



Marietta City Schools

2023–2024 District Unit Planner

Grade 8 Honors Mathematics

Unit title	Unit 2: Modeling Linear Relationships and Functions	MYP year	3	Unit duration (hrs)	MMS- (4.5 hours per week)
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Mastering Content and Skills through INQUIRY (Establishing the purpose of the Unit): *What will students learn?*

GA DoE Standards

Standards

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.

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 $y = mx + b$ (non-proportional) for a line intersecting the vertical axis at b .	<p>Fundamentals</p> <ul style="list-style-type: none"> 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. 	<p>Strategies and Methods</p> <ul style="list-style-type: none"> 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. 	<p>Example</p> <ul style="list-style-type: none"> 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.	<p>Strategies and Methods</p> <ul style="list-style-type: none"> 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.

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.	<p>Strategies and Methods</p> <ul style="list-style-type: none"> 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.	<p>Strategies and Methods</p> <ul style="list-style-type: none"> 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. 	<p>Examples</p> <ul style="list-style-type: none"> 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.	<p>Example</p> <ul style="list-style-type: none"> 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).	<p>Example</p> <ul style="list-style-type: none"> 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.	<p>Strategies and Methods</p> <ul style="list-style-type: none"> Students should be able to rewrite linear equations written in different forms depending on the given situation. 	<p>Terminology</p> <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> Use verbal descriptions, tables and graphs created by hand and/or using technology. 	Terminology <ul style="list-style-type: none"> 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 $(y - y_1) = m(x - x_1)$ (point-slope form) as defining a linear function whose graph is a straight line to reveal and explain different properties of the function.

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

MCS Gifted Standard:

MCS.Gifted.S3B. Develop critical thinking, inductive and deductive reasoning to analyze and evaluate logical reasoning within a variety of problems and dilemmas.

Vocabulary

[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		
<p>Factual— What is slope? What is y-intercept? What is the point slope formula used for?</p> <p>Conceptual— How can slope be applied in the real world? How can y-intercept be applied in the real world?</p> <p>Debatable- Does slope (unit rate) impact our everyday decision-making, why or why not?</p>		
MYP Objectives	Assessment Tasks	
<i>What specific MYP objectives will be addressed during this unit?</i>	<i>Relationship between summative assessment task(s) and statement of inquiry:</i>	<i>List of common formative and summative assessments.</i>
<p>Criterion A: Knowledge and Understanding</p> <p>Criteria B: Investigating Patterns</p> <p>Criteria C: Communication</p> <p>Criterion D: Applying Mathematics In real life contexts.</p>		<p><u>Formative Assessment(s):</u> Unit 2 CFA</p> <p><u>Summative Assessment(s):</u> Unit 2 Summative MYP: Real World Graphing Linear Equations Project</p>
Approaches to learning (ATL)		
<p>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</p>		

Learning Experiences

Add additional rows below as needed.

Objective or Content	Learning Experiences	Personalized Learning and Differentiation
<p>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.</p> <ul style="list-style-type: none"> 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. 	<p><i>Proportional-vs-Nonproportional</i></p> <p>Brief Description: 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.</p> <p>Learning Goals:</p> <ul style="list-style-type: none"> I can identify proportional and nonproportional relationships I can create linear equations to represent proportional and nonproportional relationships I can graph linear equations that represent proportional and nonproportional relationships <p>https://lor2.gadoe.org/gadoe/file/b4c91ac9-5647-49f1-bfcb-fc9615e0d6dd/1/Proportional-vs-Nonproportional-Student-Recording-Sheets.pdf (student document)</p> <p>https://lor2.gadoe.org/gadoe/file/b4c91ac9-5647-49f1-bfcb-fc9615e0d6dd/1/Proportional-vs-Nonproportional.pdf (teacher’s guide)</p>	<p>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.</p>
<p>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.</p> <ul style="list-style-type: none"> 8.FGR.5.3 Relate the domain of a linear function to its graph and 	<p>Key-Features-of-Linear-Functions</p> <p>Key-Features-of-Linear-Functions-Student-Recording-Sheets.pdf (student document)</p> <p>https://lor2.gadoe.org/gadoe/file/335dc9f0-d65e-4850-9f9e-315e09b0aabf/1/Key-Features-of-Linear-Functions.pdf (teacher’s guide)</p>	<p>In this learning plan, students will take a look at proportional and nonproportional linear functions in context and describe the characteristics of the graph. Students will explore beyond slope and y-intercept as they seek to informally describe where a linear function is positive, negative, increasing, decreasing, end behavior, and intercepts all within a relevant context.</p>

<p>where applicable to the quantitative relationship it describes.</p> <ul style="list-style-type: none"> ● 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 		
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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)