## Marietta City Schools

## 2023–2024 District Unit Planner

*Honors Algebra: Concepts & Connections*

| Unit title | Unit 1: Modeling Linear Functions | MYP year | 4 | Unit duration (hrs) | 15 hrs |
|---|---|---|---|---|---|

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

### GA DoE Standards

**Standards**

**8.PAR.3\*:(integrate along with the content included in A.FGR.2)** 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.3.1** Interpret expressions and parts of an expression, in context, by utilizing formulas or expressions with multiple terms and/or factors.

    **8.PAR.3.2** Describe and solve linear equations in one variable with one solution ($x = a$), infinitely many solutions ($a = a$), or no solutions ($a = b$). Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).

    **8.PAR.3.3** Create and solve linear equations and inequalities in one variable within a relevant application.

    **8.PAR.3.4** Using algebraic properties and the properties of real numbers, justify the steps of a one-solution equation or inequality.

    **8.PAR.3.5** Solve linear equations ~~and inequalities~~ in one variable with coefficients represented by letters and explain the solution based on the contextual, mathematical situation.

    **8.PAR.3.6** Use algebraic reasoning to fluently manipulate linear and literal equations expressed in various forms to solve relevant, mathematical problems.

**8.PAR.4\*: (teach before beginning work with linear functions through A.FGR.2)** Show and explain the connections between proportional and nonproportional relationships, lines, and linear equations; create and interpret graphical mathematical models and use the graphical, mathematical model to explain real phenomena represented in the graph.

    **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.

**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.

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Resources, materials, assessments not linked to SGO or unit planner will be reviewed at the local school level.

**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.

**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

- 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

| 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

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- Refers to the understanding that the underlying structure and shape of an entity is distinguished by its properties. | Change, Model, Pattern | Identities and Relationships - Physical, psychological and social development; transitional; health and well-being; lifestyle choices |
| **Statement of inquiry** | | |
| Forms of identities and relationships model psychological and social development using patterns and changes throughout health and well being activities. | | |

| **Inquiry questions** |
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**Factual—**

- What is the common difference in a sequence?
- What is the domain and range of a linear function?
- What are the intercepts of a linear function?
- What is the slope of a linear function?

**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-**

- Is it more effective to represent linear functions using formal notation or informally compare them to non-linear functions using parent graphs?

| **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 - Unit 1 Quiz<br><br>MYP B - DOE Identifying and Predicting Patterns Modified<br><br>MYP C - DOE Detention Hall Buyout Reflection | Summative assessment will have questions that ask students to use patterns in data to make predictions about health and wellness. | **Formative Assessment(s):**<br><br>MYP A - Unit 1 Quiz<br><br>MYP B - Identifying and Predicting Patterns<br><br>MYP C - Detention Hall Buyouts Reflection<br><br>**Summative Assessment(s):**<br><br>Unit 1 Test |
| **Approaches to learning (ATL)** | | |
| **Category:** Communication Skills<br>**Cluster:** Communication<br>**Skill Indicator:** Understand and use mathematical notation<br>**Learning Activity:** DOE Exploring Growth Rates (Function Notation) | | |

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|---|---|---|
| **Category:** Thinking Skills<br>**Cluster:** Critical-thinking<br>**Skill Indicator:** Gather and organize relevant information to formulate an argument.<br>**Learning Activity:** DOE Detention Hall Buy Out ( Which option is best?) | | |

| **Learning Experiences** | | |
|---|---|---|
| Add additional rows below as needed. | | |
| **Objective or Content** | **Learning Experiences** | **Personalized Learning and Differentiation** |
| 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.<br>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. | **Exploring Patterns**<br>Students will explore visual and numerical patterns to understand arithmetic sequences. Students will make connections between arithmetic sequences and linear functions by examining explicit equations. Students will make connections, in context, and apply their knowledge to create their own patterns and critique the patterns of their peers.<br><br>Learning Goals:<br>• I can use arithmetic sequences to describe patterns.<br>• I can identify arithmetic sequences in linear functions to describe real world phenomena.<br>• I can construct and interpret graphs of linear functions. | **Language Supports:** Provide multiple opportunities for structured peer interactions or conversations (pairs or triads) to negotiate meaning using charts, graphic organizers, a word bank and/or sentence frames. There should also be a focus on precise vocabulary.<br><br>**Supporting the Learning:** Pose purposeful questions to assess prior knowledge and elicit student thinking to address concepts needing review.<br>○ What does this mean?<br>○ What are the quantities in the problem?<br>○ What are different ways the situation can be represented?<br>○ How do these concepts/models compare? |
| 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.<br>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.<br>A.FGR.2.4 Use function notation to build and evaluate linear functions for inputs in | **Detention Hall Buyout**<br>Students will  practice the creation of arithmetic sequences, and the creation of equations using function notation to recognize the relationship between the two.<br><br> Learning Goals:<br>• I can interpret linear functions in context<br>• I can make conjectures about the relationship between arithmetic sequences and function notation. | **Support the learning:**<br>○ Students should build on their knowledge of linear functions to make connections to arithmetic sequences. Allow students to use both concrete and abstract models to help students to make sense of the concept.<br>○ Make explicit connections between current and prior lessons regarding linear functions. Students should have a firm understanding of linear functions (creating & interpreting) to make the connection to function notation.<br><br>**Extend the Learning:** Allow students to make connections to real-life phenomena as they move towards interpreting linear functions and |

| their domains and interpret statements that use function notation in terms of a mathematical framework. | | their key characteristics in context. |
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| Content Resources |
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**Textbook Correlation: enVision A|G|A - Algebra 1**

**A.FGR.2.1** - Lesson 3-4
**A.FGR.2.2** - Lessons 3-2, 3-3
**A.FGR.2.3** - Lesson 3-1
**A.FGR.2.4** - Lessons 3-2, 3-3
**A.FGR.2.5** - Lesson 5-1

**EdPuzzle**
**A.FGR.2.1** - Intro to Arithmetic Sequences
**A.FGR.2.2** - Characteristics of Linear Equations
**A.FGR.2.3** - Domain and Range
**A.FGR.2.4** - Functions; Function Notation; Evaluating Functions

**YouTube**
**Approaches To Learning Skills** - TEDEd
**A.FGR.2.1** - Erin's Essential Equations: Arithmetic Sequences
**A.FGR.2.2** - Erin's Essential EquationsPlaylist: Linear Functions
**A.FGR.2.3 -** Erin's Essential Equations: Domain & Range

**Khan Academy**

**Additional Tasks (not required but highly suggested as time permits)**
**A.FGR.2.2; A.FGR.5** Getting Ready for a Pool Party (Mathematics Vision Project - HONORS)