Marietta City Schools

2023–2024 District Unit Planner

Enhanced Algebra: Concepts & Connections (Grade 8)

Unit title	*Unit 1: Modeling Linear Relationships & Functions*	**MYP year**	*3*	**Unit duration (hrs)**	*Enter Hours* *MSGA- (5 hours per week)* *MMS- (4.5 hours per week)* *MHS- (7.5 hours per 2 weeks)*

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

GA DoE Standards

Standards

Gifted 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.

8.PAR.3: Create and interpret expressions within relevant situations. Create, interpret, and solve linear equations and linear inequalities in one variable to model and explain real phenomena.

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.

A.FGR.2: Construct and interpret arithmetic sequences as functions, algebraically and graphically, to model and explain real-life phenomena. Use formal notation to represent linear functions and the key characteristics of graphs of linear functions, and informally compare linear and nonlinear functions using parent graphs.

A.FGR.2.1 Use mathematically applicable situations algebraically and graphically to build and interpret arithmetic sequences as functions whose domain is a subset of the integers

Fundamentals - Students should be able to:

- make connections between linear functions and arithmetic sequences presented in mathematically applicable situations.
- build and interpret arithmetic sequences as functions presented graphically and algebraically.
- convert arithmetic sequences from explicit to recursive form and vice versa.
- define sequences recursively and explicitly.

Example • By graphing or calculating terms, students should be able to show how the arithmetic sequence in recursive form $a_1=7$, $a_n=a_n$-1 +2; the arithmetic sequence in explicit form $a_n = 2(n-1) + 7$; and the function $f(x) = 2x + 5$ (when x is a natural number) all define the same sequence.

A.FGR.2.2 Construct and interpret the graph of a linear function that models real-life phenomena and represent key characteristics of the graph using formal notation.

Strategies and Methods

• Students should be able to use graphs created by hand and with technology, verbal descriptions, tables, and function notation when analyzing linear functions that represent real-life phenomena.

• Students should be given opportunities to use interactive graphing technologies to explore and analyze key characteristics of linear functions, including domain, range, intercepts, intervals where the function is increasing or decreasing, positive or negative, maximums and minimums over a specified interval, and end behavior.

Fundamentals

• Students should be able to express characteristics in interval and set notation with linear functions.

• Students should be able to interpret the key characteristics of the graph in a situation.

A.FGR.2.3 Relate the domain and range of a linear function to its graph and, where applicable, to the quantitative relationship it describes. Use formal interval and set notation to describe the domain and range of linear functions.

Examples

• 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.

• Use symbolic notation to represent the domain and range of a linear function, considering the specific context.

$(-\infty,\infty)$ $[3, \infty)$ D: $\{x| x\epsilon\mathbb{R}\}$ D: $\{x| x > 0\}$ D: $\{x| x = 1,2,3,4,5,\ldots\}$ R: $\{y| y = 10,20,30,\ldots\}$

A.FGR.2.4 Use function notation to build and evaluate linear functions for inputs in their domains and interpret statements that use function notation in terms of a mathematical framework.

Fundamentals

• Students should develop a deep understanding of function notation to build, evaluate, and interpret linear functions; this understanding will be applied to other functions studied hereafter.

A.FGR.2.5 Analyze the difference between linear functions and nonlinear functions by informally analyzing the graphs of various parent functions (linear, quadratic, exponential, absolute value, square root, and cube root parent curves).

Fundamentals

• Students should explore the parent function graphs to compare linear and nonlinear relationships (including a visual analysis of end behavior, increasing and decreasing, domain and range, intercepts, and general curvature).

• Learning all the characteristics of these nonlinear functions is not an expectation for this learning objective.

• Students should be able to identify parent functions by name (i.e., linear, quadratic, etc.).

• Students should have opportunities to explore the various graphs using technology.

Strategies and Methods

• Students should be able to informally analyze the curvature of several parent functions to highlight the characteristics of linear functions in comparison to several nonlinear functions.

• This is an introduction to functions they will explore in future units and courses.

• Students should be provided opportunities to utilize graphing calculators and interactive graphing technologies to explore this concept.

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.

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A.MM.1: Apply mathematics to real-life situations; model real-life phenomena using mathematics

A.MM.1.1 Explain applicable, mathematical problems using a mathematical model.

Fundamentals

• Students should be provided with opportunities to learn mathematics in the framework of real-life problems.

