Marietta City Schools

2023–2024 District Unit Planner

Enhanced Algebra: Concepts & Connections (Grade 8)

Unit title	*Unit 4: Modeling and Analyzing Quadratic 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

A.PAR.6 : Build quadratic expressions and equations to represent and model real-life phenomena; solve quadratic equations in mathematically applicable situations

A.PAR.6.1: Interpret quadratic expressions and parts of a quadratic expression that represent a quantity in terms of its context.

A.PAR.6.2: Fluently choose and produce an equivalent form of a quadratic expression to reveal and explain properties of the quantity represented by the expression.

A.PAR.6.3: Create and solve quadratic equations in one variable and explain the solution in the framework of applicable phenomena.

A.PAR.6.4: Represent constraints by quadratic equations and interpret data points as possible or not possible in a modeling framework.

A.FGR.7 : Construct and interpret quadratic functions from data points to model and explain real life phenomena; describe key characteristics of the graph of a quadratic function to explain a mathematically applicable situation for which the graph serves as a model.

A.FGR.7.1: Use function notation to build and evaluate quadratic functions for inputs in their domains and interpret statements that use function notation in terms of a given framework.

A.FGR.7.2: Identify the effect on the graph generated by a quadratic function when replacing f(x) with f(x) + k, kf(x), f(kx), and f (x + k) for specific values of k (both positive and negative); find the value of k given the graphs.

A.FGR.7.3: Graph and analyze the key characteristics of quadratic functions.

A.FGR.7.4: Relate the domain and range of a quadratic function to its graph and, where applicable, to the quantitative relationship it describes.

A.FGR.7.5: Rewrite a quadratic function representing a mathematically applicable situation to reveal the maximum or minimum value of the function it defines. Explain what the value describes in context.

A.FGR.7.6: Create quadratic functions in two variables to represent relationships between quantities; graph quadratic functions on the coordinate axes with labels and scales.

A.FGR.7.7: Estimate, calculate, and interpret the average rate of change of a quadratic function and make comparisons to the average rate of change of linear functions.

8.FGR.7.8: Write a function defined by a quadratic expression in different but equivalent forms to reveal and explain different properties of the function.

A.FGR.7.9: Compare characteristics of two functions each represented in a different way.

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.

A.MP.1-8 : 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

A.PAR.6.1: Interpret quadratic expressions and parts of a quadratic expression that represent a quantity in terms of its context.
A.PAR.6.2: Fluently choose and produce an equivalent form of a quadratic expression to reveal and explain properties of the quantity represented by the expression.
A.PAR.6.3: Create and solve quadratic equations in one variable and explain the solution in the framework of applicable phenomena.
A.PAR.6.4: Represent constraints by quadratic equations and interpret data points as possible or not possible in a modeling framework.
A.FGR.7.1: Use function notation to build and evaluate quadratic functions for inputs in their domains and interpret statements that use function notation in terms of a given framework.
A.FGR.7.2: Identify the effect on the graph generated by a quadratic function when replacing f(x) with f(x) + k, kf(x), f(kx), and f (x + k) for specific values of k (both positive and negative); find the value of k given the graphs.
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A.FGR.7.6: Create quadratic functions in two variables to represent relationships between quantities; graph quadratic functions on the coordinate axes with labels and scales.
A.FGR.7.7: Estimate, calculate, and interpret the average rate of change of a quadratic function and make comparisons to the average rate of change of linear functions.
8.FGR.7.8: Write a function defined by a quadratic expression in different but equivalent forms to reveal and explain different properties of the function.
A.FGR.7.9: Compare characteristics of two functions each represented in a different way.
MSC.Gifted.S3B- Students will develop and utilize critical thinking, higher order thinking, logical thinking, and problem-solving skills in various situations.
MSC.Gifted.S4B-Recognize and examine the value of other strengths, thoughts, ideas, and feeling during collaboration.

Vocabulary

[K-12 Mathematics Glossary]

Vertex	**Maximum**	**Minimum**	**Axis of Symmetry**	**Y-intercept**	**X-intercepts**	**Roots/Zeros**
Parabola	**2 Real Solutions**	**1 Real Solution**	**No Real Solutions**	**Origin**	**Quadratic**	**Average Rate of Change**
Domain	**Range**	**Positive**	**Negative**	**Standard Form**	**Vertex Form**	**Discriminant**
Completing the Square	**Concavity**	**Decreasing**	**Increasing**	**Degree**	**Difference of Two Squares**	**Function**
Horizontal Shift	**Vertical Shift**	**Leading Coefficient**	**Perfect Square Trinomial**	**Quadratic Expression**	**Quadratic Equation**	**Quadratic Function**

Notation

Key concept	Related concept(s)	Global context
Relationships	Representation, Systems and Models	Scientific and Technical Innovation

Statement of inquiry

Investigating the relationship between quadratic functions and their models through representation and systems using scientific and technical innovations can lead to deeper understanding of their behavior and applications.

