2019 - 2020

Liberal Arts Mathematics 1

Curriculum Map

1207300

Volusia County Curriculum Maps are revised annually and updated throughout the year.

The Success Criteria are a work in progress and may be modified as needed.

Florida Standards
Standards for Mathematical Practice

1. **Make sense of problems and persevere in solving them. (MAFS.K12.MP.1)**
   Solving a mathematical problem involves making sense of what is known and applying a thoughtful and logical process which sometimes requires perseverance, flexibility, and a bit of ingenuity.
2. **Reason abstractly and quantitatively. (MAFS.K12.MP.2)**
   The concrete and the abstract can complement each other in the development of mathematical understanding: representing a concrete situation with symbols can make the solution process more efficient, while reverting to a concrete context can help make sense of abstract symbols.
3. **Construct viable arguments and critique the reasoning of others. (MAFS.K12.MP.3)**
   A well-crafted argument/critique requires a thoughtful and logical progression of mathematically sound statements and supporting evidence.
4. **Model with mathematics. (MAFS.K12.MP.4)**
   Many everyday problems can be solved by modeling the situation with mathematics.
5. **Use appropriate tools strategically. (MAFS.K12.MP.5)**
   Strategic choice and use of tools can increase reliability and precision of results, enhance arguments, and deepen mathematical understanding.
6. **Attend to precision. (MAFS.K12.MP.6)**
   Attending to precise detail increases reliability of mathematical results and minimizes miscommunication of mathematical explanations.
7. **Look for and make use of structure. (MAFS.K12.MP.7)**
   Recognizing a structure or pattern can be the key to solving a problem or making sense of a mathematical idea.
8. **Look for and express regularity in repeated reasoning. (MAFS.K12.MP.8)**
   Recognizing repetition or regularity in the course of solving a problem (or series of similar problems) can lead to results more quickly and efficiently.

The following English Language Arts LAFS should be taught throughout the course:

LAFS.68.RST.1.3: Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
LAFS.68.RST.2.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.
LAFS.68.RST.3.7: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
LAFS.68.WHST.1.1: Write arguments focused on *discipline-specific content.*
LAFS.68.WHST.2.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
LAFS.8.SL.1.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.
LAFS.8.SL.1.2: Analyze the purpose of information presented in diverse media and formats (e.g., visually, quantitatively, orally) and evaluate the motives (e.g., social, commercial, political) behind its presentation.
LAFS.8.SL.1.3: Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced.
LAFS.8.SL.2.4: Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

ELD.K12.ELL.MA.1: **English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.**

ELD.K12.ELL.SI.1: English language learners communicate for social and instructional purposes within the school setting.

The following Mathematics standards should be taught throughout the course:

MAFS.912.N-Q.1.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
MAFS.912.N-Q.1.2: Define appropriate quantities for the purpose of descriptive modeling.
MAFS.912.N-Q.1.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Domain Abbreviations

RN: The Real Number System
IF: Interpreting Functions
CN: Complex Numbers
LE: Linear, Quadratic And Exponential Models
GPE: Expressing geometric properties with equations
CP: Conditional probability and the rules of probability
SSE: Seeing Structure in Expressions
APR: Arithmetic with Polynomials and Rational Expressions
REI: Reasoning with Equations and Inequalities
ID: Interpreting Categorical and Quantitative Data
IC: Making inferences and justifying conclusions

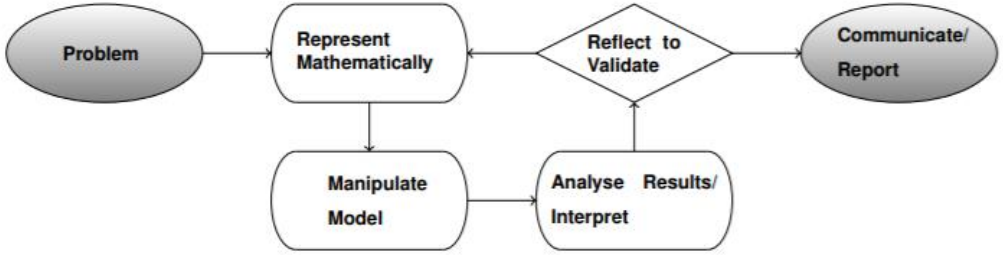
Modeling Cycle

(On our maps, modeling standards are marked with a star. ★)

The basic modeling cycle involves

1) identifying variables in the situation and selecting those that represent essential features,
2) formulating a model by creating and selecting geometric, graphical, tabular, algebraic, or statistical representations that describe relationships between the variables,
3) analyzing and performing operations on these relationships to draw conclusions,
4) interpreting the results of the mathematics in terms of the original situation,
5) validating the conclusions by comparing them with the situation, and then either improving the model or, if it is acceptable,
6) reporting on the conclusions and the reasoning behind them.

Choices, assumptions, and approximations are present throughout this cycle.



(Diagrams of modeling processes vary.)

Florida Standards Assessments – Math Florida Standards for Modeling

Achieve the Core – Modeling, High School (Page 6)

Key Shifts in Mathematics

The Mathematics Florida State Standards build on the best of existing standards and reflect the skills and knowledge students will need to succeed in college, career, and life. Understanding how the standards differ from previous standards—and the necessary shifts they call for—is essential to implementing them.

The following are the key shifts called for by the Standards:

1. Greater Focus on fewer topics
2. Coherence: Linking topics and thinking across grades
3. Rigor: Pursue conceptual understanding, procedural skills and fluency, and application with equal intensity

- Ⓒ Conceptual understanding: The Standards call for conceptual understanding of key concepts, such as place value and ratios. Teachers support students 'ability to access concepts from a number of perspectives so that students are able to see math as more than a set of mnemonics or discrete procedures.

- Ⓟ Procedural skill and fluency: The Standards call for accuracy in calculation, number sense and deep understanding of numerical principles, not blind memorization or fast recall (Boaler, 2009). Teachers structure class time and/or homework time for students to practice core functions such as single; digit multiplication so that students have access to more complex concepts and procedures.

- Ⓐ Application: The Standards call for students to use math flexibly for applications. Teachers provide opportunities for students to apply math in context. . Correctly applying mathematical knowledge depends on students having a solid conceptual understanding and procedural fluency.

The rigor of each Mathematical Florida Standards on this curriculum map has an Icon to identify the component of rigor for lesson planning.

