**Lesson Title: “Disneyland Drive”**

**Unit Title: Functional Relationships**

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**Subject, Grade Level, and Date: Algebra - 8th grade - 1/28/18**

**Placement of Lesson in Sequence**

The lesson “Disneyland Drive” will serve as a unit summation on functional relationships in which students explored linear functions, how to determine rate of change (slope), and the y-intercept. This lesson focuses on problem solving, and includes a modeling activity where students graph their findings on GeoGebra, an online graphing learning/teaching tool. This lesson will likely take two 50-minute class periods to complete.

**Central Focus and Essential Questions**

The central focus of this lesson is to improve the conceptual understanding and procedural fluency of algebraic functions by problem solving for a real-world possibility. The class will be broken into small groups, each with specifications on possible vehicles to rent to drive to Disneyland. Additionally, each group will be given a different budget for their trip. This real-world scenario will push students to come up with essential questions they need to complete this task such as, “How much does it cost to rent each vehicle? What is the gas mileage? How much is the current price of gas?” and many more. They will then graph all functions on our interactive technology, GeoGebra, and interpret their findings. They will explain their findings within their groups as well as to the entire class. Ultimately, each group will need to choose which car was best in their opinion and explain their reasoning. For the sake of this assignment, all students will assume all data is linear. For example, in reality the speed you drive changes and can increase/decrease the time it takes to travel from point A to Disneyland. For this project however, we will be picking a constant speed and gas price.

**Content Standards**

**CCSS.Math: 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.

**CCSS.Math: 8.F.B.5** – Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

**MP 4** – Model with mathematics.

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| **Learning Outcomes** | **Formative Assessment Process** |
| * Students will dissect their scenario to recognize possible functional relationships. * Students will create functions to model relationships between two variables. * Students will graph the line of a function given parameters/context for a problem. * Students wills explain the methods they used to reach their conclusion. | Formative assessment will mainly consist of silent monitoring while recording notes on a daily class clipboard.  Such notes will discuss each groups’ overall understanding of the learning targets given their parameters, as well as their grasp on rate of change, y-intercept, and what it means to be a linear function. Socratic questions during the activity will also serve as a form of formative assessment. |
| **Success Criteria** (method and criteria for interpreting student success in relation to learning target) | **Plan for Providing Feedback to Students** |
| Student success will be measured by their ability to accurately generate linear equations and graphs that model such equations. Furthermore, students will be evaluated on their interpretation/reasoning skills of the problem given to them. For example, the cost of renting a certain vehicle may be $35 a day, with an initial renters fee of $200. Students must translate this information into the equation y= 35x+200 and create an accurate graph to represent such information. | Immediate feedback will be given as the activity is in progress. Intermittently, probing questions will be asked to expand on the activity and challenge students’ critical thinking. On the second day of this activity, students will complete an Exit Slip questionnaire discussing the project. On this they will be able to divulge their opinion of their conceptual understanding and procedural fluency of the stated learning targets/objectives. Those reflections will be read by the educator who will then record such opinions in comparison to their own and adjust further instruction as to better scaffold student learning. |

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| **Learning Targets** | **Student Voice** |
| * Students will create linear function equations that accurately depict the relationship of two variables. * Students will  graph the line of a function given an equation or parameters. * Students can interpret the meaning of points on a graph, as well as the parts of a linear function equation. * Students can coherently explain their methods and reasoning for their answer. | * I can create linear equations that represent the relationship between two variables. * I can graph the line of a function. * I can describe the meaning of points on a graph, as well as parts of an equation. * I can explain to others my methods and reasoning for my answer. |

**Prior Content Knowledge and Pre-Assessment**

Up to this point, students have had quite a bit of exposure to reading graphs and tables in order to determine rate of change and the y-intercept of linear functions. Students also have had a lot of practice with producing equations based on written information. Being that this is a summative project, there will only be a short review of the previous unit before students are released into their assigned groups.

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| **Academic Language Demands** | | |
| **Language Function** | **Vocabulary & Symbols** | **Secondary Language Demand** |
| * dissect scenarios into more accessible mathematical problems. * create a function to model the relationship between two variables. * graph the line of a function given parameters and context for a problem. * explain the methods  used to reach their conclusion. | * Rate of change * Linear * Function * X and Y-axis * Independent/dependent variables * (x,y) coordinates * Variables | **Mathematical Precision:**  Students accurately decide how to form equations based on which axis each variable should be placed. Students also need to use precision when reading each graph for interpretation.  **Syntax:**  Students must graph y-intercept on y-axis, slope must be rise/run (not run/rise), linear equation form: y=mx+b, and graph coordinates must be in the format (x,y) - not (y,x).  **Discourse:**  During this activity, constant communication is crucial between group members in order to determine which vehicle is most efficient to rent for their trip. Furthermore, we will be talking about this activity as a class in case there were some misconceptions still lingering about linear functions. |

