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**Math 486**

**Lesson Title: What the Slope**

**Unit Title: Slope intercept form**

**Teacher Candidate:**

**Subject, Grade Level, and Date: Algebra, 8th grade, 7/21/17**

**Placement of Lesson in Sequence and Lesson Rationale**

**This lesson is part of a series on linear equations. Students have already worked with finding the slope, y-intercept and written linear equations in the (y = mx + b) format.**

**Central Focus and Purpose**

**The central focus for this assignment is to take a story problem and after identifying the slope and y intercept, translate it into a linear equation (y = mx + b) which they can graph and apply to the real world scenario. The purpose of the lesson is to ensure students understand the meaning associated with each piece of information provided in a story problem as it relates to building the linear equation (i.e which info pertains to the y-intercept and slope) and can use it to make predictions based on constant rate of change and create a graph. The mathematical concept of this lesson is graphing linear equations, with a focus on story problems. The procedural fluency for the lesson focuses on building upon their previous knowledge of the parts necessary for linear equations, including but not limited to: x and y-intercepts, slope, independent and dependent variables, and graphing. Discussion would be facilitated throughout to ensure the students gained a full understanding of each part of the linear equation. Some questions that would be asked include “Which set of data relates to the independent variable? What about the dependent variable? How do you know? Given two points how can you find the slope? What does the slope mean in this problem? What is the y-intercept in this problem and what does it tell you in this situation?” Both the pre-assessment and the formative assessment ask the students to physically act out the problems given to them, whether with manipulatives or their own bodies on a graph. These experiences will give them a deeper connection to the activities and will allow deeper understanding of the material. The students will also be asked to explain the process of how they got their answers and what each part means overall and in specific context to the story problems. This lesson will call students to make sense of problems and persevere in solving them, model with mathematics, and reason abstractly and quantitatively.**

**CCSS.MATH Content and Practice Standards**

[**CCSS.MATH.CONTENT.8.F.B.4**](http://www.corestandards.org/Math/Content/8/F/B/4/)

**Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (*x, y*) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.**

**Prior Content Knowledge and Pre-Assessment**

**Students previous knowledge is restricted to limited exposure to algebraic math and consists of a basic understanding of the formulas for linear equations, slope, and y-intercept. Students have been working with simple problems to plot points on a graph, find the y-intercept on the graph using charts, and make connections from looking at the graph. Students have also been working on identifying slope using a myriad of methods including: point slope method, t-charts, change on y-axis over change of x- axis, rise over run on the graph method and by substitution of numbers for variables to solve for the equation.**

**The pre-assessment will build off of the students previous knowledge by asking them to persevere through more complex and challenging problems. Prior to this lesson the students have only worked with simple linear equation problems in which the necessary info is clearly listed. The pre-assessment will provide the students with a problem in which none of the information is known beforehand, they will have to figure it out themselves as well as label what each piece means. They will use this to try to create the linear equations for the problems on their own. We will facilitate discussion and learning during the activity but ultimately the students will have to come up with the answers on their own.**

**Learning Target(s) and Plan for Clarifying Intending Learning**

1. **I can interpret data from a complex problem to create a linear equation**
2. **I can explain how to graph linear equations using my knowledge of the parts of the equation including y-intercept and slope.**
3. **I can justify how I found my formula by using logical reasoning and valid arguments from different methods for finding linear equations**
4. **I can interpret the graphs meaning and why it works.**

