Curriculum Development Course at a Glance
Planning for High School Mathematics

Content Area	Mathematics	**Grade Level**	High School
Course Name/Course Code	Algebra 2		

Standard	**Grade Level Expectations (GLE)**	**GLE Code**
1. Number Sense, Properties, and Operations	1. The complex number system includes real numbers and imaginary numbers	MA10-GR.HS-S.1-GLE.1
	2. Quantitative reasoning is used to make sense of quantities and their relationships in problem situations	MA10-GR.HS-S.1-GLE.2
2. Patterns, Functions, and Algebraic Structures	1. Functions model situations where one quantity determines another and can be represented algebraically, graphically, and using tables	MA10-GR.HS-S.2-GLE.1
	2. Quantitative relationships in the real world can be modeled and solved using functions	MA10-GR.HS-S.2-GLE.2
	3. Expressions can be represented in multiple, equivalent forms	MA10-GR.HS-S.2-GLE.3
	4. Solutions to equations, inequalities and systems of equations are found using a variety of tools	MA10-GR.HS-S.2-GLE.4
3. Data Analysis, Statistics, and Probability	1. Visual displays and summary statistics condense the information in data sets into usable knowledge	MA10-GR.HS-S.3-GLE.1
	2. Statistical methods take variability into account supporting informed decisions making through quantitative studies designed to answer specific questions	MA10-GR.HS-S.3-GLE.2
	3. Probability models outcomes for situations in which there is inherent randomness	MA10-GR.HS-S.3-GLE.3
4. Shape, Dimension, and Geometric Relationships	1. Objects in the plane can be transformed, and those transformations can be described and analyzed mathematically	MA10-GR.HS-S.4-GLE.1
	2. Concepts of similarity are foundational to geometry and its applications	MA10-GR.HS-S.4-GLE.2
	3. Objects in the plane can be described and analyzed algebraically	MA10-GR.HS-S.4-GLE.3
	4. Attributes of two- and three-dimensional objects are measurable and can be quantified	MA10-GR.HS-S.4-GLE.4
	5. Objects in the real world can be modeled using geometric concepts	MA10-GR.HS-S.4-GLE.5

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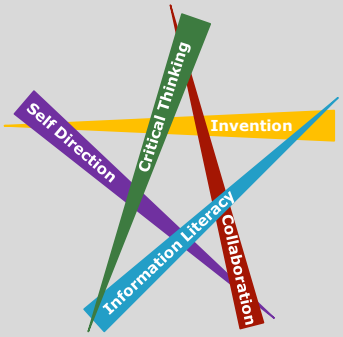
Colorado 21st Century Skills



Critical Thinking and Reasoning: *Thinking Deeply, Thinking Differently*

Information Literacy: *Untangling the Web*

Collaboration: *Working Together, Learning Together*

Self-Direction: *Own Your Learning*

Invention: *Creating Solutions*

Mathematical Practices:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Unit Titles	Length of Unit/Contact Hours	Unit Number/Sequence
Functional Form and Design	4 Weeks	1
Logarithmic Log Jams	4 Weeks	2
Poly Want a Nomial?	4 Weeks	3
Radically Rational	3 Weeks	4
Trickster Trigonmetry	4 Weeks	5
Independently Lucky	3 Weeks	6
Survey Says…	3 Weeks	7

Unit Title	Functional Form and Design		**Length of Unit**	4 weeks
Focusing Lens(es)	Structure	**Standards and Grade Level Expectations Addressed in this Unit**	MA10-GR.HS-S.1-GLE.2 MA10-GR.HS-S.2-GLE.1 MA10-GR.HS-S.2-GLE.2 MA10-GR.HS-S.2-GLE.4	
Inquiry Questions (Engaging-Debatable):	• Why are functions necessary to the design and building of skyscrapers? (MA10-GR.HS-S.2-GLE.1-IQ.7)			
Unit Strands	Number and Quantity: Quantities Algebra: Reasoning with Equations and Inequalities Functions: Interpreting Functions Functions: Building Functions Functions Linear, Quadratic, and Exponential Models Personal Financial Literacy			
Concepts	systems of functions, non-linear, linear, classes of functions, operations, constants, average rate of change, increase, decrease, interval			