Liberal Arts Math 1: Florida Standards At A Glance

FSA End of Course Assessment: Reporting Categories and Percentage of Test

Algebra and Modeling = 41% | **Functions and Modeling = 40%** | **Statistics and the Number System = 19%**

First Quarter

Unit 1: Basics of Expressions and Equations
MAFS.912.A-SSE.1.1
MAFS.912.A-SSE.1.2
MAFS.912.A-APR.1.1
MAFS.912.F-BF.1.1b.c

Unit 2: Solving Equations and Inequalities
MAFS.912.A-REI.2.3
MAFS.912.A-REI.1.1
MAFS.912.A-CED.1.1
MAFS.912.A-CED.1.2
MAFS.912.A-CED.1.4
MAFS.912.A-REI.1.2
MAFS.912.A-REI.4.10

Unit 3: Introduction to Functions
MAFS.912.F-IF.1.1
MAFS.912.F-IF.1.2
MAFS.912.F-IF.2.5
MAFS.912.F-IF.2.4
MAFS.912.F-IF.2.6
MAFS.912.F-BF.2.3

Second Quarter

Unit 4: Linear Equations, Functions, and Inequalities (continued)
MAFS.912.A-CED.1.3
MAFS.912.S-ID.3.7
MAFS.912.F-LE.2.5
MAFS.912.F-IF.3.7a
MAFS.912.A-CED.1.2
MAFS.912.A-REI.4.12

Unit 5: Systems of Linear Equations and Inequalities
MAFS.912.A-CED.1.2
MAFS.912.A-CED.1.3
MAFS.912.A-REI.3.6
MAFS.912.A-REI.4.11
MAFS.912.A-REI.3.5
MAFS.912.A-REI.4.12

Unit 6: Exponential and Radical Functions
MAFS.912.A-CED.1.1
MAFS.912.A-CED.1.2
MAFS.912.F-IF.3.7e
MAFS.912.F-IF.3.8b
MAFS.912.F-LE.1.2
MAFS.912.F-LE.2.5

Third Quarter

Unit 7: Quadratic Equations and Functions
MAFS.912.A-SSE.2.3a, b
MAFS.912.A.-REI.2.4
MAFS.912.F-IF.3.8a
MAFS.912.A-CED.1.2
MAFS.912.F-IF.3.7a

Unit 8: Statistics
MAFS.912.S-ID.1.1
MAFS.912.S-ID.1.2
MAFS.912.S-ID.1.3
MAFS.912.S-ID.1.4

Unit 9: Definitions and Constructions
MAFS.912.G-CO.1.1
MAFS 912.G-CO.1.4
MAFS 912.G-CO.1.3
MAFS.912.G-CO.4.12
MAFS.912.G-CO.4.13

Fourth Quarter

Unit 10: Similarity
MAFS.912.G-SRT.1.2
MAFS.912.G-SRT.1.3
MAFS.912.G-SRT.2.4
MAFS.912.G-SRT.2.5

Unit 11: Two-Dimensional Shapes
MAFS.912.G-MG.1.1
MAFS.912.G-MG.1.2
MAFS.912.G-MG.1.3

Unit12: Three-Dimensional Shapes
MAFS.912.G-GMD.1.3
MAFS.912.G-GMD.2.4
MAFS.912.G-MG.1.1
MAFS.912.G-MG.1.2
MAFS.912.G-MG.1.3

Rigor Coding: red = conceptual understanding green = procedural skills and fluency blue = application
***** = Algebra 1 Honors ONLY**

Liberal Arts Math 1 Pacing Guide

Days	Date	Topic
15	Aug 12 – Aug 30	UNIT 1: Basics of Expressions and Equations
13	Sept 3 - Sept 20	UNIT 2: Solving Equations & Inequalities
15	Sept 23 – Oct 11	UNIT 3: Introduction to Functions
TDD October 14		**End of 1st Grading Period**
14	Oct 15 – Nov 1	UNIT 4: Linear Equations, Functions, and Inequalities
14	Nov 4 – Nov 22	UNIT 5: Systems of Linear Equations and Inequalities
13	Dec 2 – Dec 18	UNIT 6: Exponential and Radical Functions
TDD December 19		**End of 2nd Grading Period – Winter Break**
19	Jan 6 – Jan 31	UNIT 7: Quadratic Equations and Functions
14	Feb 3 – Feb 21	UNIT 8: Statistics
14	Feb 24 – Mar 12	UNIT 9: Definitions and Constructions
TDD March 13		**End of 3rd Grading Period - Spring Break**
15	Mar 23 – Apr 10	UNIT 10: Similarity
15	Apr 13 – May 1	UNIT 11: Two-Dimensional Shapes
19	May 4 – May 29	UNIT 12: Three-Dimensional Shapes
	May 29	**End of 4th Quarter Period – Last Day for Students**

UNIT 1 – BASICS OF EXPRESSIONS AND EQUATIONS

Standard ***The students will:***	**Success Criteria** ***I know I am successful when I can:***	**Instructional Notes**
MAFS.912.A-SSE.1.1 ℂ★ Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret* $P(1+r)^n$ *as the product of* P *and a factor not depending on* P*.* **SMP: #7** **Math Nation - Algebra**	**MODELING STANDARD** • **identify** and **describe** a polynomial (include monomial, binomial, trinomial, and polynomial). • **explain** what factor, coefficient, degree, term, like terms, leading term, and leading coefficient mean in the context of expressions • **identify** factors, coefficients, different terms, and like terms in expressions • **identify** simplified form of monomials, binomials, and trinomials as standard form. • **interpret** individual parts of an exponential expression	**FSA Test Item Specifications** Assessed with A-SSE.1.2 and A-SSE.2.3 Clarifications • Students will rewrite algebraic expressions in different equivalent forms by recognizing the expression's structure. • Students will rewrite algebraic expressions in different equivalent forms using simplifying expressions (e.g., combining like terms, using the distributive property, and other operations with polynomials). Stimulus Attributes • Items assessing A-SSE.1.1 must be set in a real-world context. • Items should contain expressions only. Response Attributes • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret units. • For A-SSE.1.1, items may require the student to apply the basic modeling cycle. **Calculator:** Neutral **Coherence:** • 6.EE.1.2 Students write expressions and identify parts of an expression. Students use the vocabulary sum, term, product, factor, quotient, coefficient.

UNIT 1 – BASICS OF EXPRESSIONS AND EQUATIONS (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.A-SSE.1.2 © Use the structure of an expression to identify ways to rewrite it. ~~*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 $(x^2 - y^2)(x^2 + y^2)$.*~~ **SMP: #7** **Math Nation - Algebra**	• **use** properties (commutative, associative, and distributive) to rewrite expressions	**FSA Test Item Specifications** Also assesses A-SSE.1.1 and A-SSE.2.3 Clarifications • Students will rewrite algebraic expressions in different equivalent forms by recognizing the expression's structure. • Students will rewrite algebraic expressions in different equivalent forms using simplifying expressions (e.g., combining like terms, using the distributive property, and other operations with polynomials). Stimulus Attributes • Items should contain expressions only. • Items may require the student to provide the answer in a specific form. Response Attributes • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret units. **Calculator:** Neutral **Coherence:** • 7.EE.1.1 Students apply properties (distributive, commutative, associative, identity, and inverse properties of addition and multiplication) with rational coefficients.