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| **Strategy for using assessments to guide student learning** |
| 1. **Pre-Assessment - The pre-assessment will be used as a bridge between their previous knowledge of simple linear equation problems to the new challenge of applying that knowledge to more complex problems in this case story problems. This activity will be a hands on partner activity. By walking around and facilitating discussion by asking questions like “which set of data represents the independent variable in this problem? The dependent variable? How could we determine the slope?” We will be able to gauge the extent to which the students remember the information taught in previous lessons. Another way we may guide the students is after a while if they haven’t figured out some of the steps they should be taking to find the correct answer we can make comments like “Walking around I saw several students utilizing a t-chart tool to help them organize the data points so they could use them to make a graph. Do you think this might be a good way to solve the problem? Or maybe is there a better way?” And carry out a quick full class discussion to help steer students in the right direction. If the class is more advanced than this you could ask for suggestions of how they started the problem rather than offering them the suggestion immediately. Other than facilitating discussion, the majority of this activity will conducted solely by the students with no help from the teacher, this will ensure that this activity will test what they already know, not any new information that is being taught. It is meant to be a slight challenge to them so they can persevere with trying to figure it out.**
2. **Formative Assessment - For this section, the students will propose an idea and discuss their solutions in groups and share with the class. The teacher will be monitoring the groups and guiding discussions, making sure every answer is clear and clarify assignment questions so students continue working and complete the assignment. Each group will model their solution to the word problem on the coordinate plane with their bodies in the center of the room. The other groups will work together and identify the linear equation the group is plotting in the center of the room. Each group will be able to explain to the class their linear equation by giving an oral explanation of their word problem and their representation of their linear equation with their bodies.**
3. **Summative - Once students have finished Formative assessment, we will gauge individual understanding by handing them an exit ticket. We can see if there are any misconceptions and address it the following day when we have a few students discuss their problems.**
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| **Success Criteria (criteria for interpreting student success of the learning target)** | **Plan for providing feedback and students’ monitoring of their own learning** |
| **Exit Slip at the end of Activity two (end of group presentations). Students will be able to generate their own word problem that models the slope formula. Students will be able to deliver it, and show understanding of what the y-intercept and slope means on a linear equation. The formula can be represented in the same format as the one presented by your group to the class, but make sure to use your own real-world word problem, points on the graph and your own interpretation of what the y-intercept and the slope means for your own story. The exit ticket is worth 20 points. Rubric questions 1 and 2 are aligned to the first learning target. 3 and 4 are aligned to the second learning target.** | **The Teacher will use the students to facilitate interaction relative to the learning targets. The teacher will give each group written feedback on their exit ticket assignment using the rubric as a guide. Students will be able to discuss in class the next day: We want students to think about the information and then come to class the next day and talk about some student example problems. This will be our way of reinforcing their understanding of the ideas and concepts.** |

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| **Academic Language Demands** |
| **Language Function** | **Vocabulary & Symbols** | **Secondary Language Demand** |
| **· Students will explain how they develop their formulas****· Students will be able to justify why their formula works for any constant rate of change real world scenario.** | **· Word (story) problems: Real world application****· Math terms: slope, y-intercept, ordered pairs, rate of change.** | **Mathematical Precision:****Students must understand correlation between the y and the x axis values.** **Syntax: And have full understanding that every straight line can be represented by an equation: y = mx + b. The coordinates of every point on the line will solve the equation if you substitute them in the equation for x and y. The slope m of this line - its steepness, or slant - can be calculated like this:** **m = change in y-value** **change in x-value****The equation of any straight line, called a linear equation, can be written as: y = mx + b, where m is the slope of the line and b is the y-intercept.****Discourse: The word problem will be posed and discusses in an assigned group, students will identify the starting point on the graph, identify the rate of change to create a formula in small groups and report out to the class orally, on the board and on paper.** |

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| **Language Support (instructional and assessment strategies)** |
| **Language Instruction** | **Guided Practice** | **Independent Practice** |
| **The learning target of, “I can explain how I found my formula using different representations through a valid argument.” will be explained and the teacher will model this explanation in the “Explain” section of the lesson.** | **Students will have practice making their explanations in small groups while solving their word story problem and sharing with the teacher.** | **Students will graph their linear equation with their bodies and explain their word story problem to the class and teacher. Students will also have a chance to come up with their own problem using the Exit Ticket.**  |

