output is y, the price of the stock. So here's the first ordered pair, at 4 weeks, what was the price? The price was $78.61. That's our first ordered pair. The second ordered pair, at 14 weeks, what was the price of the stock? It was $71.71. |
| 00:01:57 | So these are the ordered pairs based on the information in the problem. This is our look at input and output in real-world relationships. |

**Section 11**

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| 00:00:01 | TEACHER: Let's look at finding the slope in the real world. |
| 00:00:03 | The relationship between the weeks Justin has owned a stock, represented by x, and its price, y, is linear. We need to find the slope between the two points of 4, 78.61, and 14, 71.71. We're going to use the slope formula to calculate slope, m equals y2 minus y1 over x2 minus x1. So the first thing we need to do is find the slope. Now in order to find the slope, we're going to use the |
| 00:00:29 | slope formula. We have to identify x1, y1, and x2, y2, and then substitute them into the formula. So y2 is 71.71 minus y1, which is 78.61. And that's going to be over x2, which is 14, minus x1, which is 4. Let's go ahead and simplify. 71.71 minus 78.61 is going to be negative 6.9, over |
| 00:01:00 | 14 minus 4 is 10. Let's divide it out. Negative 6.9 divided by 10 is going to equal negative 0.69. Now we have our slope. The question we're trying to answer is, what does the slope represent? Well, in this case, the slope represents the change in the stock price each week. |
| 00:01:27 | So the negative 0.69, that tells us that the stock is decreasing. Because it's a negative sign, it decreases $0.69 each week. Now let's look at finding the y-intercept in the real world. We still have that relationship between weeks Justin has owned a stock, x, and its price, y. This time we're going to use the slope, which we just found, the negative 0.69, and one of the points to find the |
| 00:01:54 | y-intercept. So let's go ahead and find the y-intercept. We're going to use slope-intercept form of y equals mx plus b. Let's go ahead and just use this first point to substitute into this equation. So y is going to be 78.61 equals the slope, the negative 0.69, times the x value, which is 4, plus b. |
| 00:02:20 | So let's continue solving this equation, solving for b. The negative 0.69 times 4, that ends up being a negative 2.76 plus b. Now in order to get b by itself, we're going to add 2.76 to each side. So what is b going to equal? b is going to equal 81.37. This is our y-intercept. |
| 00:02:46 | Now the question is, what does the y-intercept represent? Well, in this case, the y-intercept represents the initial price of the stock. So the initial price of the stock is right here. It's the y-intercept. So before anything happened, the stock to begin with, its initial price was $81.37. So this is how we can find the y-intercept in the real world. |

**Section 13**

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| 00:00:00 | TEACHER: Let's look at solving a linear function. |
| 00:00:03 | The price of the cell phone stock is expressed by the linear equation y equals negative 0.69x plus 81 and 37/100, where x represents the number of weeks Justin has owned the stock and y represents the price of the stock. We're trying to answer this question, if this relationship continues, what would be the price of the stock after 10 weeks? |
| 00:00:28 | Well, in order to figure this out, we're going to use the equation that we saw earlier in the problem here, y equals negative 0.69x plus the 81 and 37/100. Now we're looking for the price of the stock after 10 weeks. Remember, we identified the input as the number of weeks, so that's going to be the x. So we're going to substitute into the x |
| 00:00:50 | slot in this equation. So we're going to substitute the 10 for x. And then we're going to go ahead and solve this equation for y, which will be the price. So y is going to equal the negative 0.69 times 10 is a negative 6.9, plus 81.37. Continue, the negative 6.9 plus the 81.37 is going to end up being 74.47. |
| 00:01:18 | So what does this tell us? Well, it tells us that the price of the stock after 10 weeks is going to be $74.47. So this is how you can solve a linear function in order to answer a q |