Generalizations **My students will Understand that…**	**Guiding Questions** **Factual**	**Conceptual**
Systems of non-linear functions create solutions more complex than those of systems of linear functions. (MA10-GR.HS-S.2-GLE.4-EO.d, e)	What do the solutions of a system of nonlinear functions represent in a context? How many solutions could exist for a system involving a circle and linear function? How do you know if a given point is a solution of a given system?	Why are solving systems of nonlinear functions different than systems of linear functions? Why are systems of equations used to model a situation?
New classes of functions emerge by performing operations on a function with constants and/or another function. (MA10-GR.HS-S.2-GLE.1-EO.d.i.2, e.i, ii)	What type of function is created when multiplying two linear functions? How can a table, graph, and function notation be used to explain how one function family is different or similar to another? (MA10-GR.HS-S.2-GLE.1-IQ.2)	How is the effect on a graph different when operating on a function with a constant versus another function? How can you operate on linear functions to create other classes of functions?

Mathematicians compare average rates of change over a specified interval to determine the increase or decrease of a function relative to another function. (MA10-GR.HS-S.2-GLE.1-EO.b.iii)	How do you calculate average rate of change? How does the average rate of change impact the behavior of a function over the entire span of the function?	How is the average rate of change represented in the graph and table of a function?
The modeling of nonlinear relationships between two quantities requires the use of appropriate functions. (MA10-GR.HS-S.2-GLE.1-EO.a, d) and (MA10-GR.HS-S.2-GLE.2-EO.a, b)	How can you determine from a table or context, which function models the relationship between two quantities? How can you determine the key features of a graph of a nonlinear function from its equation? How can you model a sequence with an equation? What are the differences between a linear function and an arithmetic sequence with the same parameters, algebraically and graphically? What phenomena can be modeled with particular functions? (MA10-GR.HS-S.2-GLE.2-IQ.2)	How do you use the key features of families functions to determine the appropriate function for given situation? Why are sequences functions? Why are sequences used to model situations? How can knowing whether or not a function is even or odd be useful? Why do we classify functions? (MA10-GR.HS-S.2-GLE.2-IQ.1)
Inverse functions facilitate the efficient computation of inputs of the original function. (MA10-GR.HS-S.2-GLE.1-EO.e.iii)	What is the relationship of the graph of an its inverse? When is it necessary to limit the domain of an inverse function?	How do inverses functions expand our understanding of an original function? Why are inverses important in mathematical modeling?

Key Knowledge and Skills: **My students will…**	*What students will know and be able to do are so closely linked in the concept-based discipline of mathematics. Therefore, in the mathematics samples what students should know and do are combined.*

- Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse. (MA10-GR.HS-S.2-GLE.1-EO.e.iii)
- Solve systems of linear equations limited to 3x3 systems exactly and approximately, focusing on pairs of linear equations in two variables. (MA10-GR.HS-S.2-GLE.4-EO.d.ii)
- Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. (MA10-GR.HS-S.2-GLE.4-EO.d.iii)
- Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately and include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. (MA10-GR.HS-S.2-GLE.4-EO.e.ii)
- Determine an explicit expression, a recursive process, or steps for calculation from polynomial, exponentials, logarithmic and trigonometric contexts. (MA10-GR.HS-S.2-GLE.1-EO.d.i.1)
- Combine polynomial, exponentials, logarithmic and trigonometric functions using arithmetic operations. (MA10-GR.HS-S.2-GLE.1-EO.d.i.2)
- Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. (MA10-GR.HS-S.2-GLE.1-EO.d.ii)
- Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. (MA10-GR.HS-S.2-GLE.1-EO.a.iii)
- Identify the effect on the graph for polynomial, exponentials, logarithmic and trigonometric functions 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 and experiment with cases and illustrate an explanation of the effects on the graph using technology.