**Differentiation, Cultural Responsiveness, and Accommodation for Individual Differences**

**To accommodate for a large difference in mathematics ability, the students will work in groups to find and explain their equation. The teacher will be active during group work to help with misunderstanding. For their exit ticket assignment, students will be individually assessed (ability to understand the formula and how it is related to their story word problem). A hands-on and physical interactive lesson plan will be used to engage the students to ensure that students are interacting with the math modeling rather than simply following steps. The word problems for groups 1 and 2 are differentiated and language is simplified and shortened to meet the needs for ELL’s students.**

**Materials – Instructional and Technological Needs (attach worksheets used)**

**Activity 1. Graduated Cylinders, premarked cups, graphing paper, water**

**Activity 2. Painters tape, 6 large black markers, 20 ordered pairs blank worksheets and 4 “Graphing linear equations body style” worksheets.**

**Exit Ticket. 20 “Slope Stories worksheets “**

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| **Instructional Plan (detailed explanation for thing the lesson)** |
| **Pacing** | **Teacher Activities** | **Student Activities** |
| **10 min** | **Engage- Whole class****For the pre-assessment ensure that the students have a solid foundation of the different parts of the graph and what they actually mean in relation to a story problem.** **Ask questions to make sure they have the correct relationships between values** | **Apply previous knowledge from working with linear equations to a new and challenging hands on problem. Physically act out the problem using a graduated cylinder to fill a cup with water to certain pre-marked points, label x and y data sets (independent and dependent variables), graph the points, find the slope, find y and x-intercepts, and finally create a linear equation for the problem.** |
| **10 min** | **Explore Groups****Explain, you are given a word story problem, you should be able to make predictions by looking at what is happening. One way to do this is by figuring out what is changing and at what rate is this change and how can you show on a graph what is happening on a graph.** | **Read the instructions on the story word problem Identify the y- intercept, the slope. Use this information to create an ordered pair for each member of the group, write it on the blank ordered pair worksheet and graph ordered pairs on the worksheet with proper values. Write an equation to model the situation in (y = mx + b) form and interpret the slope.**  |
| **5 min** | **Explain Whole Class****Write down equation (y = 2x + 3) on the board. Draw quadrant I on the y axis label plant height in (ft)units. On the x axis label months. Ask two students in the class to identify the y intercept on the equation on the board. Ask the class to identify the slope on the equation. Call on a student to use the slope on the graph to create an order pair with the slope. Ask the class to think about what the slope and the y- intercept means for this equation.** |  **Have the student say the order pair for the y- intercept (0, 3) and stand at the point on the graph in the middle of the room. Have the student to create an ordered pair using the slope write it on the board and then plot the point with the body. Have students give an oral explanation what the y-intercept and slope means for the equation given.** |
| **25 min** | **Elaborate Groups****Each group was given a word problem which they will interpret on the coordinate plane on the center of the room. The group must identify the values of the x and y axis in the front white board of the class. Teacher will ask. Think about representing the linear equation on the floor. The group will model their linear equation with their bodies placing their ordered pair by their feet. Things to look for for y-intercept. The class should work together and have group discussions within their assigned groups to identify the linear equation the presenting group has plotted on the floor.**  | **The presenting group will identify the values for the y and x axis on the board as the modeled example. The groups will work together will take turns presenting their linear equations with their bodies and create their linear equation based on their story word problem. They will show the class their linear equation with their bodies for 3 minutes.** **The rest of the class will gather with their group member and will figure out the linear equation the group is presented and write it on their Activity part two section of their worksheet.****The presenting group will explain the interpretation of the word problem to the class and write their linear equation on the board for the other groups to check for accuracy.****Each group would repeat this process.** |
| **10 min (10 min next day)** | **Evaluation: most of our activities are group work. Students are using group work to understand the ideas and concepts of slope. To assess our students individually, we will give them an exit ticket. We will do a quick recap of everything we have learned and pass out the exit ticket.**  |  **Here, students will have the opportunity to show us what they have learned. Students will develop their own word problem and come up with the equation that matches everything we have been discussing. Students will then put their equation on a graph and explain what is happening in the graph. The next day, we will discuss in class to reinforce the ideas and concepts.Here is an overview:**1. **Come up with their word problem**
2. **Develop an equation**
3. **Explain what is happening**
4. **Next day, discuss in class.**
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**SLOPE STORIES**

