Title of Lesson: Trains in Motion
UFTeach Students' Names: Heather McNeill

Teaching Date and Time: 10/25/2012

Length of Lesson: 50 minutes

Grade / Topic: 8th grade Algebra I Honors

Source of the Lesson:

Texas Intruments. (2011, November 24). *Trains in motion*. Retrieved from http://education.ti.com/calculators/downloads/US/Activities/Detail?

Appropriateness for Middle School Students: The engagement portion of the lesson ties the real-world into the lesson with a discussion of the Live Space Jump that occurred on 10/14/12. The exploration portion involves students using their calculators to discover slope. The students routinely work with their calculators in class for lessons. Students will work both individually and together in groups.

Concepts: Rate of change is defined to be the change in one quantity when compared to the change in another quantity. For example, when comparing distance and time we observe that the change in distance over a specific period of time will give us the rate of change. Linear equations have a constant rate of change, is this what makes them linear. Slope is the number that tells how steep the line is, it is the constant term in the linear equation that the function changes by. Slope will be one of four things: positive, negative, zero, or undefined. When lines are horizontal they have a slope of 0. For example, if we have the points (5, 9) and (0, 9) there is no change in the y values. Vertical lines have an undefined slope. Slope can be calculated from two points on the line $(y_2 - y_1)/(x_2 - x_1)$, or from looking at the graph of the line and calculating the rise/run. Slope on a distance vs. time graph represents the velocity, or speed of an object. This is how the speed of a car is determined, the distance covered over a specific amount of time.
http://www.glencoe.com/sec/math/msmath/mac04/course2/add_lesson/rate_of_change_mac2.pdf

Florida State Standards (NGSSS):

- MA.912.A.3.9: Determine the slope~~, x-intercept, and y-intercept~~ of a line given its graph, ~~its equation~~, or two points on the line.
  Cognitive Complexity: Level 2 – Basic application of skills and concepts
- MA.912.G.1.4: Use coordinate geometry to find slopes, parallel ~~lines, perpendicular lines, and equations~~ of lines.
  Cognitive Complexity: Level 2 – Basic application of skills and concepts

Performance Objectives

- Students will be able to calculate the slope of a line from a graph.
- Students will be able to calculate the slope of a line when given two points on the line.

Materials List and Student Handouts

- 25 Trains in Motion Student WS
- 25 TI-Nspire Calculators
- 25 Comprehension Check WS

Advance Preparations

- Send SB Notebook to projector
- Send TI lesson "Trains in Motion" to student calculators
- Write in axes by hand on the comprehension check before making copies
- Make copies

Safety

- There are no significant safety concerns.

5E Lesson Templates

ENGAGEMENT		**Time: 5 minutes**
What the Teacher Will Do	**Teacher Directions and Probing Questions**	**Student Responses and Potential Misconceptions**
Display an image from the Space Jump Live mission on the SmartBoard to initiate a conversation about the event.	What do you know about this image? Did Felix break any records? What were they? How fast was he going? How do they know that, what does it mean?	[It is when Felix Baumgartner free fell from the edge of space.] I don't know what this is from. [Yes, highest manned balloon flight, highest altitude jump, and the fastest free fall.] [He went over 700mph and the speed of sound is 690mph. In one hour he would travel 700 miles. It is a ratio of distance and time.]
EXPLORATION		**Time: 20 minutes**
What the Teacher Will Do	**Teacher Directions and Probing Questions**	**Student Responses and Potential Misconceptions**
The teacher will instruct the students to open the trains in Motion file on their calculators and follow the prompts. The teacher will circulate throughout the room asking probing questions.	Please open the file I haven't sent to you, it is named, "Trains in Motion". You will follow the prompts and answer the questions. You have 5 minutes to work on problem one and then you will discuss your findings with your group. What is going on in this problem? How do the two trains differ? How are they similar?	[We are looking at 2 trains that left the train station and the speed they are traveling.][One started further than the other.][They are both leaving the station; they meet up at a point.] The trains are moving at the same speed.
The teacher will instruct the students to compare findings with their peers.	Next you are going to spend about 3 minutes discussing your findings with the members of your group. It is not about comparing answers; it is about talking about what was going on in the problem.	
The teacher will instruct the students to next work alone on problem 2. The teacher will circulate throughout the room asking probing questions.	Now I want you to work individually again and look at problem 2. What do you see in the graph and how does it compare the representation you had in problem 1? What is the line on the graph	[The graph compares both trains together, you can see the intersection point where they meet up.] [The line shows the speed, or the