(MA10-GR.HS-S.2-GLE.1-EO.e.i, ii)

- For polynomial, exponentials, logarithmic and trigonometric functions, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. (MA10-GR.HS-S.2-GLE.1-EO.b.i)
- Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval and estimate the rate of change from a graph for polynomial, exponentials, logarithmic and trigonometric functions. (MA10-GR.HS-S.2-GLE.1-EO.b.iii)
- Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions) for polynomial, exponentials, logarithmic and trigonometric functions. (MA10-GR.HS-S.2-GLE.1-EO.c.v.3)
- 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). (MA10-GR.HS-S.2-GLE.2-EO.a.ii)
- Interpret the parameters in a linear or exponential function in terms of a context. (MA10-GR.HS-S.2-GLE.2-EO.b.i)
- Define appropriate quantities for the purpose of descriptive modeling. (MA10-GR.HS-S.1-GLE.2-EO.a.ii)
- Fit a function to data; use functions fitted to data to solve the problems in the context of the data.
- Find inverse functions by solving an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse. (MA10-GR.HS-S.2-GLE.1-EO.e.iii)

Critical Language: includes the Academic and Technical vocabulary, semantics, and discourse which are particular to and necessary for accessing a given discipline. EXAMPLE: A student in Language Arts can demonstrate the ability to apply and comprehend critical language through the following statement: *"Mark Twain exposes the hypocrisy of slavery through the use of satire."*	
A student in _____ can demonstrate the ability to apply and comprehend critical language through the following statement(s):	*I know when solving a system of equations involving a circle and a linear function there may be one, two or no solutions.*
Academic Vocabulary:	solve, combine, recognize, compare, calculate, construct, define, interpret, increase, decrease, intersection, solution, positive, negative, input, output
Technical Vocabulary:	system of equations, system of functions, linear, non-linear, quadratic, classes of functions, constants, average rate of change, interval, explicit, recursive, function, arithmetic sequence, even function, odd function, Fibonacci sequence, relative maximum, relative minimum, symmetry, end behavior, periodicity, descriptive modeling, parameters

Unit Title	Logarithmic Log Jams		**Length of Unit**	4 Weeks
Focusing Lens(es)	Finance Growth	**Standards and Grade Level Expectations Addressed in this Unit**	MA10-GR.HS-S.2-GLE.1 MA10-GR.HS-S.2-GLE.2 MA10-GR.HS-S.2-GLE.3 MA10-GR.HS-S.2-GLE.4	
Inquiry Questions (Engaging-Debatable):	• What is the best way of paying of debt on multiple credit cards? • What financial phenomena can be modeled with exponential and linear functions? (MA10-GR.HS-S.2-GLE.2-IQ.3)			
Unit Strands	Algebra: Creating Equations Algebra: Seeing Structure in Expressions Functions: Interpreting Functions Functions: Building Functions Functions: Linear, Quadratic, and Exponential Models			
Concepts	logarithms, inverse, exponential functions, growth, properties of exponents, properties of operations, expressions			

Generalizations **My students will Understand that…**	**Guiding Questions** **Factual**	**Conceptual**
Logarithms, the inverse of exponential functions, provide a mechanism for transforming and solving exponential functions. (MA10-GR.HS-S.2-GLE.1-EO.e) and (MA10-GR.HS-S.2-GLE.2-EO.a.iv)	What is the relationship of the graph of an exponential function and its inverse? How can you use the properties of exponents to represent an exponential function as a logarithm?	How are logarithms used to solve exponential functions? Why are logarithms inverses of exponential functions? (MA10-GR.HS-S.2-GLE.1-IQ.3)
Mathematicians derive exponential functions to model exponential growth. (MA10-GR.HS-S.2-GLE.3-EO.b)	What situation would be modeled by a exponential inequality? How are patterns and functions similar and different? (MA10-GR.HS-S.2-GLE.1-IQ.5)	Why is a geometric series modeled with an exponential function?
Properties of exponents and operations can transform expressions for exponential functions to facilitate interpretation of the quantities represented by the expression. (MA10-GR.HS-S.2-GLE.1-EO.c.)	What is the impact on the graph of transforming an expression?	Why might it be necessary to transform an exponential expression to better interpret the context of situation?

