



**Marietta City Schools**  
**2025–2026 District Unit Planner**

*Algebra: Concepts & Connections*

<b>Unit title</b>	Unit 3: Modeling and Analyzing Exponential Expressions, Equations, and Functions (DOE Units 5 & 6)	<b>MYP year</b>	4	<b>Unit duration (hrs)</b>	12 hours
-------------------	--	-----------------	---	----------------------------	----------

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

**GA DoE Standards**

**Standards**

**DOE Unit 5:**

**A.PAR.8:** Create and analyze exponential expressions and equations to represent and model real-life phenomena; solve exponential equations in mathematically applicable situations.

**A.PAR.8.1** Interpret exponential expressions and parts of an exponential expression that represent a quantity in terms of its framework.

**Fundamentals**

- Students should be able to interpret parts of an expression, such as terms, factors, leading coefficient, coefficients, constant and degree in context.
- Given mathematically applicable situations which utilize formulas or expressions with multiple terms and/or factors, students should be able to interpret the meaning in context of individual terms or factors

**A.PAR.8.2** Create exponential equations in one variable and use them to solve problems, including mathematically applicable situations.

**Relevance and Application**

- Exponential equations are limited to those containing like bases, or exponential equations that could easily be transferred to like bases with linear operations.

**A.PAR.8.3** Create exponential equations in two variables to represent relationships between quantities, including in mathematically applicable situations; graph equations on coordinate axes with labels and scales.

**Example**

- Exponential growth and decay situations are an expectation for this learning objective.

**A.PAR.8.4** Represent constraints by exponential equations and interpret data points as possible or not possible in a modeling environment.

**Terminology**

- Possible data points are solutions to the equation(s); data points that are not possible are non-solutions to the equation(s).

**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.

**DOE Unit 6:**

**A.FGR.9:** Construct and analyze the graph of an exponential function to explain a mathematically applicable situation for which the graph serves as a model; compare exponential with linear and quadratic functions.

**A.FGR.9.1** Use function notation to build and evaluate exponential functions for inputs in their domains and interpret statements that use function notation in terms of a context.

**Fundamentals**

- Students should apply their understanding of function notation from their work with linear and quadratic functions to build, evaluate, and interpret exponential functions using function notation.
- Students should be able to interpret the domain given a function expressed numerically, algebraically, and graphically.

**A.FGR.9.2** Graph and analyze the key characteristics of simple exponential functions based on mathematically applicable situations.

**Examples**

- If the function,  $h(n)$ , gives the number of person-hours it takes to assemble  $n$  engines in a factory, then the positive integers would be an appropriate domain for the function.
- The function can be presented symbolically, as a graph, or as a table.
- Students should be able to estimate the rate of change from a graph.
- Students should be able to sketch a graph of an exponential function showing key features including domain, range, intercepts, average rate of change, intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; asymptotes; end behavior.
- Students should be given opportunities to show that linear functions grow by a constant rate and that exponential functions grow by equal factors over equal intervals. This can be shown by algebraic proof, with a table showing differences, or by calculating average rates of change over equal intervals.
- Students should be able to precisely use verbal descriptions, tables, and graphs created by hand and using technology.
- Students should be able to create graphs by hand and using graphing technology (i.e., graphing calculator or online interactive graphing technology)
- Students should be able to accurately express characteristics in interval notation and set-builder notation using inequalities.

**A.FGR.9.3** Identify the effect on the graph generated by an exponential function when replacing  $f(x)$  with  $f(x) + k$ , and  $k f(x)$ , for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs.

**Strategies and Methods**

- Students should be given opportunities to experiment with cases and illustrate an explanation of the effects on the graph using interactive technology.

**A.FGR.9.4** Use mathematically applicable situations algebraically and graphically to build and interpret geometric sequences as functions whose domain is a subset of the integers

**Fundamentals**

- Sequences can be defined recursively and explicitly.
- Connections should be made between exponential functions and geometric sequences.
- The focus of this learning objective is on building and interpreting geometric sequences.

- Students should be able to convert geometric sequences from explicit form to recursive and vice versa.
- Students should have ample opportunities to compare geometric sequences with arithmetic sequences presented in a variety of ways.

**Example**

- By graphing or calculating terms, students should be able to show how the geometric sequence in recursive form  $a_1=8$ ,  $a_n=2a_{n-1}$ ; the geometric sequence in explicit form  $s_n = 8(2)^{n-1}$ ; and the function  $f(x) = 4(2)^x$  (when  $x$  is a natural number) all define the same sequence.

**A.FGR.9.5** Compare characteristics of two functions each represented in a different way.

**Fundamentals**

- Students should be able to present functions algebraically, graphically, and numerically in tables, or by verbal descriptions.
- Students should be able to compare an exponential function to a linear function, a quadratic function, or to another exponential function.
- Students should be able to compare key characteristics of exponential functions with the key characteristics of linear and quadratic functions.
- Students should be able to observe using graphs and tables that a quantity increasing quadratically will eventually exceed a portion of a quantity increasing linearly.
- Students should be able to observe using graphs and tables that a quantity increasing exponentially will eventually exceed a portion of a quantity increasing linearly or quadratically.

**Example**

- Given a graph of one function and an algebraic expression for another, determine which has the larger y-intercept.

**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.1.4** 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.

**Concepts/Skills to support mastery of standards**

Students should be able to continue to draw on previous knowledge of expressions to help determine all parts of exponential equations.

Students should use applicable in - context situations to model growth and decay.

