MATH MCS MYP UNIT PLANNER

Teacher(s)	**J. Smith**	**Subject group and discipline**	**Algebra 1**		
Unit title	**DOE Unit 3 – Modeling and Analyzing Quadratic Functions**	**MYP year**	**4**	**Unit duration (hrs)**	**34.5 hours**

Inquiry: Establishing the purpose of the unit

Key concept	**Related concept(s)**	**Global context**
Logic	Generalization Model Representation	Scientific and Technological Innovations Exploration: Systems, Models, Methods

Statement of inquiry

Modeling using a logical process helps us to understand the world.

Inquiry questions

Factual—

How is a relation determined to be quadratic?
How is a relation determined to be quadratic?
How do I choose the most efficient method of solving quadratic equations?
How do the factors of a quadratic function yield the zeros for that function?
Where is the maximum or minimum value of a quadratic equation located?
How is the quadratic formula developed by completing the square?
How can the quadratic formula be used to find the zeros of a quadratic function?
What information can be gleaned from the table of values and the graph of a relation?
Under what circumstances can one take the square root of both sides of the equation?
What does the domain of a function tell about the quantitative relationship of the given data?
How is the rate of change for a quadratic function different from the rate of change for a linear function?
How can the graph of $f(x) = x^2$ move left, right, up, down, stretch, or compress?

Conceptual—

What are the relative advantages and disadvantages of solving a quadratic function by factoring, completing the square, quadratic formula, or taking the square root of both sides?

How do I justify the quadratic formula?
How do I interpret quadratic functions in context?
Debatable—

What is the best method for factoring a polynomial?

What is the best method to solve a quadratic function?

MYP Objectives	**Assessments**
Objective A – Knowledge and Understanding Objective B – Finding Patterns in Mathematics Objective C - Communication	Formative: Solving Quadratics Quiz MYP B – transformations Graphing & Characteristics Quiz Summative: MYP A Factoring Test Solving Quadratics Test Unit 4 Cumulative Test Students will use logical reasoning, methods and models to demonstrate their knowledge of quadratics.

Approaches to learning (ATL)

- Give and receive meaningful feedback
- Negotiate ideas and knowledge with peers and teachers
- Use and interpret a range of discipline-specific terms and symbols
- Draw reasonable conclusions and generalizations
- Apply existing knowledge to generate new ideas, products or processes
- Apply skills and knowledge in unfamiliar situations

Action: Teaching and learning through inquiry

Content Standards

Interpret structure of expressions

MGSE9-12.A.SSE.2 Use the structure of an expression to rewrite it in different equivalent forms. For example, see $x^4 – y^4$ as $(x^2)^2 – (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$.Write expressions in equivalent forms to solve problems

MGSE9–12.A.SSE.3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

MGSE9–12.A.SSE.3a Factor any quadratic expression to reveal the zeros of the function defined by the expression.

MGSE9–12.A.SSE.3b Complete the square in a quadratic expression to reveal the maximum and minimum value of the function defined by the expression.

Create equations that describe numbers or relationships

MGSE9–12.A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear, quadratic, simple rational, and exponential functions (integer inputs only).

MGSE9-12.A.CED.2 Create linear, quadratic, and exponential equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (The phrase "in two or more variables" refers to formulas like the compound interest formula, in which $A = P(1 + r/n)^{nt}$ has multiple variables.)

MGSE9–12.A.CED.4 Rearrange formulas to highlight a quantity of interest using the same reasoning as in solving equations. Examples: Rearrange Ohm's law V = IR to highlight resistance R; Rearrange area of a circle formula $A = \pi r^2$ to highlight the radius r.

Solve equations and inequalities in one variable

MGSE9-12.A.REI.4 Solve quadratic equations in one variable.

MGSE9–12.A.REI.4a Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from $ax^2 + bx + c = 0$.

MGSE9–12.A.REI.4b Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, factoring, completing the square, and the quadratic formula, as appropriate to the initial form of the equation (limit to real number solutions).

Build a function that models a relationship between two quantities.

MGSE9–12.F.BF.1 Write a function that describes a relationship between two quantities.

Build new functions from existing functions.

MGSE9–12.F.BF.3 Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k(both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

Understand the concept of a function and use function notation.