Key Knowledge and Skills: **My students will…**	*What students will know and be able to do are so closely linked in the concept-based discipline of mathematics. Therefore, in the mathematics samples what students should know and do are combined.*

- Create equations and inequalities in one variable and use them to solve problems. (MA10-GR.HS-S.2-GLE.4-EO.a.i)
- Use the properties of exponents to transform expressions for exponential functions with both rational and real exponents. (MA10-GR.HS-S.2-GLE.3-EO.b.i.3)
- Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. (MA10-GR.HS-S.2-GLE.3-EO.b.ii)
- For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where *a*, *c*, and *d* are numbers and the base *b* is 2, 10, or *e*; evaluate the logarithm using technology. (MA10-GR.HS-S.2-GLE.2-EO.a.iv)
- Graph exponential and logarithmic functions, showing intercepts and end behavior. (MA10-GR.HS-S.2-GLE.1-EO.c.iv)
- Use the properties of exponents to interpret expressions for exponential functions. (MA10-GR.HS-S.2-GLE.2-EO.c.v.2)
- Analyze the impact of interest rates on a personal financial plans. PFL (MA10-GR.HS-S.2-GLE.2-EO.d.i) *
- Evaluate the costs and benefits of credit. PFL (MA10-GR.HS-S.2-GLE.2-EO.d.ii) *
- Analyze various lending sources, service and financial institutions. PFL (MA10-GR.HS-S.2-GLE.2-EO.d.iii) *

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EXAMPLE: A student in Language Arts can demonstrate the ability to apply and comprehend critical language through the following statement: *"Mark Twain exposes the hypocrisy of slavery through the use of satire."*

A student in _____ can demonstrate the ability to apply and comprehend critical language through the following statement(s):	*I know can use properties of exponents to transform an exponential equation to a logarithm.*
Academic Vocabulary:	graph, interpret, analyze, evaluate, solve, crate, formulas, equivalent, exponents, finite, growth, decay
Technical Vocabulary:	logarithms, exponential functions, growth, properties of exponents, properties of operations, expressions, geometric series, inverse functions, intercepts, end behavior, geometric sequence, explicit, recursive, discrete, continuous, derive, common ratio

*** Denotes a connection to Personal Financial Literacy (PFL)**

Unit Title	Poly Want a Nomial?		**Length of Unit**	4 Weeks
Focusing Lens(es)	Transformations Structure	**Standards and Grade Level Expectations Addressed in this Unit**	MA10-GR.HS-S.1-GLE.1 MA10-GR.HS-S.2-GLE.1 MA10-GR.HS-S.2-GLE.3 MA10-GR.HS-S.2-GLE.4 MA10-GR.HS-S.4-GLE.3	
Inquiry Questions (Engaging-Debatable):	• What is the square root of negative 1? What are the implications of having a solution to this problem? • How did the ancient Greeks multiply binomials and find roots of quadratic equations without algebraic notations? (MA10-GR.HS-S.2-GLE.3-IQ.2)			
Unit Strands	Number and Quantity: The Complex Number System Functions: Interpreting Functions Algebra: Arithmetic with Polynomials and Rational Expressions Algebra: Seeing Structure in Expressions Algebra: Reasoning with Equations and Inequalities Geometry: Expressing Geometric Properties with Equations			
Concepts	focus, directrix, parabola, equations, transformations, expressions, structures, solutions, complex numbers, polynomial, quadratic, discriminant, zeros			

Generalizations **My students will Understand that…**	**Guiding Questions** **Factual**	**Conceptual**
Mathematicians use the focus and directrix of a parabola to derive an equation. (MA10-GR.HS-S.4-GLE.3-EO.a.3)	How can you derive a quadratic equation from a focus and directrix?	Why does the focus and directix define a parabola?
The transformation of polynomial expressions and equations can eveal underlying structures and solutions. (MA10-GR.HS-S.2-GLE.3-EO.a, d, e)	What are the different ways to solve quadratic equations? How is factoring used to solve a polynomial with a degree greater than two? When is it appropriate to simplify expressions? (MA10-GR.HS-S.2-GLE.3-IQ.1)	How can polynomial identities be used to describe numerical relationships? Why is the remainder theorem useful?

