Title: "Functions and Linear Relationships"   **Grade level: 8th Grade Pre-Algebra**

Author(s):   **Date lesson will be taught: March 24th/25th**
Anastashia Pelletier

Source of the lesson:
Teacher modified from school's CLT Plans

CONCEPT STATEMENT
  In this lesson, students will develop an understanding of functions by determining whether a given relation is a function and identifying its domain and range. By making connections between numerical and graphical representations, students will strengthen their ability to analyze relationships and apply these concepts to real-world situations. This lesson will also highlight the contributions of Dr. Gladys West, a mathematician whose work in mathematical modeling and linear equations played a crucial role in developing GPS technology. Dr. West demonstrated how linear functions and data analysis have practical applications in navigation and everyday technology. Through this lesson, students will see how the concepts are used to solve real-world problems.

Important Vocabulary:
<u>Relation</u> – A set of ordered pairs that show a relationship between two variables.
<u>Function</u> – A relation in which each input (x-value) has exactly one output (y-value).
<u>Domain</u> – The set of all possible input values (x-values) of a function.
<u>Range</u> – The set of all possible output values (y-values) of a function.
<u>Ordered Pair</u> – A pair of numbers written as (x,y) that represents a point on the coordinate plane.
<u>Vertical Line Test</u> – A method used to determine whether a graph represents a function by checking if any vertical line passes through more than one point.

LESSON OBJECTIVES
Students will be able to... determine whether a given relation is a function and determine the domain and range of a function.

VIRGINIA SOL OBJECTIVE(s) ADDRESSED
8.PFA.2 The student will determine whether a given relation is a function and determine the domain and range of a function.

MATERIALS NEEDED (Resources, supplies, and handouts)
Pencils, Chromebook, glue sticks, and notebook
'Mathematician of the Unit: Gladys West' Slides
'Relations, Functions, and Linear Equations' note bundle
'Target Practice by Graphing Points' Desmos (Restrict to slides 2-7)
'Relations and Intro to Functions' Desmos
'Functions and Relations' Quizizz
'HW2: Graphing Linear Equations by Table' Worksheet

SAFETY CONSIDERATIONS
  Students will be instructed to use all materials for their intended use.

ENGAGEMENT	Estimated Time: 10 minutes
Teacher and Student Activity	**Probing Questions**
Students will glue in 'Relations, Functions, and Linear Equations' note bundle.	
Teacher will display the 'Mathematician of the Unit: Gladys West' slides on to the smartboard. Teacher will go over the slides, explain the importance of Gladys's work and how it affected navigation today.	
Students will work in their pods and create a list of other ways lines, or a graph can be used in real life. After 5 mins, students will have a 'pass it on' discussion. For this discussion, pods will choose a representative and have them share one of their answers and explain how understanding more about lines and graphs relate to their example. The representative will then pass to the next pod. This will repeat until each group has gone once.	• Can you think of any other ways using lines or a graph might be used in real life?
Teacher will introduce today's topic of Functions, Relations and Linear Equations by asking students to open their Chromebooks.	

EXPLORATION	Estimated Time: 15 minutes
Teacher and Student Activity	**Probing Questions**
For 10 mins, students will work on the 'Target Practice by Graphing Points' Desmos (Restrict to slides 2-7). Teacher will monitor students progress from computer, helping students that are struggling.	
After 10 mins or when most of the pods have finished their work, teacher and students will discuss what they have noticed and what they wonder when it comes to the coordinate plane, x-values, y-values and graphing points. Teacher will then begin to transition to relations.	• "How do you know where to start when plotting an ordered pair on the coordinate plane?" • "Can you think of a situation where you might use the coordinates to represent something in the real world?" • "Now that we've plotted these ordered pairs on the graph, how can we describe the relationship between the x and y values? What patterns do you notice?" • "Looking at the plotted points, do you notice any repeated x-values or y-values? What does that tell you about the relation?"