Inquiry questions

Factual—

- How do I graph a quadratic equation using technology?
- How do I use the Quadratic Formula to solve a quadratic?
- Where do I locate the x-intercepts on a graph?
- What are the steps in Completing the Square?

Conceptual—

- What it meant by the transformation of a quadratic equation?
- How can you determine that the Quadratic Formula will be the best method to solve a quadratic equation?

Debatable-

- What is the best method to use when solving a Quadratic Equation?

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.*
Objective A: Knowing and Understanding Objective B: Investigating Patterns Objective C: Communicating Objective D: Applying Mathematics in Real-Life Contexts	The summative assessment will require that students apply technology to demonstrate mastery of modeling and solving quadratic equations.	**Formative Assessment(s):** **Unit 4** CFA **Summative Assessment(s):** **Unit 4** Summative Assessment **Unit 4 :** Summative Retest **MYP Project:** MYP C - DOE Seeing Structure in Expressions Diagnostic
Approaches to learning (ATL)		
Category: Thinking Skills **Cluster:** Critical Thinking **Skill Indicator:** Practice and Observation		

Learning Experiences Add additional rows below as needed.		
Objective or Content	**Learning Experiences**	**Personalized Learning and Differentiation**
A.PAR.6 : Build quadratic expressions and equations to represent and model real-life phenomena; solve quadratic equations in mathematically applicable situations. **A.PAR.6.1:** Interpret quadratic expressions and parts of a quadratic expression that represent a quantity in terms of its context. **A.PAR.6.3** Create and solve quadratic equations in one variable and explain the solution in the framework of applicable phenomena.	**DOE Seeing Structure in Expressions** **Description:** In this learning plan, students will interpret quadratic expressions and their components within relevant contexts, enhancing their ability to connect mathematical representations with real-life phenomena. Students will also create and solve quadratic equations, applying their problem solving skills to find meaningful solutions. The plan is designed to foster both conceptual understanding and procedural fluency. Students will investigate the structure and key features of quadratic functions, such as zeros, minimum values, and the relationship between coefficients and graph characteristics. **Learning Goals:** ● I can use the structure of an expression to rewrite it in different equivalent forms. ● I can find zeros of a quadratic function based on real world context ● I can use structure of a quadratic expression to interpret real world phenomena	**Extension:** Students will create their own equivalent quadratic functions written in two different forms. Using the quadratic functions created, students will come up with a story problem.
A.FGR.7.1: Use function notation to build and evaluate quadratic functions for inputs in their domains and interpret statements that use function notation in terms of a given framework. **A.FGR.7.3:** Graph and analyze the key characteristics of quadratic functions. **A.FGR.7.4:** Relate the domain and range of a quadratic function to its graph and, where applicable, to the quantitative relationship it describes.	**Graphing Transformations** Description: In this learning plan, students will explore the transformations of the graph of $f(x)=x^2$. Students will use graphing technology to graph various parabolas and examine the changes from the parent function. Students will form conjectures about how kf(x), f(kx), f(x)+k, -f(x), and f(x+k) affect the graph of a quadratic function. They will then apply this new thinking to graph parabolas by hand and to describe a contextual situation. **Learning Goals:** ● I can graph parabolas by hand and with graphing technology. ● I can investigate, identify, and explain transformations of quadratic functions.	**Extension:** Students will create their own quadratic functions and graph parabolas with vertical and horizontal shifts by hand.

Content Resources
SaVVas Envision Algebra 1 Textbook and Online Platform **A.PAR.6.1** - Lesson 7-4, 7-5, 7-6, 7-7 **A.PAR.6.2** - Lesson 7-4, 7-5, 7-6, 7-7, 9-5 **A.FGR.7.1** - Lesson 8-1, 8-2, 8-3, 8-4 **A.FGR.7.2** - Lesson 8-1, 8-2, 8-3, 10-4, 10-5 **A.FGR.7.3** - Lesson 8-1, 8-2, 8-3, Topic 8 - Math Modeling in 3 Acts **A.FGR.7.4** - Lesson 8-1, 8-4 **A.FGR.7.5** - Lesson 8-3 **A.FGR.7.6** - Lesson 8-4 **A.FGR.7.7** - Lesson 8-5 **A.FGR.7.8** - Lesson 8-3, 8-4 **A.FGR.7.9** - Lesson 8-3, 8-5 **GADOE Learning Plans for Unit 4**