Complex numbers provide solutions for quadratic equations where the discriminant is less than zero. (MA10-GR.HS-S.1-GLE.1-EO.c, d)	How do you perform operations on complex numbers? When does a quadratic equation have a complex solution? What is an imaginary number? Does every complex number have an imaginary component?	Why do the properties of operations for rational numbers hold for complex numbers? Why might imaginary numbers be useful outside of mathematics? Why are complex numbers important? (MA10-GR.HS-S.1-GLE.1-IQ.4) Why are there more complex numbers than real numbers? (MA10-GR.HS-S.1-GLE.1-IQ.2)

Key Knowledge and Skills: **My students will…**	*What students will know and be able to do are so closely linked in the concept-based discipline of mathematics. Therefore, in the mathematics samples what students should know and do are combined.*

- Know there is a complex number *i* such that $i^2 = -1$, and every complex number has the form $a + bi$ with a and b real. (MA10-GR.HS-S.1-GLE.1-EO.c.i)
- Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. (MA10-GR.HS-S.1-GLE.1-EO.c.ii)
- Solve quadratic equations with real coefficients that have complex solutions. (MA10-GR.HS-S.1-GLE.1-EO.d.i)
- Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. (MA10-GR.HS-S.2-GLE.1-EO.c.iv)
- State and apply the remainder theorem. (MA10-GR.HS-S.2-GLE.3-EO.d.i)
- Identify zeros of quadratic, cubic, and quartic polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial. (MA10-GR.HS-S.2-GLE.3-EO.d.ii)
- Prove polynomial identities and use them to describe numerical relationships. (MA10-GR.HS-S.2-GLE.3-EO.e.i)
- Use the structure of a polynomial, rational or exponential expression to identify ways to rewrite it. (MA10-GR.HS-S.2-GLE.3-EO.a.ii)
- Solve quadratic equations by inspection, taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation; recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b. (MA10-GR.HS-S.2-GLE.4-EO.c.ii.2, 3)
- Derive the equation of a parabola given a focus and directrix. (MA10-GR.HS-S.4-GLE.3-EO.a.3)

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EXAMPLE: A student in Language Arts can demonstrate the ability to apply and comprehend critical language through the following statement: *"Mark Twain exposes the hypocrisy of slavery through the use of satire."*

A student in _____ can demonstrate the ability to apply and comprehend critical language through the following statement(s):	*I know the roots of a quadratic equation are complex if the discriminant is negative.*
Academic Vocabulary:	solve, graph, identify, prove
Technical Vocabulary:	focus, directrix, parabola, equations, transformations, expressions, structures, solutions, complex numbers, polynomial, quadratic, discriminant, zeros, functions, Remainder theorem, imaginary number, roots, i, end behavior, factor, factorization, degree, derive, polynomial identities

Unit Title	Radically Rational		**Length of Unit**	3 weeks
Focusing Lens(es)	Transformations Structure	**Standards and Grade Level Expectations Addressed in this Unit**	MA10-GR.HS-S.1-GLE.1 MA10-GR.HS-S.2-GLE.3 MA10-GR.HS-S.2-GLE.4	
Inquiry Questions (Engaging-Debatable):	• How are the models of rational and radical equations related? • Can the graphs of rational and radical functions be transformed in the same way as quadratic and linear functions?			
Unit Strands	Number and Quantity: The Real Number System Algebra: Reasoning with Equations and Inequalities Algebra: Arithmetic and Polynomials and Rational Expressions			
Concepts	properties of operations, rational expressions, rational equations, radical equations, properties of integer exponents, properties of rational exponents			

Generalizations **My students will Understand that…**	**Guiding Questions** **Factual**	**Conceptual**
Properties of operations transform rational expressions with the intention of creating more efficient forms of the expression. (MA10-GR.HS-S.2-GLE.3-EO.g)	How can inspection, long division and computer algebra systems be used to rewrite rational expressions? How do you use factoring to rewrite a rational expression?	Why do we rewrite rational expressions in different forms? Why can computers solve problems that humans cannot? (MA10-GR.HS-S.2-GLE.4-IQ.3)
Solving rational and radical equations can result in extraneous solutions. (MA10-GR.HS-S.2-GLE.4-EO.b.ii)	How do you check for extraneous solutions? When do extraneous solutions arise? How can you determine if a solution is not viable?	Why do extraneous solutions occur?
The properties of integer exponents extend to rational exponents. MA10-GR.HS-S.1-GLE.1-EO.a)	What are the properties of exponents? What is the relationship between rational exponents and radicals? How can properties of exponents be used to transform rational expressions into radical expressions or vice versa? How are radical expressions simplified?	Why do we need both radicals and rational exponents?