• Mathematically applicable problems are those presented in which the given framework makes sense, realistically and mathematically, and allows for students to make decisions about how to solve the problem (model with mathematics).

A.MM.1.2 Create mathematical models to explain phenomena that exist in the natural sciences, social sciences, liberal arts, fine and performing arts, and/or humanities domains.

Fundamentals

• Students should be able to use the content learned in this course to create a mathematical model to explain real-life phenomena.

A.MM.1.4 Use various mathematical representations and structures with this information to represent and solve real-life problems.

Strategies and Methods

• Students should be able to fluently navigate between mathematical representations that are presented numerically, algebraically, and graphically.

• For graphical representations, students should be given opportunities to analyze graphs using interactive graphing technologies.

A.MM.1.5 Define appropriate quantities for the purpose of descriptive modeling.

Fundamentals

• Given a situation, framework, or problem, students should be able to determine, identify, and use appropriate quantities for representing the situation.

Concepts/Skills to support mastery of standards

8.PAR.3.1 Interpret and utilize formulas or expressions.
8.PAR.3.2 Describe and solve linear equations in order to demonstrate a simpler form of equivalent equations.
8.PAR.3.3 Create and solve linear equations and inequalities for application.
8.PAR.3.4 Applying algebraic properties in order to justify steps for one-solution equations and inequalities.
8.PAR.3.5 Solve linear equations and inequalities in one variable, and explain the contextual meaning in a scenario.
8.PAR.3.6 Apply algebraic reasoning in various forms to solve linear and literal equations.

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

Students will construct and interpret arithmetic sequences as functions, both algebraically and graphically.

Students will need to maintain their ability to interpret linear functions, including key characteristics using proper notation.

Students should be able to compare linear and nonlinear functions informally.

Vocabulary

K-12 Mathematics Glossary

- Terms
- Factors
- Coefficient
- Constant
- Variable
- Operation
- inverse
- Solution
    - One solution
    - No solution
    - Infinitely many solution
- Expression
- Equations
- Proportional
- Non-Proportional
- Coordinate Plane
- Slope
- Y-Intercept
- Standard Form
- Slope-Intercept Form
- Point-Slope Form

Arithmetic Sequence	Continuous	Dependant Variable	Discrete	Domain	Function Notation
Independent Variable	Interval Notation	Linear Function	Non-linear Functions	Parent Functions	Range
Relation	Set Notation				

Notation

y = mx

y = mx + b

Ax + By = C

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

Function Notation -

$f(t)$ Interval Notation - [.] , (,) Set Notation - D: $\{x|x \in R\}$ (Set of all real numbers) , R: $\{y \mid y \in R\}$, $\{x|5 \leq x \leq 7\}$

Key concept		Related concept(s)	Global context
Form		Model, Pattern	Identities and Relationships

Statement of inquiry

Modeling the change in relationships can impact decision-making.

Inquiry questions

Factual— Create, interpret, and solve a linear relationship in the real world? How do you interpret mathematical models in linear equations and linear inequalities? Describe the properties of linear and nonlinear functions? How are arithmetic sequences related to linear functions? How do you construct, interpret, and analyze key characteristics in set notation?

Conceptual— How do we use arithmetic sequences as functions to model and explain real-life phenomena? How do we identify characteristics of linear functions in context?

Debatable- What is the best representation of a function?

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.*
MYP A - Knowing and Understanding MYP B - Identifying and Predicting Patterns MYP C - Communicating using academic vocabulary MYP D - Creating and modeling linear equations and functions to address real world problems	Students will interpret real life scenarios to enhance their understanding of patterns.	**Formative Assessment(s):** Unit 1 CFA **Summative Assessment(s):** Unit 1 Summative Assessment Unit 1 Retake/Retest MYP Assessment: Catering Project (A,B,CD)
Approaches to learning (ATL)		
Category: Communication Skills **Cluster:** Communication **Skill Indicator:** Make Inferences and Draw Conclusions		

Learning Experiences Add additional rows below as needed.		
Objective or Content	**Learning Experiences**	**Personalized Learning and Differentiation**
• A.MM.1.1 – Explain applicable, mathematical problems using a mathematical model. • A.MM.1.2 – Create mathematical models to explain phenomena that exist in the natural sciences, social sciences, liberal arts, fine and performing arts, and/or humanities domains • A.MM.1.4 – Use various mathematical representations and structures with this information to represent and solve real-life problems. 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 the	**Table for 63, Please!** https://lor2.gadoe.org/gadoe/file/f969597d-bf7a-4fff-ac04-d98513f22dae/1/Table-for-63-Please-Student-Recording-Sheets.pdf **(Student Document)** https://lor2.gadoe.org/gadoe/file/f969597d-bf7a-4fff-ac04-d98513f22dae/1/Table-for-63-Please-Learning-Plan.pdf **(Teacher's Document)**	Learning Plan Description: 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.