UNIT 1 – BASICS OF EXPRESSIONS AND EQUATIONS (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.A-APR.1.1 ©℗ Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. **MFAS:** Adding Polynomials Multiplying Polynomials – 1 Multiplying Polynomials – 2 Subtracting Polynomials **SMP #2, 7** **Math Nation - Algebra**	• **apply** arithmetic operations of addition, subtraction, and multiplication of polynomials and functions with integral coefficients and **explain** the properties used. • **explain** closure and understand that adding, subtracting, or multiplying two polynomials always produces a polynomial.	**FSA Test Item Specifications** Clarifications • Students will relate the addition, subtraction, and multiplication of integers to the addition, subtraction, and multiplication of polynomials with integral coefficients through application of the distributive property. • Students will apply their understanding of closure to adding, subtracting, and multiplying polynomials with integral coefficients. • Students will add, subtract, and multiply polynomials with integral coefficients. Assessment Limits • Items set in a real-world context should not result in a nonreal answer if the polynomial is used to solve for the unknown. • In items that require addition and subtraction, polynomials are limited to monomials, binomials, and trinomials. The simplified polynomial should contain no more than six terms. • Items requiring multiplication of polynomials are limited to a product of: two monomials, a monomial and a binomial, a monomial and a trinomial, two binomials, and a binomial and a trinomial. Stimulus Attributes • Items may be set in a mathematical or real-world context. • Items may use function notation Response Attributes • Items may require the student to write the answer in standard form. Items may require the student to recognize equivalent expressions. • Items may require the student to rewrite expressions with negative exponents, but items must not require the student to rewrite rational expression as seen in the standard MAFS.912.A-APR.4.7. **Calculator:** Neutral **Coherence:** • 7.EE.1.1 Students apply properties (distributive, commutative, associative, identity, and inverse properties of addition and multiplication) with rational coefficients. • 8.EE.1.1 Students know and apply the properties of integer exponents.

UNIT 1 – BASICS OF EXPRESSIONS AND EQUATIONS (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.F-BF.1.1b.c ⓒⓟⓐ★ Write a function that describes a relationship between two quantities. ~~a. Determine an explicit expression, a recursive process, or steps for calculation from a context.~~ b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.* c. Compose functions. *For example, if $T(y)$ is the temperature in the atmosphere as a function of height, and $h(t)$ is the height of a weather balloon as a function of time, then $T(h(t))$ is the temperature at the location of the weather balloon as a function of time.* **MFAS: Furniture Purchase** **How Much Bacteria?** **SMP: #4, 7** **Math Nation - Algebra**	**MODELING STANDARD** • **write** a function that combines functions using arithmetic operations (addition, subtraction, and multiplication) and relate the result to the context of the problem. • **write** a function to model a real-world context by composing functions and the information within the context. • **explain** process of composition – that is, explain that *f(g(x))* takes an *x* value to its *g* output and then takes the *g* output to its *f* output.	**FSA Test Item Specifications** Assessed with F-LE.1.2 and F-IF.1.3 Clarifications • Students will write a function that combines functions using arithmetic operations and relate the result to the context of the problem. • Students will write a function to model a real-world context by composing functions and the information within the context. Assessment Limits • In items where the student must write a function using arithmetic operations or by composing functions, the student should have to generate the new function only. Stimulus Attributes • For F-BF.1.1, items should be set in a real-world context. • Items must use function notation. • In items where the student builds a function using arithmetic operations or by composition, the functions may be given using verbal descriptions, function notation or as equations. Response Attributes • For F-BF.1.1b and c, the student may be asked to find a value. • For F-BF.1.1, items may require the student to apply the basic modeling cycle. • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. **Calculator:** Neutral

UNIT 2 – SOLVING EQUATIONS AND INEQUALITIES

Standard ***The students will:***	**Success Criteria** ***I know I am successful when I can:***	**Instructional Notes**
MAFS.9.12.A-REI.2.3 (P) Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. **MFAS:** Solve for M Solve for N Solve for X Solve for Y Solving a Literal Linear Equation Solving a Multistep Inequality **SMP #5, 7** **Math Nation - Algebra**	• **solve** linear equations and inequalities in one variable including equations with coefficients represented by letters. • **solve** compound inequalities. **Note:** Solutions should be expressed in a variety of methods including: **Inequality Notation** Examples: $x < 4$ $-5 \leq x \leq 3$ **Interval Notation** Examples: $(\infty, 4]$ [-5, 3] **Set Notation (also called Set Builder Notation)** Examples: $\{x \mid x < 4\}$ $\{x \mid -5 \leq x \leq 3\}$	**FSA Test Item Specifications** Assessed with A-CED.1.1 and A-CED.1.4 Clarifications • Students will solve a linear equation. • Students will solve a linear inequality. • Students will solve formulas and equations with coefficients represented by letters. Assessment Limits • Items may include equations or inequalities that contain variables on both sides. • Items may include compound inequalities. • In items that require the student to write or solve an inequality, variables are restricted to an exponent of one. • Items may require the student to recognize equivalent expressions but may not require a student to perform an algebraic operation outside the context of Algebra 1. Stimulus Attributes • Items assessing REI.2.3 do not have to be in a real-world context. Response Attributes • Items assessing REI.2.3 should not require the student to write the equation. • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret units. **Calculator:** Neutral **Coherence:** • 6.EE.2.5, 8.EE.3.7 Students solve and graph inequalities.

UNIT 2 – SOLVING EQUATIONS AND INEQUALITIES (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.A-REI.1.1 © Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. **NO CALCULATOR** **MFAS:** Does It Follow? Equation Logic Justify the Process 1 Justify the Process 2 **SMP: # 2, 3** **Math Nation - Algebra**	• **apply** order of operations and inverse operations to solve equations. • **construct** a viable argument (properties) to complete an algebraic proof to justify the steps of a solution and a solution method.	**FSA Test Item Specifications** Clarifications • Students will complete an algebraic proof of solving a linear equation. • Students will construct a viable argument to justify a solution method. Assessment Limit • Items will not require the student to recall names of properties from memory. Stimulus Attributes • Items should be set in a mathematical context. • Items may use function notation. • Items should be linear equations in the form of $ax + b = c,\ a(bx + c) = d,\ ax + b = cx + d$, or $a(bx + c) = d(ex + f)$, where $a, b, c, d, e,$ and f are rational numbers. Equations may be given in forms that are equivalent to these. • Coefficients may be a rational number or a variable that represents any real number. • Items should not require more than four procedural steps to reach a solution. Response Attributes • Items may ask the student to complete steps in a viable argument. • Items should not ask the student to provide the solution. **Calculator:** Neutral **Coherence:** • 6.EE.2.5, 8.EE.3.7 Students solve and graph inequalities.