Key Knowledge and Skills: **My students will…**	*What students will know and be able to do are so closely linked in the concept-based discipline of mathematics. Therefore, in the mathematics samples what students should know and do are combined.*

- Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system. (MA10-GR.HS-S.2-GLE.3-EO.g)
- Explain each step in solving simple rational or radical equations as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution and construct a viable argument to justify a solution method. (MA10-GR.HS-S.2-GLE.4-EO.b.i)
- Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. (MA10-GR.HS-S.2-GLE.4-EO.b.ii)
- Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. (MA10-GR.HS-S.1-GLE.1-EO.a.i)
- Rewrite expressions involving radicals and rational exponents using the properties of exponents. (MA10-GR.HS-S.1-GLE.1-EO.a.ii)

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A student in _____ can demonstrate the ability to apply and comprehend critical language through the following statement(s):	*I can factor the expressions in the numerator and denominator in order to simplify a rational expression.*
Academic Vocabulary:	rewrite, equality, solve, explain, definition, meaning, extending
Technical Vocabulary:	rational expression radical expressions, radical equation, rational equation, extraneous solution, rational exponents, properties of integer exponents, properties of rational exponents, radicals, inspection, long division, quotient, remainder, divisor, polynomial, properties of operations, degree of polynomial

Unit Title	Trickster Trigonometry		**Length of Unit**	4 Weeks
Focusing Lens(es)	Relationships Modeling	**Standards and Grade Level Expectations Addressed in this Unit**	MA10-GR.HS-S.2-GLE.1 MA10-GR.HS-S.2-GLE.2 MA10-GR.HS-S.4-GLE.2	
Inquiry Questions (Engaging-Debatable):	• How does the periodicity in the unit circle correspond to the periodicity in graphs of models of periodic phenomena? (MA10-GR.HS-S.2-GLE.2-EO.c) • Why can the same class of functions model diverse types of situations (e.g., sales, manufacturing, temperature, and amusement park rides)?			
Unit Strands	Functions: Interpreting Functions Functions: Trigonometric Functions			
Concepts	unit circle, coordinate plane, trigonometric functions, angles, model, periodic phenomena			

Generalizations **My students will Understand that…**	**Guiding Questions** **Factual**	**Conceptual**
The unit circle in the coordinate plane represents the trigonometric functions for any angle. (MA10-GR.HS-S.2-GLE.1-EO.f.ii), (MA10-GR.HS-S.2-GLE.4-EO.d) and (MA10-GR.HS-S.4-GLE.2-EO.d)	How is the circumference of a unit circle used to determine the radian measure of an angle? Given an angle, how is the unit circle used to determine each of the trigonometric functions? How are the relationships of right triangles used to determine the trigonometric functions of an angle?	How is the Pythagorean identity represented in the unit circle? How does the Pythagorean Identity illustrate the inverse nature of the relationship between sine and cosine?
Trigonometric functions model periodic phenomena. (MA10-GR.HS-S.2-GLE.2-EO.c.i, iv)	What situations would it be appropriate to model with trigonometric? How are period, midline and amplitude reflected in the equation of a trigonometric function?	Why would the parent trigonometric function change in period, midline and amplitude for a given situation?

Key Knowledge and Skills: **My students will…**	*What students will know and be able to do are so closely linked in the concept-based discipline of mathematics. Therefore, in the mathematics samples what students should know and do are combined.*

- Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle. (MA10-GR.HS-S.2-GLE.1-EO.f.i)
- Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle. (MA10-GR.HS-S.2-GLE.1-EO.f.ii)
- Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. (MA10-GR.HS-S.2-GLE.2-EO.c.i)
- Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find sin(θ), cos(θ),or tan(θ) given sin(θ), cos(θ), or tan(θ) and the quadrant of the angle. (MA10-GR.HS-S.2-GLE.4-EO.d)
- Graph trigonometric functions expressed symbolically and show key features (e.g., period, midline, and amplitude) of the graph, by hand in simple cases and using technology for more complicated cases. (MA10-GR.HS-S.2-GLE.2-EO.c.iv)

