Marietta City Schools

2023–2024 District Unit Planner

Grade 8 Mathematics

Unit title	Unit 2: Modeling Linear Relationships and Functions	**MYP year**	3	**Unit duration (hrs)**	*MMS- (4.5 hours per week)*

Mastering Content and Skills through INQUIRY (Establishing the purpose of the Unit): ***What will students learn?***

Georgia K-12 Standards

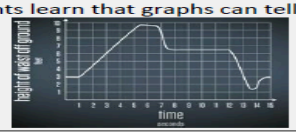
Standards

7.PAR.4 Recognize proportional relationships in relevant, mathematical problems; represent, solve, and explain these relationships with tables, graphs, and equations.

8.PAR.4 Show and explain the connections between proportional and non-proportional relationships, lines, and linear equations; create and interpret graphical, mathematical models and use the graphical, mathematical model to explain real-life phenomena represented in the graph.

Expectations		Evidence of Student Learning (not all inclusive; see Grade Level Overview for more details)		
8.PAR.4.1	Use the equation y = mx (proportional) for a line through the origin to derive the equation *y* = m*x* + b (non-proportional) for a line intersecting the vertical axis at b.	***Fundamentals*** • Students should be given opportunities to explore how an equation in the form y = mx + b is a translation of the equation y = mx. • In Grade 7, students had multiple opportunities to build a conceptual understanding of slope as they made connections to unit rate and analyzed the constant of proportionality for proportional relationships. • Students should be given opportunities to explore and generalize that two lines with the same slope but different intercepts, are also translations of each other. • Students should be encouraged to attend to precision when discussing and defining b (i.e., b is not the intercept; rather, b is the y-coordinate of the y-intercept). Students must understand that the x-coordinate of the y-intercept is always 0.	***Strategies and Methods*** • Students should be given the opportunity to explore and discover the effects on a graph as the value of the slope and y-intercept changes using technology.	***Example*** • The business model for a company selling a service with no flat cost charges $3 per hour. What would the equation be as a proportional equation? If the company later decides to charge a flat rate of $10 for each transaction with the same per hour cost, what would be the new equation? How do these two equations compare when analyzed graphically? What is the same? What is different? Why?
8.PAR.4.2	Show and explain that the graph of an equation representing an applicable situation in two variables is the set of all its solutions plotted in the coordinate plane.	***Strategies and Methods*** • Students should use algebraic reasoning to show and explain that the graph of an equation represents the set of all its solutions. • Students continue to build upon their understanding of proportional relationships, using the idea that one variable is conditioned on another. • Students should relate graphical representations to contextual, mathematical situations. • Students should use tables to relate solution sets to graphical representations on the coordinate plane.		

8.FGR.5 Describe the properties of functions to define, evaluate, and compare relationships, and use functions and graphs of functions to model and explain real-life phenomena.

Expectations		Evidence of Student Learning (not all inclusive; see Grade Level Overview for more details)	
8.FGR.5.1	Show and explain that a function is a rule that assigns to each input exactly one output.	***Strategies and Methods*** • Students should be able to use algebraic reasoning when formulating an explanation or justification regarding whether or not a relationship is a function or not a function. • Describe the graph of a function as the set of ordered pairs consisting of an input and the corresponding output.	
8.FGR.5.2	Within realistic situations, identify and describe examples of functions that are linear or nonlinear. Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	***Strategies and Methods*** • Students should be able to model practical situations using graphs and interpret graphs based on the situations. • Students should model functions that are nonlinear and explain, using precise mathematical language, how to tell the difference between linear (functions that graph into a straight line) and nonlinear functions (functions that do not graph into a straight line). • Students should analyze a graph by determining whether the function is increasing or decreasing, linear or non-linear. • Students should have the opportunity to explore a variety of graphs including time/distance graphs and time/velocity graphs.	**Examples** • The function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line. • Examples such as this can be used to help students learn that graphs can tell stories. 
8.FGR.5.3	Relate the domain of a linear function to its graph and where applicable to the quantitative relationship it describes.	***Example*** • If the function h(n) gives the number of hours it takes a person to assemble n engines in a factory, then the set of positive integers would be an appropriate domain for the function.	
8.FGR.5.4	Compare properties (rate of change and initial value) of two functions used to model an authentic situation each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	***Example*** • Given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.	
8.FGR.5.5	Write and explain the equations $y = mx + b$ (slope-intercept form), $Ax + By = C$ (standard form), and $(y - y_1) = m(x-x_1)$ (point-slope form) as defining a linear function whose graph is a straight line to reveal and explain different properties of the function.	***Strategies and Methods*** • Students should be able to rewrite linear equations written in different forms depending on the given situation.	***Terminology*** • Forms of linear equations: standard, slope-intercept, and point-slope forms.

8.FGR.5.6	Write a linear function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.	***Strategies and Methods*** • Problems should be practical and applicable to represent real situations, providing a purpose for analyzing equivalent forms of an expression. • Rewrite a function expressed in standard form to slope-intercept form to make sense of a meaningful situation.	
8.FGR.5.7	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.	***Strategies and Methods*** • This learning objective also includes verbal descriptions and scenarios of equations, tables, and graphs.	
8.FGR.5.8	Explain the meaning of 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.	***Strategies and Methods*** • This learning objective also includes verbal descriptions and scenarios of equations, tables, and graphs.	
8.FGR.5.9	Graph and analyze linear functions expressed in various algebraic forms and show key characteristics of the graph to describe applicable situations.	***Strategies and Methods*** • Use verbal descriptions, tables and graphs created by hand and/or using technology.	***Terminology*** • Various forms of linear functions include standard, slope-intercept, and point-slope forms. • Key features include rate of change (slope), intercepts, strictly increasing or strictly decreasing, positive, negative, and end behavior.