UNIT 2 – SOLVING EQUATIONS AND INEQUALITIES (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.A-CED.1.1 ℂℙ𝔸★ Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, simple rational, absolute, and exponential functions.* **MFAS:** State Fair Music Club **SMP: # 4** **Math Nation - Algebra**	**MODELING STANDARD** • **identify** the variables and quantities represented in a real-world problem. • **create** one variable equations or inequalities that best models the problem. • **solve** equations or inequalities that model real-world problems	**FSA Test Item Specifications** Assessed with A-REI.2.3 and A-CED.1.4 Clarifications • Students will write an equation in one variable that represents a real-world context. • Students will write an inequality in one variable that represents a real-world context. • Students will solve a linear equation. • Students will solve a linear inequality. Assessment Limits • In items that require the student to write an equation, equations are limited to exponential functions with one translation, linear functions, or quadratic functions. • Items may include equations or inequalities that contain variables on both sides. • Items may include compound inequalities. • In items that require the student to write or solve an inequality, variables are restricted to an exponent of one. • Items may require the student to recognize equivalent expressions but may not require a student to perform an algebraic operation outside the context of Algebra 1. Stimulus Attributes • Items assessing A-CED.1.1 must be placed in real-world context. Response Attributes • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret units. • For A-CED.1.1, items may require the student to apply the basic modeling cycle. **Calculator:** Neutral **Coherence:** • 7.EE.2.4 Students model word problems with simple equations and solve them.

UNIT 2 – SOLVING EQUATIONS AND INEQUALITIES (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.A-CED.1.2 ⓒⓟⓐ★ Create equation in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **MFAS:** Tee It Up **SMP #4** **Math Nation - Algebra**	**MODELING STANDARD** • **identify** the variables and quantities represented in a real-world problem. • **create** equations and inequalities with two variables. • **graph** equations on the coordinate plane that represent all possible solutions to a real-world problem using appropriate labels and scales.	**FSA Test Item Specifications** Assessed with A-REI.3.5, A-REI.3.6, and A- Clarifications • Students will identify the quantities in a real-world situation that should be represented by distinct variables. Stimulus Attributes • Items assessing A-CED.1.2 must be placed in a real-world context. Response Attributes • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. • For A-CED.1.2, items may require the student to apply the basic modeling cycle. **Calculator:** Neutral **Coherence:** • 8.F.2.4 Students identify the slope and y-intercept from tables, graphs, equations, and verbal descriptions of linear relationships and construct a function.

UNIT 2 – SOLVING EQUATIONS AND INEQUALITIES (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.A-CED.1.4 ⓒⓟⒶ★ Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. **MFAS:** Literal Equations Rewriting Equations Solving Formulas for a Variable Solving Literal Equations Surface Area of a Cube **SMP: # 4** **Math Nation - Algebra**	**MODELING STANDARD** • **solve** formulas for a specified variable. • **explain** the steps used to rearrange a formula to highlight a variable of interest. • **make** connections between solving equations and rearranging formulas.	**FSA Test Item Specifications** Assessed with A-CED.1.1 and A-REI.2.3 Clarifications • Students will solve multi-variable formulas or literal equations for a specific variable. Assessment Limits • Items that involve formulas should not include overused contexts such as Fahrenheit/Celsius or three-dimensional geometry formulas. • In items that require the student to solve literal equations and formulas, a linear term should be the term of interest. • Items should not require more than four procedural steps to isolate the variable of interest. • Items may require the student to recognize equivalent expressions but may not require a student to perform an algebraic operation outside the context of Algebra 1. Stimulus Attributes • Items assessing A-CED.1.4 must be placed in real-world context. Response Attributes • For A-CED.1.4, items may require the student to apply the basic modeling cycle. **Calculator:** Neutral
MAFS.912.A-REI.1.2 ⓒⓟ Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. **SMP #1, 3** **Math Nation - Algebra**	• **define** extraneous solutions. • **solve** a rational or radical equation in one variable. • **determine** which numbers cannot be solutions of a rational or radical equation and explain why they cannot be solutions.	

UNIT 2 – SOLVING EQUATIONS AND INEQUALITIES (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.A-REI.4.10 © Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). **MFAS:** Case In Point Finding Solutions What is the Point? **SMP: #2** **Math Nation - Algebra**	• **create** a graph where the ordered pairs are solutions to the equation • **verify** that any point on a graph will result in a true equation when their coordinates are substituted into the equation. • **explain** if a function is discrete or continuous	**FSA Test Item Specifications** Assessed with A-REI.4.11 Clarifications • Students will verify if a set of ordered pairs is a solution of a function. Assessment Limits • In items where a function is represented by an equation, the function may be an exponential function with no more than one translation, a linear function, or a quadratic function. • In items where a function is represented by a graph or table, the function may be any continuous function. Stimulus Attributes • Items may be set in a mathematical or real-world context. • Items may use function notation. • Items must designate the place value accuracy necessary for approximate solutions. **Calculator:** Neutral

UNIT 3 – INTRODUCTION TO FUNCTIONS

The standards in this Unit should be carried into each function family (linear, quadratic, exponential, etc). The standards are not listed individually in the subsequent Units but can be assessed on DIAs in those Units for those families.

Standard ***The students will:***	**Success Criteria** ***I know I am successful when I can:***	**Instructional Notes**
MAFS. 912.F-IF.1.1 © Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f(x)* denotes the output of *f* corresponding to the input x. The graph of *f* is the graph of the equation *y=f(x).* **MFAS:** Cafeteria Function Circles and Functions Identifying Functions Identifying the Graphs of Functions What Is a Function? Writing Functions **SMP: #6, 7** **Math Nation - Algebra**	• **define** vocabulary (relation, domain and range). • **determine** if the correspondence in a graph, table, mapping diagrams or set of ordered pairs represent a function. • **create** examples of what is and what is not a function using different representations, including graphs, tables, symbols, and contexts. • **explain** that function notation is not limited to $f(x)$ *(e.g.* $g(x), h(x), k(t)$*).*	**FSA Test Item Specifications** Assessed with F-IF.1.2 and F-IF.2.5 Clarifications • Students will use the definition of a function to determine if a relationship is a function, given tables, graphs, mapping diagrams, or sets of ordered pairs. Assessment Limits • Items may present relations in a variety of formats, including sets of ordered pairs, mapping diagrams, graphs, and input/output models. Stimulus Attributes • For F-IF.1.1, items may be set in a real-world or mathematical context. • Items must use function notation. **Calculator:** Neutral **Coherence:** • 8.IF.1.1 Students are introduced to the definition of a function and identifying them from tables, graphs, and equations. Function notation is introduced in Algebra 1.