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A student in _____ can demonstrate the ability to apply and comprehend critical language through the following statement(s):	*I know the sine of an angle in the first two quadrants of the unit circle is always positive.*
Academic Vocabulary:	explain, prove, graph, key features, interpret, angles, model, counterclockwise, clockwise,
Technical Vocabulary:	unit circle, coordinate plane, trigonometric functions, periodic phenomena, radian measure, subtend, amplitude, frequency, midline, period, Pythagorean identity, sine, cosine, tangent, arc length, real numbers, quadrant

Unit Title	Independently Lucky		**Length of Unit**	3 Weeks
Focusing Lens(es)	Decision-making Classification	**Standards and Grade Level Expectations Addressed in this Unit**	MA10-GR.HS-S.3-GLE.3	
Inquiry Questions (Engaging-Debatable):	• How does probability relate to obtaining car insurance? (MA10-GR.HS-S.3-GLE.3-IQ.3) • Why is it hard for humans to determine if a set of numbers was created randomly?			
Unit Strands	Statistics and Probability: Conditional Probability and the Rules of Probability			
Concepts	two-way frequency tables, associations, conclusions, categorical variables, unions, intersections, complements, events, subsets, sample space, independence, probabilities, products, conditional probability, given			

Generalizations **My students will Understand that…**	**Guiding Questions** **Factual**	**Conceptual**
Two-way frequency tables provide the necessary structure to make conclusions about the association of categorical variables. (MA10-GR.HS-S.3-GLE.3-EO.a.iv)	How is conditional probability represented in a two-way frequency table? How do you determine the conditional probability of A given B from a frequency table? How do you determine if two events are independent from a frequency table?	Why are two-way frequency tables useful in probability?
Unions, intersections and complements of events describe subsets of a sample space. (MA10-GR.HS-S.3-GLE.3-EO.a.i)	How do the word “and” and “or” relate to unions and intersections? How are intersections and complements related? When is it appropriate to use unions, intersections, or complements in determining probability?	Why is the addition rule related to unions, intersections and complements?
Mathematicians determine the independence of events A and B by examining if the product of the probabilities of A and B equals the probability of A and B occurring together. (MA10-GR.HS-S.3-GLE.3-EO.a.iii)	How can you determine if two events are independent?	Why are events independent if the product of the probabilities of A and B equals the probability of A and B occurring together?
Mathematicians find the probability of an event given the occurrence of another event through conditional probability. (MA10-GR.HS-S.3-GLE.3-EO.a.iii)	When do we use conditional probability?	How are independence and conditional probability related?

Key Knowledge and Skills: **My students will…**	*What students will know and be able to do are so closely linked in the concept-based discipline of mathematics. Therefore, in the mathematics samples what students should know and do are combined.*

- Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not"). (MA10-GR.HS-S.3-GLE.3-EO.a.i)
- Understand two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent. (MA10-GR.HS-S.3-GLE.3-EO.a.i)
- Understand the conditional probability of *A* given *B* as *P*(*A* and *B*)/*P*(*B*), and interpret independence of *A* and *B* as saying that the conditional probability of *A* given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B.* (MA10-GR.HS-S.3-GLE.3-EO.a.ii)
- Determine if two events are independent by showing that if two events A and B are independent then the probability of A and B occurring together is the product of their probabilities. (MA10-GR.HS-S.3-GLE.3-EO.a.ii)
- Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. (MA10-GR.HS-S.3-GLE.3-EO.a.iv)
- Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. (MA10-GR.HS-S.3-GLE.3-EO.a.v)
- Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model. (MA10-GR.HS-S.3-GLE.3-EO.b.i)
- Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model. (MA10-GR.HS-S.3-GLE.3-EO.b.ii)
- Analyze the cost of insurance as a method to offset the risk of a situation. (MA10-GR.HS-S.3-GLE.3-EO.c) *

Critical Language: includes the Academic and Technical vocabulary, semantics, and discourse which are particular to and necessary for accessing a given discipline.
EXAMPLE: A student in Language Arts can demonstrate the ability to apply and comprehend critical language through the following statement: *"Mark Twain exposes the hypocrisy of slavery through the use of satire."*

A student in _____ can demonstrate the ability to apply and comprehend critical language through the following statement(s):	*I can determine if two events A and B are independent by determining if conditional probability of A given B is the same as the probability of A.*
Academic Vocabulary:	outcomes, describe, determine, construct, interpret, recognize, explain, find, apply, model, classified, categories
Technical Vocabulary:	Addition Rule, two-way frequency tables, associations, conclusions, categorical variables, unions, intersections, complements, events, subsets, sample space, independence, probabilities, products, conditional probability, given, random, event

