EDCI 5964: Lesson Plan #4
Name: Emily Staskin **Date:** 12/419 **Grade/Class:** Algebra I

SOL: A.7 The student will investigate and analyze linear and quadratic function families and their characteristics both algebraically and graphically, including

a) determining whether a relation is a function;
b) domain and range;
c) zeros;
d) intercepts;
e) values of a function for elements in its domain; and
f) connections between and among multiple representations of functions using verbal descriptions, tables, equations, and graphs.

The students already have prior knowledge from the following Math 8 standard:
8.15 *The student will*

a) determine whether a given relation is a function; and
b) determine the domain and range of a function.

From this standard, students should already know how to represent a relation or a function from a set of ordered pairs, a table, or a graph. These concepts will be reviewed in the lesson, but less emphasis will be placed on them since they should be prior knowledge. Some students may also know the difference between a relation and a function, but this will be discussed in detail.

In this lesson, the focus will be an investigating and analyzing functions and their characteristics, including parts a, b, e, and f of standard A.7. Any purely algebraic functions will be linear, although some real-world situations may be non-linear.

Learning Target:

- I can explain whether or not a relation is a function.
- I can identify the domain and range of a relation.
- I can make connections between representations of functions using words, tables, equations, and graphs.

Key Vocabulary: relation, domain, range, function, ordered pairs, table, graph, mapping

Materials: "The Sneetches" by Dr. Seuss (book or online video), Function Card Sort

SIOP Features

Preparation: X Adaptation of content X Links to background X Links to past learning X Strategies incorporated	Scaffolding: X Modeling □ Guided Practice X Independent Practice X Comprehensible Input	Group Options: X Whole class X Small groups X Partners X Independent
Integration of Process: X Reading X Writing X Speaking X Listening	Application: X Hands-on X Meaningful X Linked to objectives X Promotes engagement	Assessment: X Individual X Group X Written X Oral

Total Time: 1hr 30min

Engagement (15min):

The teacher will begin the class by reading "The Sneetches" by Dr. Seuss to the class. If the book is not available, the teacher can play a video of the story from either of these links:

- https://www.youtube.com/watch?v=XMolzESn4oI
- https://www.youtube.com/watch?v=8-QevAGsl6A

After reading the story, the teacher will ask questions about the two machines in the story to review domain and range.

Key Questions:

- *What types of actions did the machines in the story do?*
- *What was the same or different about the two machines?*
- *What types of machines do we have in our lives? What do they do? What do you put in the machine and what comes out of it?*
- *What is the relationship between the 'in' and 'out' sides of the machine and domain and range? (connect to inputs and outputs)*
- *What was the domain and range of the first machine? The second?*
- *Can you tell me what domain and range are?*

Exploration (25min):

The teacher will explain to the class that they will be designing their own machines, just like the ones from the story with the Sneetches. They will work in groups of 2-3 students to determine what goes into their machine and how it has changed when it comes out. Students will be asked to 'collect' data as they put various things into their machines and represent it in a way that makes sense to their group.

While groups are working, the teacher will be monitoring and asking questions to make sure the groups are on task.

Key Questions:

- *What is the domain and range of your machine? How do you know?*
- *Can you get two different outputs from the same input? Why or why not?*
- *Can you have two different inputs that give you the same output? Why or why not?*

Explanation (25min):

The teacher will select various groups to share their machine with the class (the selecting and sequencing process should be completed while students are still working within their groups). The teacher should choose some groups whose machines have some inputs that result in multiple outputs and some who have the same output for multiple inputs. If there are no machines like this, the teacher can introduce one at the end of the discussion as "a machine from a previous class."

Possible machines for the discussion if more cases are needed are below. The teacher will present these in various representations, such as a table, mapping, or graph, depending on which representations have not been shared previously in the class discussion. (i.e. If no group has a mapping, the teacher will present one of these machines with the data in a mapping.)

Machine 1: This machine inputs real numbers and outputs the same number plus 2. Some examples of various inputs and outputs are:

Input	-4	-3	-2	-1	0	1	2	3	4
Output	-2	-1	0	1	2	3	4	5	6

Machine 2: This machine inputs a student's name and outputs their favorite Disney movie. This has the potential for multiple inputs with the same output.