UNIT 3 – INTRODUCTION TO FUNCTIONS (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.F-IF.1.2 ©℗ Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. **MFAS:** Cell Phone Battery Life Evaluating a Function Graphs and Functions What Is the Function Notation? What is the Value? **SMP: #7** **Math Nation - Algebra**	• **explain** how the output of a function is matched to its input. • **evaluate** a function for a given domain value. • **identify** the numbers that are not in the domain of a function, including real-world context. • **choose** and **analyze** inputs (and outputs) that make sense based on the problem.	**FSA Test Item Specifications** Assessed with F-IF.1.1 and F-IF.2.5 Clarifications • Students will evaluate functions that model a real-world context for inputs in the domain. • Students will interpret the domain of a function within the real-world context given. • Students will interpret statements that use function notation within the real-world context given. Assessment Limits • For F-IF.1.2, in items that require the student to find a value given a function, the following function types are allowed: quadratic, polynomials whose degrees are no higher than 6, square root, cube root, absolute value, exponential except for base e, and simple rational. Stimulus Attributes • For F-IF.1.2, items that require the student to evaluate may be written in a mathematical or real-world context. Items that require the student to interpret must be set in a real-world context. • Items must use function notation. Response Attributes • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. **Calculator:** Neutral

UNIT 3 – INTRODUCTION TO FUNCTIONS (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS. 912.F-IF.2.5 ©Ⓐ★ 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.* **MFAS:** Car Wash Describe the Domain Height vs. Shoe Size **SMP: #4** **Math Nation - Algebra**	**MODELING STANDARD** • **determine** what the domain for a function should be and create a graph that displays it. • **explain** why the function for a given context has a continuous or discrete domain or range. • **state** the appropriate domain of a function that represents a problem situation. • **explain** why numbers might be excluded from the domain. **connect** a function to the context it represents using quantities.	**FSA Test Item Specifications** Assessed with F-IF.1.2 and F-IF.1.1 Clarifications • Students will determine the feasible domain of a function that models a real-world context. Assessment Limits • In items requiring the student to find the domain from graphs, relationships may be on a closed or open interval. • In items requiring the student to find domain from graphs, relationships may be discontinuous. • Items may not require the student to use or know interval notation. Stimulus Attributes • For F-IF.2.5, items must be set in a real-world context. • Items must use function notation. Response Attributes • For F-IF.2.5, items may require the student to apply the basic modeling cycle. • Items may require the student to write domains using inequalities. **Calculator:** Neutral

UNIT 3 – INTRODUCTION TO FUNCTIONS (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS. 912.F-IF.2.4 ©★ For a function that models a relationship between two quantities, 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. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; ~~and periodicity~~.* **MFAS:** Bike Race Elevation Along a Trail Surf's Up Taxi Ride Uphill and Downhill (exclude last question on periodicity) **SMP: #1, 7, 8** **Math Nation - Algebra**	**MODELING STANDARD** • **find** the key features of the graphs and tables of a function. • **interpret** the meaning of an ordered pair. • **determine** if negative inputs and/or outputs make sense in the problem. • **identify** and **explain** the *x* and *y*-intercept and what it means in a problem situation. • **explain** that a function can have only one *y*-intercept but can have more than one *x*-intercept. • **define** whether the function is increasing and decreasing from a table, graph, or problem situation. • **define** and **identify** the relative maximums and minimums on a table, graph, or problem situation. • **identify** reflective symmetries in a table, graph, or problem situation. • **define** and **explain** positive and negative end behavior as the trend of a function's outputs as the input grows increasingly positive or negative. • **decide** which quantity should be used as the input when using a verbal or written description. • **identify** which parts of a verbal or written description indicate the function's key features. • **create** an approximation of a graph that could model a context.	**FSA Test Item Specifications** Assessed with F-IF.3.9 Clarifications • Students will determine and relate the key features of a function within a real-world context by examining the function's table. • Students will determine and relate the key features of a function within a real-world context by examining the function's graph. • Students will use a given verbal description of the relationship between two quantities to label key features of a graph of a function that model the relationship. • Students will differentiate between different types of functions using a variety of descriptors (e.g., graphically, verbally, numerically, and algebraically). Assessment Limits • Functions represented algebraically are limited to linear, quadratic, or exponential. • Functions may be represented using tables, graphs or verbally. Functions represented using these representations are not limited to linear, quadratic or exponential. • Functions may have closed domains. • Functions may be discontinuous. • Items may not require the student to use or know interval notation. • Key features include x-intercepts, y-intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior. Stimulus Attributes • For F-IF.2.4, items should be set in a real-world context. • Items may use verbal descriptions of functions. • Items must use function notation. Response Attributes • For F-IF.2.4, items may require the student to apply the basic modeling cycle. • Items may require the student to write intervals using inequalities. • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. **Calculator:** Neutral **Coherence:** • 8.F.2.4 Students are introduced to the y-intercept of a graph. • 8.F.2.5 Students analyze where a graph is increasing or decreasing, linear or nonlinear.

SECTION 3 – INTRODUCTION TO FUNCTIONS (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS. 912.F-IF.2.6 ©℗★ 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. **MFAS:** Estimating the Average Rate of Change Pizza Palace **MFAS:** ***tasks are listed in the individual function family Units*** **SMP #4, 5** **Math Nation - Algebra**	**MODELING STANDARD** • **define** and **explain** interval, rate of change and average rate of change. • **calculate** and **interpret** the average rate of change of a function, represented algebraically, a graph, or a table, or as a set of data, over a specific input interval. • **compare** the rates of change of two or more functions when they are represented with function notation, with a graph, or with a table. • **interpret** the meaning of the average rate of change (using units) in the context of the problem.	**FSA Test Item Specifications** Assessed with S-ID.3.7 Clarifications • Students will calculate the average rate of change of a continuous function that is represented algebraically, in a table of values, on a graph, or as a set of data. • Students will interpret the average rate of change of a continuous function that is represented algebraically, in a table of values, on a graph, or as a set of data with a real-world context. Assessment Limits • Items requiring the student to calculate the rate of change will give a specified interval that is both continuous and differentiable. • Items assessing F-IF.2.6 should not be linear. Stimulus Attributes • Items may require the student to apply the basic modeling cycle. • Items should be set in a real-world context. • Items must use function notation. • Items may require the student to choose and interpret variables. Response Attributes • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. **Calculator:** Neutral **Coherence:** • 8.F.B.4 Student identify the rate of change from tables, graphs, equations, and verbal descriptions of linear relationships. Students calculate slope of a line using the rise to run ratio.

