**Lesson Title:** Domain and Range

**Grade and Subject:** 9th Grade Algebra 1 Common Core **Date:** February 24th, 2015

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| 1. LESSON PLAN LEARNING OUTCOMES AND PROCEDURE |
| **Essential Question(s) / Central Focus** | What is a domain? What is a range? How do I determine the domain and range of a function? |
| **Learning Objective(s)** | * Students will be able to explain what the domain and range of a function are.
* Students will be able to determine the domain and the range of a function when given a table of values or a graph.
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| **CCGPS or GPS Standard(s)** | **MCC8.F.1** Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.**MCC9-12.F.IF.**1 Understand that a function from one set (called the domain) to another set (called the range) assigns each element of the domain exactly one element of the range. If f is a function and x is an element of the domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y=f(x). |
| **Instructional Strategies & Learning Tasks that Support Diverse Student Needs** | Introduct-ion to Lesson | A whole class discussion will take place to continue the introduction from the previous day, involving toast. We will discuss what outcomes can come from using a toaster with various inputs such as bread, bagel, pop tart, waffle, etc. If you put a slice of bread into a toaster is it possible to get a warm waffle when it is done? Will putting a pop tart into a toaster give you a piece of toast? We discussed previously that these scenarios will not happen and thus tell us that a toaster is a function, but the relationship between one input and one output also share more specific information about the function. These relationships will begin the discussion of domain and range as related to inputs and outputs. The introduction will take 5 minutes to complete.  |
| Body of Lesson | After homework assignments have been turned in and the introduction has been completed, this lesson begins by discussing bounded and unbounded/not bounded graphs. Students must understand that a bounded graph has specific beginning and end points while an unbounded graph continues onto infinity. These differences in types of graphs affect their appearance, but also their domain and ranges. The differences between these two types of graphs will be discussed and compared in the organizer provided in the copies of the day’s notes. The difference between an open and closed dot will also be discussed and how these differences are represented in the domain and range of a function. The definitions of both domain and range will also be discussed and shared as students are asked to find the domain and range of a graph which is bounded and then of the same graph that has been made unbounded. For bounded graphs, a rectangle can be made by drawing horizontal lines through the minimum (lowest point) and maximum (highest point) of the graph as well as vertical lines through each “end” of the graph to determine the domain and range. On an unbounded graph however, it will be discussed why creating a domain and range rectangle is not logical. This comparison will assist students in understanding how a graph being bounded or unbounded can vastly change the characteristics of the graph. The beginning of the body of this lesson will take between 5-10 minutes to complete.Following the introductory definitions and graph explanations, the whole group will discuss whether the next four graphs are bounded or unbounded as well as list their domain and range. To find the domain and range, the “rectangle method” will once again be used, specifically on bounded graphs. Additionally, we will discuss either each of the relations is a function based on the vertical line test. This portion of the note taking should take approximately 10 minutes.The remaining three problems for in class work will be done individually, while I assist students as needed and circulate the room to observe student work and understanding. Following individual thinking time, I will ask for student volunteers to approach the board and share their solutions to one of these problems in order for the student who have an opportunity to verbally share their thought processes as they solved the assigned problem. I will also be probing both the presenting students as well as the seated ones, with guiding questions as well as to enhance and further student learning beyond the current topic. For example, from a graph several other factors can also be determined such as x- and y-intercepts, minimum, maximum, etc. If time allows, these additional graphical features may be highlighted throughout student presentations in order to accommodate for students who tend to move at a faster pace and complete the three problems early. The individual student working time as well as presentations should take 15 minutes to be completed. |
| Closure | The closure of the lesson will involve each student discussing the domain and range of various functions. The homework assignment from the previous night will be shown and I will ask the students to determine the domain and the range of a relation from a given table of values. The students understand that the domain is the set of all inputs and the range is the set of all outputs. Therefore, a whole group discussion will ensue so that students understand that the domain and range of a table of values are $\left\{x\_{1},x\_{2},x\_{3,}…,x\_{n}\right\}$ and $\left\{y\_{1},y\_{2},y…,y\_{n}\right\}$ respectively. The closure should take 10 minutes. |
| **Learning Supports: Differentiation, Modification(s)and Accommoda-tion(s)** | All students in this class have an Individualized Education Program. As discussed above, many students in the class require copies of class notes as listed in their IEP classroom accommodations, and therefore I offer and provide copies of all class work to each of my students. Additionally, a majority of the students in this class require additional time to respond, breaking material into manageable parts, and repeating directions as needed. To accommodate these needs, I do not overwhelm my students with several problems at once and therefore try to limit questions on each PowerPoint slide of class notes to one or two problems. As students are answering questions/problems individually before whole group instruction continues, I also circulate around the room to observe each student’s work and to gauge if the students need more time, especially before calling upon them. I also provide a copy of the class notes, project the information on the classroom white board, and verbally state directions so that both auditory and visual learners are able to understand what is expected of them. For the several students who receive an accommodation of reduced number of assignments I speak with them about their alternative assignments on an individual basis depending on each student’s unique needs. |
| **Formal and Informal Assessment** | **Formal Assessment:** A formal assessment in the form of a quiz will be given following lesson 4.**Informal Assessment:** Student responses and individual work throughout the lesson will be used to informally assess student understanding and achievement. Student work on the domain and range homework will be used as well.  |
| 2. RESOURCES |
| **Academic Language** | **Language Functions** | Students will compare/contrast the differences between bounded and unbounded graphs and the change in both the domain and range of these types of function graphs. In order to do so thoroughly, students will be able to explain domain and range as well as how to determine them. Students will also be expected to use appropriate vocabulary when comparing and contrasting the characteristics of graphs. |
| **Vocabulary** | Students will verbally explain whether or not a relation is a function as well as describe the domain and range of each. Vocabulary for this lesson includes:* Relation
* Function
* Input
* Output
* Domain
* Range
* Minimum
* Maximum
* Vertical Line Test
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| **Syntax or Discourse** | Students will be expected to demonstrate their understanding of syntax/discourse through their explanations and justifications both orally and in written form when describing relations and their domain/range. They will be expected to use vocabulary from this lesson to accurately explain the difference between a relation and a function as well as both domain and range. |
| **Materials** | * White board
* Projector
* Domain and Range Notes
* Domain and Range Homework
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| **Technology** | For this lesson, the technology used is a classroom projector system which allows all students the opportunity to clearly see class notes as well as both teacher examples and those presented by peers. |