MGSE9–12.F.IF.1 Understand that a function from one set (the input, called the domain) to another set (the output, called the range) assigns to each element of the domain exactly one element of the range, i.e. each input value maps to exactly one output value. If f is a function, x is the input (an element of the domain), and f(x) is the output (an element of the range). Graphically, the graph is y = f(x).

MGSE9–12.F.IF.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

Interpret functions that arise in applications in terms of the context.

MGSE9–12.F.IF.4 Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.

MGSE9–12.F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, 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.

MGSE9–12.F.IF.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. Analyze functions using different representations.
MGSE9–12.F.IF.7 Graph functions expressed algebraically and show key features of the graph both by hand and by using technology.
MGSE9–12.F.IF.7a Graph linear and quadratic functions and show intercepts, maxima, and minima (as determined by the function or by context).
MGSE9–12.F.IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
MGSE9–12.F.IF.8a Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. For example, compare and contrast quadratic functions in standard, vertex, and intercept forms.
MGSE9–12.F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one function and an algebraic expression for another, say which has the larger maximum.

***All Unit 5, Comparing Functions, standards will be included in this unit. Unit 5 standards not listed above are included below.**
Construct and compare linear, quadratic, and exponential models and solve problems
MGSE9-12.F.LE.1 Distinguish between situations that can be modelled with linear functions and with exponential functions.
MGSE9-12.F.LE.1a Show that linear functions grow by equal differences over equal intervals
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).
MGSE9-12.F.LE.1b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
MGSE9-12.F.LE.1c Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
MGSE9-12.F.LE.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
MGSE9-12.F.LE.3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

Interpret expressions for functions in terms of the situation they model
MGSE9-12.F.LE.5 Interpret the parameters in a linear (f(x) = mx + b) and exponential (f(x)=a•dx) function in terms of context. (In the functions above, “m” and “b” are the parameters of the linear function, and “a” and “d” are the parameters of the exponential function.) In context, students should describe what these parameters mean in terms of change and starting value.

Learning Activities and Experiences

Topic	Resources	Content Covered	Standards
	7-4 Factoring Polynomials **Pearson enVision pg. 281 - 286**	● Find the greatest common factor of the terms in a polynomial. ● Use the structure of a polynomial to rewrite it in factored form. ● Factor polynomials that represent real-world problems.	MGSE9-12.A.SSE.2 MGSE9-12.A.APR.1

	7-5 / 7-6 Factoring Trinomials **Pearson enVision pg. 287 – 293, 295 – 300**	• Factor trinomials in the form $ax^2 + bx + c$ • Identify and use patterns in the signs of the coefficients of the terms of a trinomial expression. • Identify the common factor of the coefficients in the terms of a trinomial expression when $a = 1$ • Write a quadratic trinomial as a product of two binomial factors.	MGSE9-12.A.SSE.1 MGSE9-12.A.SSE.1a MGSE9-12.A.SSE.1b MGSE9-12.A.SSE.2
	3-Act Task Who's Right? **Pearson enVision pg. 294**		MGSE9-12.A.APR.1
	7-7 Factoring Special Cases **Pearson enVision pg. 301 - 306**	• Identify and factor a trinomial that is a perfect square or a binomial that is a difference of two squares. • Factor special cases of polynomials within the context of real-world problems.	MGSE9-12.A.SSE.1 MGSE9-12.A.SSE.1b MGSE9-12.A.SSE.2
	Additional Resources:		
Solving Quadratic Equations	**9-1 Solving Quadratic Equations using Graphs and Tables Pearson enVision pg. 357 - 362**	• Use a graph to identify the x-intercepts as solutions of a quadratic equation • Use a graphing calculator to make a table of values to approximate or solve a quadratic equation.	MGSE9-12.A.CED.1 MGSE9-12.A.CED.2 MGSE9-12.A.REI.4b MGSE9-12.A.REI.11
	9-2 Solving Quadratic Equations by Factoring **Pearson enVision pg. 363 – 369**	• Use the Zero-Product Property and factoring to find the solutions of a quadratic equation. • Apply factoring to solve real-world problems. • Use the zeros of a quadratic to sketch the graph. • Write the factored form of a quadratic function from a graph.	MGSE9-12.A.SSE.3a MGSE9-12.A.APR.3 MGSE9-12.A.REI.4b MGSE9-12.F.IF.8
	9-4 Solving Quadratic Equations Using Square Roots **Pearson enVision pg. 376 - 381**	• Solve quadratic equations by finding square roots. • Determine reasonable solutions for real-world problems.	MGSE9-12.A.CED.1 MGSE9-12.A.SSE.2 MGSE9-12.A.REI.4b
	9-5 Completing the Square **Pearson enVision pg. 382 - 388**	• Solve a quadratic trinomial by completing the square to transform a quadratic equation into a perfect square trinomial. • Use completing the square to write a quadratic equation in vertex form.	MGSE9-12.A.REI.4b MGSE9-12.A.SSE.3 MGSE9-12.F.IF.8