Computation with whole numbers and decimals, including application of order of operations

Graphing on a coordinate plane

Calculating with exponents

Applying rules of negative exponents

**Vocabulary**

DOE Unit 5

Asymptotic Behavior	Average Rate of Change	Coefficient	Constraint	Continuous	Decay
Decreasing	Domain	End Behavior	Exponential Expression	Exponential Model	Exponential Relationship
Geometric Sequence	Growth	Increasing	Interval Notation	Parameter	Range
Term	x-intercept	y-intercept			

DOE Unit 6

Arithmetic Sequence	Asymptote	Asymptotic Behavior	Base	Characteristics of a Graph	Compound Interest
Compression	Domain	End Behavior	Exponent	Exponential	Exponential Decay
Exponential Growth	Function Notation	Graph	Half-life	Horizontal Translation	Intercept
Interval of Increase	Interval of decrease	Infinity	Negative Infinity	Parent Function	Positive Infinity
Range	Recursive Relationship	Simple Interest	Stretch	Strictly Decreasing	Strictly Increasing
Transformations	Vertical Translation	Zero			

**Notation**

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

Key concept	Related concept(s)	Global context
Logic A method of reasoning and a system of principles used to build arguments and reach conclusions.	Generalization, Pattern, Representation	Globalization and Sustainability: Consumption, conservation, natural resources and public goods

**Statement of inquiry**

The application of logical reasoning principles, including validity and quantity, within mathematical models can enhance our understanding of the relationship between globalization and sustainability, particularly in the context of consumption, conservation of natural resources, and the provision of public goods.

**Inquiry questions**

**DOE Unit 5:**

**Factual—**

- What is the formula for growth and decay exponential equations?
- How do I graph an exponential function?
- What does half-life mean?
- What does a growth and a decay function look like on a graph?

**Conceptual—**

- How can you interpret an exponential function?
- What is the difference between a growth and a decay within an exponential function?

**Debatable-**

- Is it easier to interpret a graph of an exponential function or the equation?

**DOE Unit 6:**

**Factual—**

- What do “a” and “b” represent within an exponential parent function?
- What causes an exponential graph to translate left or right?
- What causes an exponential graph to translate up or down?
- What does an exponential graph look like?

**Conceptual—**

- Explain what causes growth or decay.
- How can I use an equation to tell how the graph will look?

**Debatable-**

- Which one is faster growing a linear, quadratic or exponential function?

MYP Objectives	Assessment Tasks	
<i>What specific MYP <b>objectives</b> 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>

MYP A - Unit Assessment MYP C - A Penny a Day MYP B - Sequences	Summative assessment will have questions that ask students to use multiplying cells learning activity to make predictions about sustainability.  Summative assessment will compare exponential growth functions and their transformation in relation to scientific and technical innovation.	<b>Formative Assessment(s):</b> Common Formative  <b>Summative Assessment(s):</b> MYP A  Cumulative Assessment
---	--	--

**Approaches to learning (ATL)**

<b>Category:</b> Thinking Skills <b>Cluster:</b> Critical-thinking <b>Skill Indicator:</b> Practice visible thinking strategies and techniques <b>Learning Experience:</b> Paper Folding Task	<b>Category:</b> Self-Management Skills <b>Cluster:</b> Organization <b>Skill Indicator:</b> Use appropriate strategies for organizing complex information
--	--

**Learning Experiences**

Objective or Content	Learning Experiences	Personalized Learning and Differentiation
<p><b>A.PAR.8.1</b> - Interpret exponential expressions and parts of an exponential expression that represent a quantity in terms of its framework</p> <p><b>A.PAR.8.2</b> - Create exponential equations in one variable and use them to solve problems, including mathematically applicable situations.</p> <p><b>A.PAR.8.3</b> - Create exponential equations in two variables to represent relationships between quantities, including in mathematically applicable situations; graph equations on coordinate axes with labels and scales.</p> <p><b>A.PAR.8.4</b> - Represent constraints by exponential equations and interpret data points as possible or not possible in a modeling environment.</p>	<p><b>Paper Folding Task (Explore (Desmos), Apply, and Reflect) (Honors same)</b></p> <p><b>Description:</b> In this learning plan, students will use paper folding to model exponential functions. Students will collect data and determine algebraic models that represent their functions.</p> <p><b>Learning Goals:</b></p> <ul style="list-style-type: none"> <li>● I can write an equation to represent an exponential relationship.</li> <li>● I can model a data set using an equation.</li> <li>● I can choose the best form of an equation to model exponential functions</li> </ul>	<p>Supporting the Learning: Make explicit connections between current and prior lessons by reminding students that they've already learned 2 types of functions (linear and Quadratic). This task will introduce students to using exponential functions to model real-world situations.</p> <p>Extending the Learning: Once students have completed the task, allow time to discuss the findings. Focus on questioning that verifies and deepens students' understanding such as: ○ How does the initial value change the function? ○ How do we use exponential functions to represent real-life situations? ○ What is happening to the function as it approaches the x-intercept? ○ How can we tell if we have exponential growth or decay based on the equation?</p>

**Content Resources**

**Textbook Correlation: enVision A|G|A - Algebra 1**

**A.PAR.8.1** - Lesson 6-2, 6-3

**A.PAR.8.2** - Lessons 6-1

**A.PAR.8.3** - Lesson 6-3, Topic 6 - Mathematical Modeling in 3 Acts

**A.PAR.8.4** - Lessons 6-3

**A.FGR.9.1** - Lesson 6-2, 6-3, Topic 6 - Mathematical Modeling in 3 Acts

**A.FGR.9.2** - Lessons 6-3, 8-5

**A.FGR.9.3** - Lesson 6-5, 10-4

**A.FGR.9.4** - Lessons 6-4

**A.FGR.9.5** - Lessons 8-5