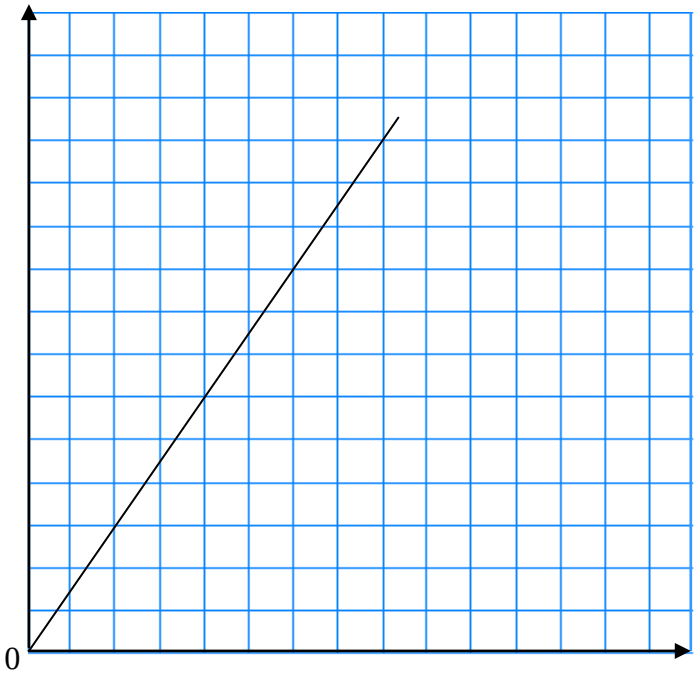
	representing? Why do you think this? How could you write an equation to represent each train?	velocity of the trains at any given point.] It shows how far they have gone. It shows how long ago it left the station. [train 1: d = 80t + 80, train 2: 120t] Train 1: d=80t, train 2: 120t
The teacher will instruct the students to now discuss their findings with their team.	Now you should spend time discussing your findings with your team. Did you have any differences in your findings? Compare the equations you can up with.	[We had different variables in our equation, but they mean the same thing.]
EXPLANATION		**Time: 10 minutes**
What the Teacher Will Do	**Teacher Directions and Probing Questions**	**Student Responses and Potential Misconceptions**
The teacher will ask for students to share their findings from problems 1 and 2.	Who will share with the class how they went about problem one? Who will share with the class how they went about problem one?	[Student explains answers, if struggling s/he can call on another student for help] [Student explains answers, if struggling s/he can call on another student for help]
Teacher makes sure that the concept is made clear to the students.	What did the line on the graph represent? Which train was moving faster? Which slope was steeper? Is there a correlation, or was this by chance? What might the graph look like of a golfer's score over time when he practices?	[The speed of the train.] The distance the train had gone. [Train 2] Train1 [Train 2] Train 1 [The steeper the line, the faster the movement.] No. [It will go down, have a negative correlation.] It would be the same as the trains.
ELABORATION		**Time: 10 minutes**
What the Teacher Will Do	**Teacher Directions and Probing Questions**	**Student Responses and Potential Misconceptions**
The teacher will have students return to the calculator to attempt problem 3.	Next please look at problem 3 in the file. Talk with your group to answer these questions together.	
The teacher will circulate throughout the room.	What do you notice when r changes? What happens when r=0? Can it? How could you get a vertical line?	[The line is changing steepness] The distance changes. [The line is horizontal.] It can't. [You can't because you are going over 'running' 0 and that would be

		undefined.] When the slope if infinity.
The class will come together once more to discuss their additional findings.	Alright, who would like to share what they discovered in problem 3?	
EVALUATION		**Time: 5 minutes**
What the Teacher Will Do	**Teacher Directions and Probing Questions**	**Student Responses and Potential Misconceptions**
Students work individually on the comprehension check.		

Name:_____

Trains In Motion! Comprehension Check

1.) What is the slope of the graphed line? Explain how you use the graph to answer the question. Classify this slope as either positive, negative, zero, or undefined. [m = 3/2, positive]



2.) What is the slope of the line that passes through the points (9, -3), (-4, 1) ? Show your work. Classify this slope as either positive, negative, zero, or undefined.
[m = -4/13]