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| **Language Target** | **Language Support** | **Assessment of Language Target** |
| * Students will orally share their methods with other students as well as the teacher. * Students will use correct mathematical terminology to explain their reasoning. * Students will use numbers, tables, and graphs to visually represent their method to solve the scenario. * Students will discuss within their groups, and will share with the class their evidence for choosing one of the cars. | Before we begin the lesson, we will review important terminology and concepts. These will be written on the whiteboard as a resource during the activity.  Students will have their math journals, which will contain definitions and examples we’ve covered in previous lessons. The students can refer to these notes during this activity.  We will discuss the directions for the activity as a class to address any questions or confusion. | As students work on the activity, I will circulate the room and ask them to explain their process for solving the scenario. This will include which variables they choose to compare, and how those relate to choosing the best car.  I will ask probing questions about specific terminology associated with the graphs, and how the graphs represent the relationship between variables.  I will listen for accurate usage of terms such as rate of change, linear function, independent/dependent variables, and coordinates. |

**Lesson Rationale (Connection to previous instruction and Objective Standards)**

This lesson provides students with the opportunity to continue developing procedural fluency in creating equations, graphing, and interpreting functions. This lesson helps students increase their understanding of functions and slope by creating their own functions out of real life data and interpreting them to solve everyday problems. This lesson will help students bridge the gap between what they have been learning and how they can use it to solve real life problems. This is important for students to be able to connect functions to everyday life and to realize the importance of being able to identify a  function and calculate a data point. This skill will become useful in future math classes as well as real life.

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

This class of 28 students consists of 3 African Americans, 2 Asian Americans,  and 3 Latinx with the rest being some form of European American heritage. All students are fairly fluent with linear functions, but sometimes mix up the (x,y) to (y,x). This project is very applicable to students’ lives, for some students will be entering driver’s education classes soon! They will need to understand how to ration money for gas and other traveling expenses. Additional accommodations will be made if students are struggling with comprehension of the learning objectives and targets.

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

Materials for this lesson will include an overhead projector connected to computer, Chromebooks with internet access for GeoGebra, standard and graphing paper, pencil, ruler, and a calculator. Each group will also receive a rubric to guide them on what is expected.

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| **Teaching & Instructional Activities** | | | |
| **Day One** | | | |
| **Time** | **Teacher Activity** | **Student Activity** | **Purpose** |
| 15-20 min. | Announce to the class that they will be doing a kahoot to review what they have been learning over the past couple days.  <https://create.kahoot.it/details/linear-functions/765fb5b8-7af1-4fd9-b909-6b944f1391bb> | Students will answer kahoot questions to their best ability. | The kahoot is a simple way to quickly review and assess what students remember and took away from the previous lesson. |
| 5 min | Re-teach or show another way to look at any of the concepts that were clearly not understood from the kahoot.  Make sure that relevant terminology is understood:  “Where are the independent/dependent variables represented on a graph?”  “What does the slope represent? How can we express it in terms of x and y?”  “What is the mathematical structure of a linear equation?” | Students will take notes in their math composition books to help remind them of the concepts they haven't quite yet mastered. | It is important to ensure the students are grasping concepts and you often will have to go over an idea several times before it becomes concrete in the students’ minds. |
| 10 min | Explain the project and go over the rubric for it with the class. | Students should listen attentively and ask questions when appropriate. | While this is a highly interpretive lesson, students still need to know what they are being graded on. The rubric will show the students what is expected of them. |
| 5 Min. | Assign groups and give them all a copy of a rubric, their cars they will be comparing, and their money limit. | Students will look over their options and acquaint themselves with the group. | Group work allows for collaboration and discourse, and coming up with multiple approaches to the same problem. |
| 15-20 min. | Monitor students working and write anecdotal notes on daily rubrics while walking around.  Provide help/guidance whenever needed. | Students will work efficiently and will be engaged in collaborating together. Once they have their functions they will use geogebra to graph them and evaluate them in the context of the problem. | The scenario has parameters, while also allowing a lot of freedom in how to solve. This promotes the low floor, high ceiling concept. |

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| **Day Two** | | | |
| **Time** | **Teacher Activity** | **Student Activity** | **Purpose** |
| 25-30 min. | Announce to the class that they will have up to 30 additional minutes to have all of their equations, graphs, and explanation/interpretations completed, for we will then be discussing each group’s work as a whole. | Continue project from the previous day’s lesson.  Ask any last-minute clarifying questions! | Give all groups enough time to fully complete the activity to be ready for the class discussion. |
| 20-25 min. | Gather class attention and ask for a group to volunteer to go first. No volunteers means the random drawing of group members!  Important questions to ask groups to promote deeper understanding:  “Why did you choose those variables? How did they help you decide which car to use?”  “What does the slope tell us about the relationship between the variables?”  “What changes in the variables might lead you to choose the other car instead?”  “What other factors might we need to keep in mind in real life?” | Students will volunteer to present their projects and make sure to include why they chose that particular vehicle. The remaining class will be listening intently, and ask questions after each group has presented. | This extends the discourse to the classroom level, and promotes students’ ability to coherently explain evidence for their answer. |
| 5 min. | Hand out Exit Slip to students. | Students will complete an Exit Slip questionnaire. All answers must be in complete sentences with our current math language utilized throughout. | This will give insight into the effectiveness of the activity, and the students’ level of comprehension at the end of the unit. |

RUBRIC for activity:

