Marietta City Schools

2023–2024 District Unit Planner

Accelerated Grade 7/8 Mathematics

Unit title	Unit 4: 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?***

GA DoE Standards

Standards

7.PAR.4 (5,7,8) 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.

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.

8.MP.1-8
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.

- 8.MP.1: Make sense of problems and persevere in solving them.
- 8.MP.2: Reason abstractly and quantitatively.
- 8.MP.3: Construct viable arguments and critique the reasoning of others.
- 8.MP.4: Model with mathematics.
- 8.MP.5: Use appropriate tools strategically.
- 8.MP.6: Attend to precision.
- 8.MP.7: Look for and make use of structure.
- 8.MP.8: Look for and express regularity in repeated reasoning.

Gifted Standards

Strand 2: Creative Thinking Skills
Students will develop and utilize creative thinking through a variety of products and problem solving.

Strand 3: Higher Order Thinking and Problem Solving Skills
Students will develop and utilize critical thinking, higher order thinking, logical thinking and problem solving skills in various situations.

Strand 4: Advanced Communication and Collaboration Skills
Students will develop advanced communication and collaboration skills in working toward a common goal with shared accountability for the final outcome.

7.PAR.4.5	Use context to explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.	***Example*** • Erik feeds stray cats near his house. A graph shows different amounts of cat food he puts out based on the number of cats near his house. Erik graphs point P to represent the unit rate. What does point P mean in terms of the situation? Cups of cat food per cat.
7.PAR.4.7	Use similar triangles to explain why the slope, *m*, is the same between any two distinct points on a non-vertical line in the coordinate plane.	***Strategies and Method*** • Students should be able to use proportional reasoning to explain why the slope, *m*, is the same between any two distinct points.
7.PAR.4.8	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.	***Fundamentals*** • Students should demonstrate a conceptual understanding of slope. • Students should be able to use graphical reasoning to represent proportional relationships. The proportional relationships explored by students should represent practical, realistic situations.
		Examples • Compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed. • Mark was looking to fertilize his lawn, which is 432 sq. ft. He read the packages of 2 different fertilizer bags to see how much should be used. Bag A stated 2 ounces per 4 square feet and Bag B can be represented using the table below: **Ounces** 2 4 12 **Square Feet** 3 6 18 What is the unit rate for each bag? Which bag should Mark purchase for his lawn? Why?

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 = mx + 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.

FUNCTIONAL & GRAPHICAL REASONING *–relate domain to linear functions, rate of change, linear vs. nonlinear relationships, graphing linear functions, systems of linear equations, parallel and perpendicular lines*

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 phenomena.

<table>
<tr><th colspan="2">Expectations</th><th colspan="2">Evidence of Student Learning
(not all inclusive; see Grade Level Overview for more details)</th></tr>
<tr><td>8.FGR.5.1</td><td>Show and explain that a function is a rule that assigns to each input exactly one output.</td><td colspan="2">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.</td></tr>
<tr><td>8.FGR.5.2</td><td>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.</td><td>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.</td><td>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.
  </td></tr>
<tr><td>8.FGR.5.3</td><td>Relate the domain of a linear function to its graph and where applicable to the quantitative relationship it describes.</td><td colspan="2">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.</td></tr>
<tr><td>8.FGR.5.4</td><td>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).</td><td colspan="2">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.</td></tr>
<tr><td>8.FGR.5.5</td><td>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.</td><td>Strategies and Methods
• Students should be able to rewrite linear equations written in different forms depending on the given situation.</td><td>Terminology
• Forms of linear equations: standard, slope-intercept, and point-slope forms.</td></tr>
</table>

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.

Concepts/Skills to support mastery of standards

8.PAR.4.1 Use the equation y = mx (proportional) for a line through the origin to derive the equation y = mx + b (non-proportional) for a line intersecting the vertical axis at b.

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.

8.FGR.5.1 Show and explain that a function is a rule that assigns to each input exactly one 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.

8.FGR.5.3 Relate the domain of a linear function to its graph and where applicable to the quantitative relationship it describes.

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).

8.FGR.5.5 Write and explain the equations y = mx + b (slope-intercept form), Ax + By = C (standard form), and (y - y1) = m(x-x1) (point-slope form) as defining a linear function whose graph is a straight line to reveal and explain different properties of the function.

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.

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.

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.

8.FGR.5.9 Graph and analyze linear functions expressed in various algebraic forms and show key

Vocabulary

K12 Mathematics Glossary

Proportional	Non-Proportional	Coordinate Plane	Slope	Y-Intercept	**Standard Form**
Slope-Intercept Form	Point-Slope Form				

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 information in different forms helps us make decisions.		
Inquiry questions		

Factual— What is slope? What is y-intercept? What is the point slope formula used for?

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 Criterion D: Applying Mathematics In real life contexts.	Students will demonstrate how modeling change in relationships can impact decision-making.	**Formative Assessment(s):** ● Unit 5 CFA **Summative Assessment(s):** ● Unit 5 Summative ● Catering Project Unit 5 MYP Task
Approaches to learning (ATL)		
Category: Social **Cluster:** Collaboration Skills **Skill Indicator:** Give and receive meaningful feedback.		

Learning Experiences Add additional rows below as needed.		
Objective or Content	**Learning Experiences**	**Personalized Learning and Differentiation**
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. ● 8.PAR.4.1 Use the equation y = mx (proportional) for a line through the origin to derive the equation y = mx + b (non-proportional) for a line intersecting the vertical axis at b. ● 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.	Proportional-vs-Nonproportiona l Proportional-vs-Nonproportional SD (student document) Proportional-vs-Nonproportional DT (Desmos task) Proportional-vs-Nonproportional TG (teacher's guide)	In this learning plan, students will explore proportional and nonproportional scenarios. Students will discuss proportional linear equations in the form y=mx and nonproportional linear equations in the form y=mx+b. Students will notice differences and similarities of these two equations as they begin their journey to describe linear equations as functions and identify key characteristics in context later in the unit.
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. ● 8.FGR.5.3 Relate the domain of a linear function to its graph and where applicable to the quantitative relationship it describes. ● 8.FGR.5.8 Explain the meaning of the rate of change and initial value of a linear function in terms of the	Interpreting Distance Time Graphs Interpreting Distance Time Graphs_SD (student document) Interpreting Distance Time Graphs_TG (teacher's guide)	In this learning plan, students will interpret distance-time graphs as qualitative functions. The relationship between time and distance will always represent a function as no input of time can yield two different distances. Students will apply their ability to identify functions, while describing functions in a real-world context. This will prepare students for the remainder of the unit where they will focus mainly on linear functions and briefly circle back to nonlinear functions.

situation it models, and in terms of its graph or a table of values. • 8.FGR.5.9 Graph and analyze linear functions expressed in various algebraic forms and show key		
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. • 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). • 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.	Table for 63 Please Table for 63 Please SD (student document) Table for 63 Please TG (Teacher's Guide)	In this learning plan, students will create and use an equation to describe a function within the context of a real-life situation. Students will begin to compare linear function examples within the same scenario
Content Resources		

Interventions

Ratios - Hands on investigation

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

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)