UNIT 3 – INTRODUCTION TO FUNCTIONS (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.F-BF.2.3 ℂ ℙ Identify the effect on the graph of replacing $f(x)$ by $f(x)+k$, $kf(x)$, $f(kx)$, and $f(x+k)$ for specific values of k (both positive and negative); find the value of k given the graphs. 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.* **MFAS:** ***tasks are listed in the individual function family Units*** **SMP #5, 7** **Math Nation - Algebra**	• **explain** why $f(x)+k$ translates the original graph of $f(x)$ up k units and why $f(x)-k$ translates the original graph of $f(x)$ down k units. • **explain** why $f(x+k)$ translates the original graph of $f(x)$ left k units and why $f(x-k)$ translates the original graph of $f(x)$ right k units. • **explain** why $kf(x)$ vertically stretches or shrinks the graph of $f(x)$ by a factor of k and predict whether a given value of k will cause a stretch or a shrink. • **explain** why $f(kx)$ horizontally stretches or shrinks the graph of $f(x)$ by a factor of $\frac{1}{k}$ and predict whether a given value of k will cause a stretch or a shrink. • **describe** the transformation that changed a graph of $f(x)$ into a different graph when given pictures of the pre-image and image.	**FSA Test Item Specifications** Clarifications • Students will determine the value of k when given a graph of the function and its transformation. • Students will identify differences and similarities between a function and its transformation. • Students will identify a graph of a function given a graph or a table of a transformation and the type of transformation that is represented. • Students will graph by applying a given transformation to a function. • Students will identify ordered pairs of a transformed graph. • Students will complete a table for a transformed function. Assessment Limits • Functions represented algebraically are limited to linear, quadratic, or exponential. • Functions represented using tables or graphs are not limited to linear, quadratic, or exponential. • Functions may be represented using tables or graphs. • Functions may have closed domains. • Functions may be discontinuous. • Items should have a single transformation. Stimulus Attributes • Items should be given in a mathematical context. • Items must use function notation. • Items may present a function using an equation, a table of values, or a graph. Response Attributes • Items may require the student to explain or justify a transformation that has been applied to a function. • Items may require the student to explain how a graph is affected by a value of k. • Items may require the student to find the value of k. • Items may require the student to complete a table of values. **Calculator:** Neutral Note: Our resources identify transformations using the variables *a*, *h* and *k*. The standard and assessments only use *k*. The translation is based on the position of the variable, not the letter of the variable.

UNIT 4 – LINEAR EQUATIONS, FUNCTIONS, AND INEQUALITIES

These standards should be included within this Unit as they apply to Linear Functions.

MAFS.912.F-BF.2.3 **MFAS:** Comparing Functions - Linear
MAFS. 912.F-IF.1.1
MAFS.912.F-IF.1.2
MAFS. 912.F-IF.2.5
MAFS. 912.F-IF.2.4
MAFS. 912.F-IF.2.6 **MFAS:** Identifying Rate of Change

Standard ***The students will:***	**Success Criteria** ***I know I am successful when I can:***	**Instructional Notes**
MAFS.912.A-CED.1.3 ©Ⓐ★ Represent constraints by equations or inequalities, ~~and by systems of equations and/or inequalities~~, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* **MFAS:** Constraints on Equations **SMP #4** **Math Nation - Algebra**	**MODELING STANDARD** • **create** equations and inequalities that best models the constraints of a real-world problem. **interpret** the solution of a real-world context as viable or not viable.	**FSA Test Item Specifications** Clarifications • Students will write constraints for a real-world context using equations or inequalities. • Students will interpret the solution of a real-world context as viable or not viable. Assessment Limits • In items that require the student to write an equation as a constraint, the equation may be a linear function. Stimulus Attributes • Items must be set in a real-world context. • Items may use function notation. Response Attributes • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. • Items may require the student to apply the basic modeling cycle. **Calculator:** Neutral

UNIT 4 – LINEAR EQUATIONS, FUNCTIONS, AND INEQUALITIES (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.S-ID.3.7 ©★ Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. **MFAS:** Bungee Cord Model Intercept for Life Expectancy Slope for Life Expectancy **SMP: #2, 4, 5** **Math Nation - Algebra**	**MODELING STANDARD** • **interpret** the meaning of the slope in terms of the units stated in the data. • **interpret** the meaning of the y-intercept in terms of the units stated in the data.	**FSA Test Item Specifications** Assessed with F-IF.2.6 Clarifications • Students will interpret the average rate of change of a continuous function that is represented algebraically, in a table of values, on a graph, or as a set of data with a real-world context. • Students will interpret the y-intercept of a linear model that represents a set of data with a real-world context. Assessment Limits • Items should not require the student to find an equation of a line. • Items assessing S-ID.3.7 should include data sets. Data sets must contain at least six data pairs. The linear function given in the item should be the regression equation. • For items assessing S-ID.3.7, the rate of change and the y-intercept should have a value with at least a hundredths place value. Stimulus Attributes • Items may require the student to apply the basic modeling cycle. • Items should be set in a real-world context. • Items must use function notation. • Items may require the student to choose and interpret variables. Response Attributes • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. **Calculator:** Neutral **Coherence:** • 8.F.2.4 Students identify the slope and y-intercept from tables, graphs, equations, and verbal descriptions of linear relationships and construct a function. • 8.SP.1.3 Students interpret the slope and intercept for the context of bivariate measurement data.

UNIT 4 – LINEAR EQUATIONS, FUNCTIONS, AND INEQUALITIES (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.F-LE.2.5 ©★ Interpret the parameters in a linear ~~or exponential~~ function in terms of a context. **MFAS:** Computer Repair Lunch Account **SMP #2, 4** **Math Nation - Algebra**	**MODELING STANDARD** • **identify** the names and definitions of the parameters m and b in the linear function $f(x) = mx + b$. • **explain** the meaning of the slope of a line when the line models a real-world relationship. • **explain** the meaning of the y-intercept and other points on the line when the line models a real-world relationship.	**FSA Test Item Specifications** Assessed with F-LE.1.1 Clarifications • Students will interpret the rate of change and intercepts of a linear function when given an equation that models a real-world context. Stimulus Attributes • Items should be set in a real-world context. • Items must use function notation. Response Attributes • Items may require the student to apply the basic modeling cycle. • Items may require the student to choose a parameter that is described within the real-world context. • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. **Calculator:** Neutral **Coherence:** • 8.F.2.4 Students identify the slope and y-intercept from tables, graphs, equations, and verbal descriptions of linear relationships and construct a function.

