**Lesson:** Depression Depreciation

**Unit:** Linear, Quadratic and Exponential Functions

1. **Benchmark/Standard:**

[CCSS.Math.Content.HSF-IF.B.4](http://www.corestandards.org/Math/Content/HSF/IF/B/4) For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

[CCSS.Math.Content.HSF-LE.A.2](http://www.corestandards.org/Math/Content/HSF/LE/A/2) Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

1. **Behavioral/Objective**

By the end of this lesson, students will be able to:

* + 1. Identify properties of graphs including where the function is increasing, decreasing, positive, or negative.
    2. Describe how the two quantities are related.
    3. Begin to determine whether an exponential or quadratic function represents the given data.

It is important for students to be able to identify the properties of graphs including where the function is increasing, decreasing, positive, or negative so they can later write out the equation for the function. Describing the relationship between the quantities will also help when determining the equation of the function.

1. **Anticipatory Set**
   1. Generate Interest: Students will collect the discovered data they analyzed the previous day and begin to look at the relationships between the graphs and tables they generated.
   2. Access Prior Knowledge: Students will be asked to indicate what it means for a graph to have a positive slope and what it means for a graph to have a negative slope by indicating what the graph will look like using their arms during a “Simon Says” game.
   3. Practice something: Students will look at their graphs and compare their results to the tables and whether this makes the function increasing, decreasing, or both.
2. **Objective/Purpose:**

By the end of this lesson, students will be able to:

* + 1. Identify where a graph is increasing, decreasing, positive, and negative.
    2. Describe relationships between various functions, their graphs, and tables.
    3. Determine if the data indicates a quadratic or exponential function.

Students must be able to identify, describe, and determine these attributes of a function so they can identify what function best relates to the data given.

1. **Input:**
   1. Task Analysis
      1. Students must know the definitions of the terms: graph, table, function, increasing, decreasing, positive, and negative.
      2. Procedure
         1. Students will play a “Simon says” game where they show positive and negative slopes with their arms as the teacher or selected student calls out the commands.
         2. Students will gather their data collected the previous class period.
         3. Students will work with their group mates to analyze if the function is increasing, decreasing, positive or negative.
         4. I will walk the students through a set of data I collected related to the great depression. I will indicate how to find positive, negative, increasing, and decreasing sections of the graph by color coding these sections on the board for them all to see.
         5. I will circulate the room and assist with this exploration activity.
         6. Students will record their discoveries on their graphs and separate scratch paper.
         7. Each student will need to indicate how they found the indicated properties. How they present this discovery is up to them and will be left as a choice. They may:
            1. Explain in an essay format what their graph is showing. (Linguistic intelligence)
            2. Indicate using a slope formula and a video showing what is happening to the slope and how they know it is increasing/decreasing. (Logical-mathematical intelligence)
            3. Visually show the class using a picture and color coded sectionals where the graph is positive/negative by drawing, painting, making a collage of the graph. (Spatial intelligence)
            4. Put together a skit about how their function came to happen in regards to the depression at that time. (Bodily-Kinesthetic intelligence)
            5. Create a song that explains the company’s struggles at that time and the result on the unemployment rate by incorporating what the graph is showing. (Musical intelligence)
            6. Collaborate within the group to create a dialogue explaining the changes in the graph (Interpersonal intelligence)
            7. Reflects individually on the graph and what it represents in terms of increasing and decreasing by writing a short reflection paper (Intrapersonal intelligence)
            8. Identify how this change in employment could impact nature and the ramifications of this impact (Naturalist intelligence)
         8. Students will complete an exit ticket regarding their understanding of analyzing graphs. The ticket will include a graph with positive, negative, increasing, and decreasing parts to the function. Students will be asked to label what each part of the graph is and explain how they came to this conclusion.
         9. Students will work at home on anything they do not finish in class regarding their project.
   2. Thinking Levels: Bloom’s Taxonomy
      1. Knowledge: Able to identify each of the parts of the graph as either positive or negative and increasing or decreasing.
      2. Comprehension: Interpret what is happening when the graph is increasing/decreasing in terms of unemployment.
      3. Application: Determine how the company was affected by this change in employment.
      4. Analysis: Analyze how this affected the economy and America as a whole.
      5. Synthesis: Other times this type of graphical representation has been witnessed and the effects from this change in a business.
      6. Evaluation: Determine where the company’s future appears to be heading towards based on the acquired data.
   3. Learning Styles and/or Accommodations
      1. Remediation: Students will be supplied picture cards that show what it means for a graph to be increasing and decreasing. Students must match this graphical image to the one they have acquired.
      2. Extensions: Provide students with a graph containing multiple shifts where the graph may increase, then decrease, then increase again. Students may also be asked to analyze what it means for there to be negative employment or what the flat sections on a graph indicate.
      3. Differentiated Curriculum: Students will be asked to create a graph using the positive and negative sections they are given. They will then use this creation to determine what type of function is shown.
   4. Method and Materials
      1. Introduction of increasing/decreasing functions, demonstration of how to label the parts of the graph, work through a provided graph with the students watching.
      2. Materials:
         1. Data collected from the previous day (graphs and tables)
         2. Scrap paper
         3. Pencil
         4. Whiteboard and Markers
2. **Modeling**
   1. I will give an example of how to label the increasing and decreasing sections on a sample graph.
   2. I will provide them examples of presentation techniques they could use.
3. **Checking for Understanding**
   1. Example Questions:
      1. What indicates the graph is increasing?
      2. What indicates the graph is decreasing?
      3. What indicates the graph is positive?
      4. What indicates the graph is negative?
      5. What does it mean for the employment to change in this way?
      6. Where is this relationship seen in your everyday life?
   2. Stop and Check:
      1. 5 fingers check for understanding, (1 – no idea what we are doing, 5 – understand the material completely): This will be used when explaining how to show the indicated parts of the graph.
      2. Thumbs up/thumbs down: Indicates that they agree with what I chose for my labels of the graph.
   3. Discussion of Discoveries:
      1. Students will discuss with their group mates what they chose to label on their graphs and come to a consensus about which one to use in the final project.
4. **Guided Practice**
   1. Model to students how to label the different parts of the graph.
   2. Teacher circulates the classroom and assists the students as needed by using guided questioning.
5. **Independent Practice**
   1. Students will examine their data prior to discussing it with their group mates. This independent work time will help all students focus on the given task and how to find the different parts of the graph.
6. **Closure:**
   1. Students:
      1. Finish labeling the different parts of the graph.
      2. Complete an exit slip showing their understanding of the material.
      3. Begin looking at the type of data displayed, (quadratic or exponential).
   2. Teacher:
      1. Reflect on the lesson by reviewing the exit slips.
      2. Evaluate the effectiveness of the lesson based on the students’ success with the exploration activity, their ability to communicate the properties during the small group discussions, and the correctness of their data and evaluation of that data.