EXPLANATION	Estimated Time: 30 minutes
Teacher and Student Activity	**Probing Questions**
After the discussion, Teacher will play the first 2 videos on the 'Relations and Intro to Functions' Desmos. As they watch the videos, students will fill in the guided notes in their notebooks. Teacher will then ask the students to describe what a relation is in their own words. Teacher will repeat this for domain and range.	• "If we have a set of ordered pairs, how do we find the domain? Can the domain have repeated x-values?" • "What does the range of a function represent? How do you find the range by looking at the y-values of the ordered pairs?" • "Can a relation have multiple outputs for a single input? Can you think of a situation where this might happen?"
After discussion, teacher will play the last video on the Desmos. Once again, students will fill in their guided notes along side the video. Teacher will ask a few questions to help differentiate between a relation and a function. Students will talk in their pods before sharing their answers with the class.	• "What's the difference between a relation and a function? How would you describe a relation based on what we have seen plotted?"
Using the Doodle note page, Teacher will explain that functions are like a machine, that if you input something, then something will be output. Teacher will use x-values as an example of something that could be input to the 'machine' and ask the class what they expect to be output. Teacher will repeat this with domain and independent, writing in the note page displayed on the board.	
Teacher will then define a function as a relation with variables where each input has a single output. Teacher will relate this to a coordinate plane by saying that each x-value but have only 1 y-value for the relation to be a function. Students will then look at the 2 examples on the page and discuss which one do they think is a function and why. Teacher will call on a few students to share their answers.	
Teacher will explain that in higher math courses, the students will see the notation f(x), which is pronounced as f of x. Teacher will explain that this notation is the exact same the y-value that they will see in the equations that this unit will introduce.	
Teacher will explain that to solve for the y-value of any given functions, the students will be using substitution. This will be accomplished by replacing the x in the equations with a blank ( )	

and then placing in the number that x is equal to. Teacher will demonstrate this with the example on the notes.	
Teacher will then transition to showing how we will solve for the range of a function, using the domain.	• "If we know the domain of a function, what steps can we take to find the range? How do the domain values help guide us to the range?"

ELABORATION	Estimated Time: 15 minutes
Teacher and Student Activity	**Probing Questions**
Teacher will explain that if there is a domain, then we will run each x-value into the function and calculate the y-value for that x-value. Teacher will explain that to write these values as the range, then it is important to use { }. These curly brackets or fancy brackets are used in math to indicate a set. Teacher will go through example 7.	
Before going through the second example, Teacher will instruct students to open their Desmos scientific calculators. Teacher will have the students put in y=-2x+5 into the first line and then press enter. Then students will type in x= and then a number of their choice. Students will see that this is a way to be able to quickly find the y-values of their function.	
Using their calculators, Students will work on solving example 9. Once done, Teacher will explain that we can use the domain and range to find ordered pairs and create a graph of the function. Using both examples, Teacher will have students fill in the 2 tables before creating a graph for each. Teacher will ask probing questions on what do the students notice about the difference between the two equations.	• "For our first equation, what do we notice about the points? How about for the second equation?" • "Are these two equations functions? How can we tell?"
Teacher will then explain that the first equation forms a line when graph, so it is called a linear equation. Teacher will explain that the second equation created a parabola, and these equations are called quadratic equations. These are equations that students will see in high math courses. For this year, students will be focusing on graphing and calculating linear equations.	

EVALUATION	Estimated Time: 10 minutes
Teacher and Student Activity	**Probing Questions**
Students will then sign onto their Quizizz account and begin working on the 'Functions and Relations' assignment. Teacher will track students progress during this time. Students that complete their Quizizz and earn a 100% will be rewarded with a Jolly Rancher or 500 Paw Points.	
After 5 minutes, teacher will announce major summative for the topic next week and assign students to complete even problems 2-12 from 'HW 2: Graphing Linear Equations by Table' and to start the Study Guide for major summative 4.	

DIFFERENTIAL STRATEGIES

To support diverse learners, this lesson incorporates multiple strategies, including visual, auditory, and hands-on activities. Students will engage with guided notes, videos, and interactive Desmos activities to accommodate different learning styles. Scaffolding is provided through structured discussions and group work, ensuring that students with varying levels of understanding can participate. For students who need additional support, teacher and peer assistance will be available, and the SPED teacher and TA will help provide modifications. Advanced learners will be challenged by exploring real-world applications of functions beyond the basic curriculum.

ASSESSMENT

Throughout the lesson, students will demonstrate their learning through class discussions, Desmos activities, and guided notes. The teacher will monitor progress in real-time, addressing misconceptions as they arise. At the end of the lesson, students will complete a Quizizz assessment to check for mastery of functions and relations. Students scoring 100% will receive an incentive, reinforcing engagement and motivation. Additionally, a summative assessment will be announced for the following week, with a study guide assigned to support review and preparation.

Attach any SUPPLEMENTARY MATERIALS (handouts, worksheets, data collection tables, assessments, etc.) as part of your lesson plan.

Important Links:

Gladys West Google Slides
https://docs.google.com/presentation/d/1-HMzDbZP4xNpEALDgz9_1wJTuha3NXdUq23TUJmmJ4M/edit?usp=sharing

Target Practice by Graphing Points Desmos:
https://teacher.desmos.com/activitybuilder/custom/60798d81f59bf80cd8cb13e8

Relations and Intro to Functions Desmos:
https://teacher.desmos.com/activitybuilder/custom/60745a62469d370d611f1cba

Relations and Functions Quizizz
https://quizizz.com/admin/quiz/60798b721e68cb001cce85aa