UNIT 4 – LINEAR EQUATIONS, FUNCTIONS, AND INEQUALITIES (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.F-IF.3.7a ℂℙ Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated functions. a. Graph linear ~~and quadratic~~ functions and show intercepts, maxima, and minima. ~~b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.~~ ~~c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.~~ ~~d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.~~ ~~e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.~~ **MFAS:** Graphing a Linear Function **SMP: #7, 8** **Math Nation - Algebra**	**MODELING STANDARD** • **identify** the key features of a linear function by looking at its graph (intercepts and rates of change) • **identify** that the parent function for lines is $f(x) = x$. • **graph** linear functions by using transformations of the parent functions. • **identify** the point-slope form of a linear function as $y - y_1 = m(x - x_1)$. • **graph** a line in point-slope form and use the graph to show where the starting point (x_1, y_1) and the slope (m) are represented on the graph. • **identify** the slope-intercept form of a linear function as $f(x) = mx + b$. • **graph** a line in slope-intercept form and use the graph to show where the y-intercept (b) and the slope (m) are represented on the graph. • **identify** the standard form of a linear function as $Ax + By = C$. • **use** the definitions of x-intercept and y-intercept to find the intercepts of a standard form line and graph the line. • **relate** the constants $A, B,$ and C to the values of the x-intercept, y-intercept, and slope.	**FSA Test Item Specifications** **Assessed with F-IF.3.8 and A-APR.2.3** Clarifications • Students will identify the $x-$ and $y-$intercepts and the slope of the graph of a linear function. • Students will graph a linear function using key features. • Students will identify and interpret key features of a graph within the real-world context that the function represents. Assessment Limits • For F-IF.3.7, items are limited to linear, ~~quadratic, and exponential~~ functions. Stimulus Attributes • Items may require the student to identify a correct graph. • Items may be set in a mathematical or real-world context. • For F-IF.3.7, items may use an equation or a function. Response Attributes • For F-IF.3.7, items may require the student to apply the basic modeling cycle. • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. • Items may require the student to provide the answer in a specific form. **Calculator:** Neutral

UNIT 4 – LINEAR EQUATIONS, FUNCTIONS, AND INEQUALITIES (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.A-CED.1.2 ⓒⓟⓐ★ Create equation in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales **MFAS:** Tech Repairs Tech Repairs Graph **SMP #4** **Math Nation - Algebra**	**MODELING STANDARD** • **identify** the variables and quantities represented in a real-world problem. • **create** a system of equations or inequalities with two variables. • **graph** a system equations or inequalities on the coordinate plane that represent all possible solutions to a real-world problem using appropriate labels and scales	**FSA Test Item Specifications** Assessed with A-REI.3.5, A-REI.3.6, and A-REI.4.12 Clarifications • Students will identify the quantities in a real-world situation that should be represented by distinct variables. Stimulus Attributes • Items assessing A-CED.1.2 must be placed in a real-world context. Response Attributes • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. • For A-CED.1.2, items may require the student to apply the basic modeling cycle. **Calculator:** Neutral **Coherence:** • 8.F.2.4 Students identify the slope and y-intercept from tables, graphs, equations, and verbal descriptions of linear relationships and construct a function.
MAFS.912.A-REI.4.12 ⓟ Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), ~~and graph the solution set to a system of linear inequalities in two variables as the intersection of corresponding half-planes.~~ **MFAS:** Graphing Linear Inequalities Linear Inequalities in the Half-Plane **SMP #5** **Math Nation - Algebra**	• **define** linear inequality, half-plane, and boundary. • **graph** a linear inequality of a coordinate plane, resulting in a boundary line (solid or dashed) and a shaded half-plane. • **solve** problems involving a single linear inequality graphically.	**FSA Test Item Specifications** Assessed with A-CED.1.2, A-REI.3.5, A-REI.3.6 Clarifications • Students will identify the graph that represents a linear inequality. • Students will graph a linear inequality. Stimulus Attributes • Items assessing A-REI.4.12 may be set in a real-world or mathematical context. Response Attributes • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. **Calculator:** Neutral **Coherence:** • 7.EE.2.4b Students create, solve, and graph inequalities of the form $px + q > r$ or $px + q < r$, where $p, q,$ and r are specific rational numbers.

UNIT 5 – SYSTEMS OF LINEAR EQUATIONS AND INEQUALITIES

Standard ***The students will:***	**Success Criteria** ***I know I am successful when I can:***	**Instructional Notes**
MAFS.912.A-CED.1.2 Ⓒ Ⓟ Ⓐ ★ Create equation in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **MFAS:** **SMP #4** **Math Nation - Algebra**	**MODELING STANDARD** • **define** system of linear equations and solution of a system • **identify** the variables and quantities represented in a real-world problem. • **create** a system of equations or inequalities with two variables. • **graph** a system equations or inequalities on the coordinate plane that represent all possible solutions to a real-world problem using appropriate labels and scales	**FSA Test Item Specifications** Assessed with A-REI.3.5, A-REI.3.6, and A-REI.4.12 Clarifications • Students will identify the quantities in a real-world situation that should be represented by distinct variables. • Students will write a system of equations given a real-world situation. Assessment Limits • Items that require the student to write a system of equations using a real-world context are limited to a system of 2 x 2 linear equations. Stimulus Attributes • Items assessing A-CED.1.2 must be placed in a real-world context. Response Attributes • For A-CED.1.2, items may require the student to apply the basic modeling cycle. **Calculator:** Neutral **Coherence:** • 8.EE.3.8 Students analyze and solve (graphically, algebraically, and by inspection) pairs of simultaneous linear equations.

UNIT 5 – SYSTEMS OF LINEAR EQUATIONS AND INEQUALITIES (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.A-CED.1.3 ©Ⓐ★ Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.* **MFAS:** Sugar and Protein The New School **SMP #4** **Math Nation - Algebra**	**MODELING STANDARD** • **create** equations and inequalities that best models the constraints of a real-world problem. • **create** a system of equations and inequalities that best models the constraints of a real-world problem. • **interpret** the solution of a real-world context as viable or not viable.	**FSA Test Item Specifications** Clarifications • Students will write constraints for a real-world context using a system of equations, or a system of inequalities. • Students will interpret the solution of a real-world context as viable or not viable. Assessment Limits • In items that require the student to write a system of equations to represent a constraint, the system is limited to two variables. • In items that require the student to write a system of inequalities to represent a constraint, the system is limited to two variables. Stimulus Attributes • Items must be set in a real-world context. • Items may use function notation. Response Attributes • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. • Items may require the student to apply the basic modeling cycle. **Calculator:** Neutral