	9-6 The Quadratic Formula and the Discriminant **Pearson enVision pg. 389 - 395**	• Derive the quadratic formula by completing the square. • Solve quadratic equations in one variable by using the quadratic formula. • Use the discriminant to determine the number and type of solutions to a quadratic equation.	MGSE9-12.N.Q.3 MGSE9-12.A.SSE.3 MGSE9-12.A.CED.1 MGSE9-12.A.REI.4a MGSE9-12.A.REI.4b
	3-Act Task Unwrapping Change **Pearson enVision pg. 396**		MGSE9-12.A.CED.1 MGSE9-12.A.CED.3 MGSE9-12.A.REI.4
	Additional Resources: • DOE Framework Tasks - Completing the Square and Deriving the Quadratic formula; Just the Right Border; Quadratic Fanatic; Acme Fireworks • Desmos Activity Will it Hit the Hoop? (Desmos)		
Graphing Quadratic Functions	**8-1 Key Features of a Quadratic Function** **Pearson enVision pg. 315 – 321**	• Identify key features of the graph of a quadratic function using graphs, tables, and equations. • Explain the effect of the value of *a* on the quadratic parent function.	MGSE9-12.A.CED.2 MGSE9-12.F.IF.6 MGSE9-12.F.BF.3
	8-2 Quadratic Functions in Vertex Form **Pearson enVision pg. 322 - 328**	• Identify key features of the graph of quadratic functions written in vertex form. • Graph quadratic functions in vertex form.	MGSE9-12.F.IF.7 MGSE9-12.F.BF.3
	8-3 Quadratic Functions in Standard Form **Pearson enVision pg. 329 – 335**	• Graph quadratic functions in standard form and show intercepts, maxima, and minima. • Determine how the values of *a*, *b*, and *c* affect the graph of $f(x) = ax^2 + bx + c$. • Identify key features of parabolas. • Compare properties of quadratic functions presented in different forms (algebraically, in a table, graphically)	MGSE9-12.F.BF.4 MGSE9-12.F.IF.7 MGSE9-12.F.IF.8 MGSE9-12.F.IF.9
	8-4 Modeling with Quadratic Functions **Pearson enVision pg. 336 – 342**	• Use quadratic functions fitted to data to model real-world situations. • Use the vertical motion model to write an equation. • Compare a model to a data set by analysing and evaluating residuals.	MGSE9-12.F.IF.2 MGSE9-12.F.BF.1 MGSE9-12.S.ID.6a MGSE9-12.S.ID.6b
	3-Act Task The Long Shot **Pearson enVision pg. 343**		MGSE9-12.F.BF.4 MGSE9-12.A.REI.10
	Additional Resources: • Desmos Activities Polygraph: Parabolas (Desmos) Match My Parabola (Desmos)		

	Card Sort: Parabolas (Desmos) Marbleslides: Parabolas (Desmos) Two Truths and a Lie: Parabolas (Desmos)

Personalized Learning and Differentiation

Teachers differentiate by providing examples (work samples or task-specific clarifications of assessment criteria); structuring support (advance organizers, flexible grouping, peer relationships); establishing flexible deadlines, and adjusting the pace.

-SWD/504- Accommodations provided
-ELL- Five Principle ELL Curriculum Framework and Vocabulary Supports
-Intervention Support- Reteaching Activities in Small Groups with Progress Monitoring
-Extensions- Enrichment Tasks and Projects

Resources

DOE Framework Tasks

Savvas Textbook Resources