relationship or from two (x,y) values, including reading these from a table or from a graph.		
• A.MM.1: Apply mathematics to real-life situations; model real-life phenomena using mathematics. • A.MM.1.1 Explain applicable, mathematical problems using a mathematical model. • A.MM.1.2 Create mathematical models to explain phenomena that exist in the natural sciences, social sciences, liberal arts, fine and performing arts, and/or humanities domains. • A.MM.1.5 Define appropriate quantities for the purpose of descriptive modeling. • A.FGR.2: Construct and interpret arithmetic sequences as functions, algebraically and graphically, to model and explain real-life phenomena. Use formal notation to represent linear functions and the key characteristics of graphs of linear functions, and informally compare linear and nonlinear functions using parent graphs. • A.FGR.2.2 Construct and interpret the graph of a linear function that models real-life phenomena and represent key characteristics of the graph using formal notation. • A.FGR.2.3 Relate the domain and range of a linear function to its graph and, where applicable, to the quantitative relationship it describes. Use formal interval and set notation	**Time-Graphs** https://lor2.gadoe.org/gadoe/file/a3caf917-958b-4067-9cb9-63a94ec07412/1/Time-Graphs-Student-Recording-Sheets.pdf **(Student Document)** https://lor2.gadoe.org/gadoe/file/a3caf917-958b-4067-9cb9-63a94ec07412/1/Time-Graphs-Learning-Plan.pdf **(Teacher Document)**	In this learning plan, students will analyze parts of a graph determining where a graph is constant, increasing, or decreasing, as well as identify the domain and range that graph. These are two key characteristics that students will explore building from function notation as they are introduced to interval and set notation. Students will explore these characteristics in the context of the familiar concept of time graphs from 8th grade.

to describe the domain and range of linear functions. ● A.FGR.2.4 Use function notation to build and evaluate linear functions for inputs in their domains and interpret statements that use function notation in terms of a mathematical framework.		
● A.MM.1: Apply mathematics to real-life situations; model real-life phenomena using mathematics. ● A.MM.1.1 – Explain applicable, mathematical problems using a mathematical model. ● A.MM.1.2 – Create mathematical models to explain phenomena that exist in the natural sciences, social sciences, liberal arts, fine and performing arts, and/or humanities domains. ● A.MM.1.4 – Use various mathematical representations and information to represent and solve real-life problems. ● A.MM.1.5 – Define appropriate quantities for the purpose of descriptive modeling. A.FGR.2: Construct and interpret arithmetic sequences as functions, algebraically and graphically, to model and explain real-life phenomena. Use formal notation to represent linear functions and the key characteristics of graphs of linear functions, and	Enhanced Characteristics of Linear Functions https://lor2.gadoe.org/gadoe/file/5c39da33-a39a-4be2-b425-0e47d1a051a4/1/Enhanced-Characteristics-of-Linear-Functions-Student-Reproducibles.pdf (Student's Document) https://lor2.gadoe.org/gadoe/file/5c39da33-a39a-4be2-b425-0e47d1a051a4/1/Enhanced-Characteristics-of-Linear-Functions-Learning-Plan.pdf (Teacher's Document)	In this learning plan, students will dive deeply into the key features of linear functions. This skill will prove useful to students as they seek to explore key features of other nonlinear functions. Students will explore key features of linear functions and their graphs including domain and range, end behavior, and where a graph is positive or negative. Students will then apply that knowledge to real-world phenomena to relate domain and range of a linear function to its graph.

informally compare linear and nonlinear functions using parent graphs. ● A.FGR.2.2 – Construct and interpret the graph of a linear function that models real life phenomena and represent key characteristics of the graph using formal notation. ● A.FGR.2.3 – Relate the domain and range of a linear function to its graph and, where applicable, to the quantitative relationship it describes. Use formal interval and set notation to describe the domain and range of linear functions. ● A.FGR.2.4 – Use function notation to build and evaluate linear functions for inputs in their domains and interpret statements that use function notation in terms of a mathematical framework.structures with this		
Content Resources		
Savvas GaDOE resources		