8.MP: Display perseverance and patience in problem-solving. Demonstrate skills and strategies needed to succeed in mathematics, including critical thinking, reasoning, and effective collaboration and expression. Seek help and apply feedback. Set and monitor goals.

K12 Mathematics Glossary

Proportional	Non-Proportional	Coordinate Plane	Slope	Y-intercept	Standard Form
Slope-Intercept Form	Point Slope Form	Function	Relation	Range	Domain
Constant of Proportionality	Horizontal Axis	Initial Value	Linear Relationship	Non-Linear Relationship	Rate of Change
Vertical Axis	X - Intercept				

Notation

$y = mx$

$y = mx + b$

$Ax + By = C$

$y - y_1 = m (x - x_1)$

Key concept	Related concept(s)	Global context
Relationships	Measurement and space	Globalization and Sustainability

Statement of inquiry

Modeling the change in relationships can impact decision-making.

Inquiry questions

- **Factual—** What is slope? What is y-intercept?
- **Conceptual—** How can slope be applied in the real world? How can y-intercept be applied in the real world?
- **Debatable-** Does slope (unit rate) impact our everyday decision-making, why or why not?

MYP Objectives	Assessment Tasks	
*What specific MYP **objectives** will be addressed during this unit?*	***Relationship** between summative assessment task(s) and statement of inquiry:*	*List of common formative and summative assessments.*
Criterion A: Knowledge and Understanding Criteria B: Investigating Patterns Criteria C: Communication in Mathematics	Students will demonstrate how modeling change in relationships can impact decision-making.	**Formative Assessment(s):** Unit 2 CFA **Summative Assessment(s):** Unit 2: Modeling Linear Relationships and Function Test Unit 2 MYP Assessment: Catering Project

Criterion D: Applying Mathematics In real life contexts.		

Approaches to learning (ATL)
Need: Draw reasonable conclusions and generalizations. **Category:** Thinking **Cluster:** Critical Thinking, Creative Thinking, Transfer **Skill Indicator:** Analyzing and evaluating issues and ideas and Utilizing skills, knowledge in multiple contexts, and generating novel ideas and considering new perspectives

Learning Experiences Add additional rows below as needed.		
Objective or Content	**Learning Experiences**	**Personalized Learning and Differentiation**
8.FGR.5.1 Show and explain that a function is a rule that assigns to each input exactly one output.	Functional Relationships Brief Description: Description: In this learning plan, students will define a function within the context of real-life situations. Students will determine whether certain situations represent functions. This learning plan has the potential to advance and strengthen students' abilities to think in terms of functions in order to solve real world problems. In order to think in terms of functions, students must have the ability to abstract from particular input-output pairs. Standard questions about the domain and ranges of functions are artificial and usually feel purposeless to students and therefore, do not prepare them for the process of abstraction. In the questions in this learning plan, inputs and outputs appear in a concrete context that is meaningful in a real-world situation for students. Learning Goals: ● I can use strategies to identify patterns and relate them to functions. ● I can use functions to model real-world situations. ● I can use graphs to help interpret real-world problems.	In this learning plan, students will define a function within the context of real-life situations. Students will determine whether certain situations represent functions. This learning plan has the potential to advance and strengthen students' abilities to think in terms of functions in order to solve real world problems. In order to think in terms of functions, students must have the ability to abstract from particular input-output pairs. Standard questions about the domain and ranges of functions are artificial and usually feel purposeless to students and therefore, do not prepare them for the process of abstraction. In the questions in this learning plan, inputs and outputs appear in a concrete context that is meaningful in a real-world situation for students.
8.FGR.5.1 Show and explain that a function is a rule that assigns to each input exactly one output.	DESMOS: Guess My Rule Brief Description: In this learning plan, students will write rules based on input-output pairs represented in tables and to be introduced to the concept of function through these rules. This lesson introduces students to functions. They will learn that a function is a rule that only produces one possible output for a given input. In future lessons, students will expand on this definition as they work with representations of functions . Learning Goals: Write rules for producing outputs from inputs. Understand that a function has one and *only one* output for each allowable input.	Students are introduced to the concept of functions using input and output pairs in a table. Thye explore how rules are numeric and also abstract using letters or words.

	Identify rules that do and do not represent functions	
8.FGR.5.4 Compare properties (rate of change and initial value) of two functions used to model an authentic situation each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).	Multiple Representations Task Multiple Representations Practice.pdf	This task serves multiple purposes. First, it allows the students to apply their knowledge of writing a linear equation by identifying the slope and y-intercept in a given situation. It also enables the students to graph linear equations, as well as interpret a real life situation using their knowledge of y=mx+b. Finally, it gives them a "preview" of the unit MYP project because it is very similar.

Content Resources

DOE UNIT 2 Link

Savvas Math 8 Correlation Document (see pgs. 8 - 12)

SAVVAS Lessons

- Lesson 2-5 (Compare proportional relationships)
- Lesson 2-6 (Connect proportional relationships and slope)
- Lesson 2-7 (Analyze linear equations y = mx)
- Lesson 2-8 (Understand the y-intercept of a line)
- Lesson 2-9 (Analyzing linear equations y = mx+b)
- Lesson 3-1 (Understanding relations and functions)
- Lesson 3-2 (Connect representations of functions)
- Lesson 3-3 (Compare linear and nonlinear functions)
- Lesson 3-5 (Intervals of increase and decrease)
- Lesson 3-6 (Sketch functions from verbal descriptions
- Lesson 3-4 (Construction functions to model linear relationships)

Interventions

Ratios - Hands on investigation

Additional Resources:

Linear Graphs and Patterns - Students are working towards learning and understanding using **STAGE 8** Strategies