**Instructions: Students! For your exit ticket, you will be coming up with your own slope-intercept story. I want you to come up with a story, make a slope equation, and graph it.**

1. **Come up with a story that incorporates slope-intercept form.**
2. **Write out the equation for your story below.**
3. **Graph it below**



1. **Interpret the y-intercept and the slope for your story problem.**

**Y-intercept**

**Slope**

**Clarity and organization**

1. We broke this lesson plan into 3 parts: Pre-Assessment, Formative, and summative assessment.
	1. Pre-Assessment (Kelsey) - Opened the lesson with a simple problem to make sure students understand the basic concept.
		1. This activity will provide the students to physically manipulate the materials and allow them to really understand what each part of the equation means in the problem and how they relate to each other, for example why one variable is dependent but one is independent and what that means in terms of an actual problem.
	2. Formative Assessment (Connie) - Students will be working with their groups to graph out the problems.
		1. This activity will provide students a fun way to practice graphing linear equations and an opportunity to explain what the equation/graph mean in relation to the problem, for example the line may show that a population is increasing and at a certain point it will hit a specific population size.
	3. Summative (Fernando) - For our summative assessment, we have created an exit ticket.
		1. This exit ticket will have students using the knowledge they have gained from this lesson to build their own slope-intercept story problem. They will need to meet the following:
			1. Story problem
			2. Slope formula
			3. Graph it
		2. This is how we will assess our students individually to see exactly how much they understand.

**Identified A CCSS.M.**

1. [CCSS.MATH.CONTENT.8.F.B.4](http://www.corestandards.org/Math/Content/8/F/B/4/)
	1. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (*x, y*) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

**Identified a CCSS.M. Practice**

1. Make sense of problems and persevere in solving them.
	1. Students in the beginning, were to find a way to solve the story problem and graph it. We will have them work in their groups to discuss what is happening and how to solve it (we will help with leading questions).
2. Reason abstractly and quantitatively
	1. Students will break the problem down into a graph. This is another way for student to represent the data without using the formula. We are doing this by using the graph in the middle of the class, and with our last section of our exit ticket.
3. Construct viable arguments and critique the reasoning of others
	1. Students will have a chance to talk in their own groups and as a class about the problems. One group will go up, at a time, and put themselves on the graph. The other students will discuss and try to figure out what the formula (they will argue and critique each other to get to the right answer).
4. Attend to precision
	1. Students will solve problems with exactness. They will work together to figure out exactly what the formula is and explain what is happening in the graph.
5. Look for and make use of structure
	1. Students can figure out the patterns by looking at the slope. Once slope is found, the students can figure out points further down by using the pattern.
6. Model with mathematics???
	1. Use math to solve real world problems, organize data, and understand world around you.

**Justify how modeling is used to enhance learning**

1. We used a graph in the middle of the classroom to help student better understand what the slope formula is (we introduced the slope equation so students could figure out the slope by just looking at a graph). Students go up in groups and they are the dots on the graph. The other students will try to solve what the formula is and will discuss with their groups and the other groups to make sense of this graph. The problems are being modeled by students and critical thinking is happening.

**Activity and Discussion was engaging**

1. We used several engaging activities. We used a large graph in the middle of the classroom and students had to come up in their groups and put themselves on the graph according to their problem. The other groups are to use the points on the graph to help the come up with a formula (3 groups, 3 problems). Once we have finished with the group activity, we will finish up with an exit ticket. Here students will be using what they have learned to make their own story, slope formula, and graph. This will show us exactly how much they understood.