Input	Emma	Jared	Lucas	Sandra	Brian
Output	Finding Nemo	Hercules	The Lion King	Cinderella	Hercules

Machine 3: This machine inputs a student's age and outputs how many cousins they have. This has the potential for the same input to have multiple outputs.

Input	12	13	12	11	14	13
Output	5	17	0	9	6	8

Students may choose to represent their data in a set of ordered pairs, a table, a graph, an equation, or a mapping. The teacher will have students compare and contrast the various representations and discuss how they can find domain and range in each representation.

Key Questions:

- *Can someone else explain to me how this group's machine works?*
- *How did you all represent your data?*
- *Where do we see domain and range in each of these representations of data?*

The teacher will then point out that all of the students have created a relation, which is a set of ordered pairs (a domain and range). Then, the teacher will point out two different machines to compare. One of them should have the same input values with different outputs, which means it would not be a function.

The teacher would ask the class to come up with additional ordered pairs for each relation.

Key Questions:

- *How do you know that ordered pair will work for this relation?*

- *What if I had another (whatever the repeated input value was) as an input? How do I know what the output will be? How can you be sure?*
- *Which of these relations is easier to find additional ordered pairs for? Why is that?*

The goal is for students to take note that when the same input value has more than one output value, there is no way of knowing which output value it should go to. They should recognize that they can only be positive about the ordered pairs they come up with for the relation that is a function.

The teacher will then tell the class which of the two relations is a function and which is not. The teacher will then help the class determine a definition for a function. One possible definition: *Functions describe the relationship between two variables where each input is paired to a unique output.* OR *A relation is a function if and only if each element in the domain is paired with a unique element of the range.*

Elaborate (15min):

Students will go back to their groups and work on the Function Sort. In this activity, the groups will cut out the cards for the sort, which are attached at the bottom of the lesson plan. Then, they will be asked to sort the cards into relations and functions.

Once they have sorted the cards, students will discuss with their groups and make a list of strategies they used to determine whether each card was or was not a function.

Key Questions:
- *Are you using different strategies for each representation (i.e. tables, graphs, etc.)?*
- *What characteristics are you looking for to determine whether or not it is a function?*
- *What are the advantages and disadvantages of your strategy?*

At this point, students may use a method similar to the vertical line test to determine whether or not the graphs in the sort are functions. If this is the case, the teacher will make sure that every other member of the group also understands the strategy and if time allows, they can share their strategy with the class or another group.

Evaluate (10min):

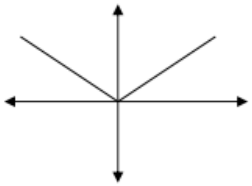
The teacher will be monitoring the students throughout the lesson and taking note of individual students' thinking during group work and whole class discussions.

In addition, at the end of the lesson, the teacher will ask students to answer the following prompt individually and turn it in: *Explain why it is important to identify the domain and range values of a relation when determining if it is a function.*

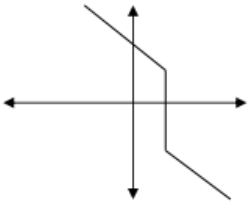
Function Sort Cards

x	y
1	–2
3	4
5	10

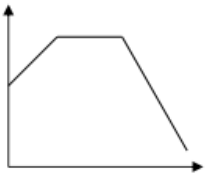
A grocery store is selling peaches for $0.98 per pound.



x	y
2	–1
2	–3
2	–5



You visit a yard sale with your friends Pete, Sharon, and Brandon. Brandon buys 4 old CDs for $8.00, and Sharon buys 3 old CDs for $6.00. Pete talks to the seller and makes a deal to buy 4 CDs for $7.00.

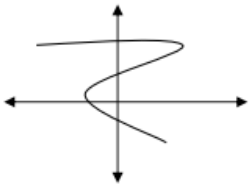


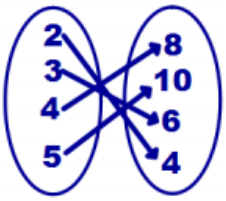
$y = 3x + 2$

x	y
–2	10
0	6
2	10

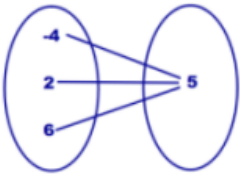
$y = x^2$

x	y
5	1
6	1
7	1





{(2, 4), (3, 6), (4, 8)}



{(3, 2), (4, 1), (2, 3), (5, 1)}