*** Denotes a connection to Personal Financial Literacy (PFL)**

Unit Title	Survey Says…		**Length of Unit**	3 Weeks
Focusing Lens(es)	Justification Inferences	**Standards and Grade Level Expectations Addressed in this Unit**	MA10-GR.HS-S.3-GLE.1 MA10-GR.HS-S.3-GLE.2	
Inquiry Questions (Engaging-Debatable):	• When should sampling be used? When is sampling better than a census? (MA10-GR.HS-S.3-GLE.2-IQ.3)			
Unit Strands	Statistics and Probability			
Concepts	inferences, parameters, random sample, population, validity, sampling, surveys, experiments, observational studies, statistical results, randomization, simulation, indirect, data			

Generalizations **My students will Understand that…**	**Guiding Questions** **Factual**	**Conceptual**
Random samples from a population allow statisticians to make inferences about population parameters. (MA10-GR.HS-S.3-GLE.2.a)	How can we reduce the margin of error in a population prediction? How can I use mean and standard deviation of a data set to draw a normal distribution? What happens to sample-to-sample variability when you increase the sample size? (MA10-GR.HS-S.3-GLE.2-IQ.2)	Why is the normal distribution commonly used to model a population and when is this not appropriate? How can the results of a statistical investigation be used to support an argument? (MA10-GR.HS-S.3-GLE.2-IQ1) Why is the margin of error in a study important? (MA10-GR.HS-S.3-GLE.2-IQ.5) How is it known that the results of a study not simply due to chance? (MA10-GR.HS-S.3-GLE.2-IQ.6)
Validity in sampling, surveys, experiments, observational studies and the interpretation of statistical results depends on randomization. (MA10-GR.HS-S.3-GLE.2-EO.b)	In what ways can a survey be biased? How does randomization factor into the design of an experiment?	Why is randomization an important component of sampling?
Simulation provides a means to indirectly collect data. (MA10-GR.HS-S.3-GLE.2-EO.b)	How do you design a simulation to model the collection of data that isn't easily obtainable?	How has the use of technology enhanced our ability to study difficult to measure phenomena?

Key Knowledge and Skills: **My students will…**	*What students will know and be able to do are so closely linked in the concept-based discipline of mathematics. Therefore, in the mathematics samples what students should know and do are combined.*

- Understand statistics as a process for making inferences about population parameters based on a random sample from that population. (MA10-GR.HS-S.3-GLE.2-EO.a.i)
- Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. (MA10-GR.HS-S.3-GLE.2-EO.a.ii)
- Recognize the purposes of and differences among sample surveys, experiments, and observational studies and explain how randomization relates to each. (MA10-GR.HS-S.3-GLE.2-EO.b.i))
- Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. (MA10-GR.HS-S.3-GLE.2-EO.b.ii, iii)
- Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. (MA10-GR.HS-S.3-GLE.2-EO.b.iv)
- Evaluate reports based on data. (MA10-GR.HS-S.3-GLE.2-EO.b.vi)
- Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages and recognize that there are data sets for which such a procedure is not appropriate; use calculators, spreadsheets, and tables to estimate areas under the normal curve. (MA10-GR.HS-S.3-GLE.1-EO.a.iv, v)

Critical Language: includes the Academic and Technical vocabulary, semantics, and discourse which are particular to and necessary for accessing a given discipline.
EXAMPLE: A student in Language Arts can demonstrate the ability to apply and comprehend critical language through the following statement: *"Mark Twain exposes the hypocrisy of slavery through the use of satire."*

A student in _____ can demonstrate the ability to apply and comprehend critical language through the following statement(s):	*Statistics is a process for making inferences about population parameters based on a random sample of a population.*
Academic Vocabulary:	inferences, surveys, experiments, observational studies, data, conclusions, interpret, evaluate, recognize, compare, model, explain, spreadsheets, estimate
Technical Vocabulary:	statistic, statistics, sampling, mean, standard deviation, data sets, normal distribution, normal curve, margin of error, parameters, random sample, population, validity, sampling, statistical results, randomization, simulation, indirect, data