UNIT 5 – SYSTEMS OF LINEAR EQUATIONS AND INEQUALITIES (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.A-REI.3.6 (P) Solve systems of linear equations exactly and approximately (with graphs), focusing on pairs of linear equations in two variables. **MAFS:** Apples and Peaches Solving a System of Equations – 1 Solving a System of Equations – 2 Solving a System of Equations - 3 **SMP # 5, 7** **Math Nation - Algebra**	• **explain** why and **identify** when some linear systems have no solutions or infinitely many solutions. • **identify** systems whose solutions would be the same through examination of the coefficients. • **solve** a system of linear equations algebraically (by substitution or elimination) to find an exact solution. • **graph** a system of linear equations using appropriate axis labels and scale and determine the approximate solution by estimating the point of intersection. • **explain** the steps in an algebraic proof that shows one equation being replaced with another to find a solution for a system of equations. • **explain** why a method was chosen when solving a system of equation.	**FSA Test Item Specifications** Assessed with A-CED.1.2, A-REI.3.5, A-REI.4.12 Clarifications • Students will graph a system of equations that represents a real-world context using appropriate axis labels and scale. • Students will solve systems of linear equations. • Students will provide steps in an algebraic proof that shows one equation being replaced with another to find a solution for a system of equations. • Students will identify systems whose solutions would be the same through examination of the coefficients. Assessment Limits • Items that require the student to solve a system of equations are limited to a system of 2 x 2 linear equations. • Items that require the student to graph a system of equations to find the solution are limited to a 2 x 2 system. Stimulus Attributes • Items assessing A-REI.3.6 may be set in a real-world or mathematical context. • Items may result in infinitely many solutions or no solution. Response Attributes • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. **Calculator:** Neutral **Coherence:** • 8.EE.3.8 Students analyze and solve (graphically, algebraically, and by inspection) pairs of simultaneous linear equations.

UNIT 5 – SYSTEMS OF LINEAR EQUATIONS AND INEQUALITIES (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.A-REI.4.11 ℂ ℙ ★ 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, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, ~~polynomial, rational, absolute value, exponential, and logarithmic~~ functions. **SMP #5** **Math Nation - Algebra**	**MODELING STANDARD** • **explain** that a point of intersection on the graph of a system of equations represents a solution to both equations. • **verify** that the *x*-coordinate of the points of intersections are solutions for $f(x) = g(x)$. • **determine** the approximate solutions to a system of equations using a graph or a table of values.	**FSA Test Item Specifications** Assessed with A-REI.4.10 <u>Clarifications</u> • Students will find a solution or an approximate solution for $f(x) = g(x)$ using a graph. • Students will find a solution or an approximate solution for $f(x) = g(x)$ using a table of values. • Students will find a solution or an approximate solution for $f(x) = g(x)$ using successive approximations that give the solution to a given place value. • Students will justify why the intersection of two functions is a solution to $f(x) = g(x)$. <u>Assessment Limits</u> • In items where a function is represented by an equation, the function may be a linear function. • In items where a function is represented by a graph or table, the function may be any continuous function. <u>Stimulus Attributes</u> • Items may be set in a mathematical or real-world context. • Items may use function notation. • Items must designate the place value accuracy necessary for approximate solutions. <u>Response Attributes</u> • Items may require the student to complete a missing step in an algebraic justification of the solution of $f(x) = g(x)$. • Items may require the student to explain the role of the x-coordinate and the y-coordinate in the intersection of $f(x) = g(x)$. • Items may require the student to explain a process. • Items may require the student to record successive approximations used to find the solution of $f(x) = g(x)$. **Calculator:** Neutral

UNIT 5 – SYSTEMS OF LINEAR EQUATIONS AND INEQUALITIES (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.A-REI.3.5 © Prove that given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. **MFAS:** Solution Sets of Systems Solving Systems **SMP # 3** **Math Nation - Algebra**	• **recall** that equivalent equations result when an equation is multiplied by the same number on both sides of the equal sign. • **prove** that replacing one equation with the sum of that equation and a multiple of the other creates a system with the same solutions as the original system.	**FSA Test Item Specifications** Assessed with A-CED.1.2, A-REI.3.6, A-REI.4.12 Clarifications • Students will provide steps in an algebraic proof that shows one equation being replaced with another to find a solution for a system of equations. • Students will identify systems whose solutions would be the same through examination of the cooefficients. Assessment Limits • Items that require the student to solve a system of equations are limited to a system of 2 x 2 linear equations. Stimulus Attributes • Items assessing A-REI.3.5 must be placed in a mathematical context. **Calculator:** Neutral **Coherence:** • 8.EE.3.8 Students analyze and solve (graphically, algebraically, and by inspection) pairs of simultaneous linear equations.

UNIT 5 – SYSTEMS OF LINEAR EQUATIONS AND INEQUALITIES (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.A-REI.4.12 ℙ ~~Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and~~ graph the solution set to a system of linear inequalities in two variables as the intersection of corresponding half-planes. **MFAS:** Graph a System of Inequalities Which Graph? **SMP #5** **Math Nation - Algebra**	• **define** linear inequality, half-plane, and boundary. • **graph** a linear inequality of a coordinate plane, resulting in a boundary line (solid or dashed) and a shaded half-plane. • **graph** the solution set to a system of linear inequalities on a coordinate plane. • **explain** that the solutions set for a system of linear inequalities is the intersection of the shaded regions (half-planes) of both inequalities. • **verify** points in the intersection of the half-planes to check if they represent a solution to the system. **solve** problems involving a single linear inequality or systems of linear inequalities graphically.	**FSA Test Item Specifications** Assessed with A-CED.1.2, A-REI.3.5, A-REI.3.6 Clarifications • Students will identify the solution set to a system of inequalities. • Students will identify ordered pairs that are in the solution set of a system of inequalities. • Students will graph the solution set to a system of inequalities. Assessment Limits • Items that require the student to graph a system of inequalities to find the solution are limited to a 2 x 2 system. Stimulus Attributes • Items assessing A-REI.4.12 may be set in a real-world or mathematical context. • Items may result in infinitely many solutions or no solution. Response Attributes • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. **Calculator:** Neutral **Coherence:** • 7.EE.2.4b Students create, solve, and graph inequalities of the form $px + q > r$ or $px + q < r$, where $p, q,$ and r are specific rational numbers. • 8.EE.3.8 Students analyze and solve (graphically, algebraically, and by inspection) pairs of simultaneous linear equations.

UNIT 6 – EXPONENTIAL AND RADICAL FUNCTIONS

These standards should be included within this Unit as they apply to Exponential Functions. MAFS.912.F-BF.2.3 **MFAS: Comparing Functions - Exponential (Note: task suggests using technology but can be done pencil/paper)** MAFS. 912.F-IF.1.1 MAFS.912.F-IF.1.2 MAFS. 912.F-IF.2.5 MAFS. 912.F-IF.2.4 MAFS. 912.F-IF.2.6 **MFAS: Air Cannon**		
Standard ***The students will:***	**Success Criteria** ***I know I am successful when I can:***	**Instructional Notes**
MAFS.912.A-CED.1.1 ©℗Ⓐ★ Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from ~~linear and quadratic functions, simple rational, absolute, and~~ exponential functions.* **MFAS:** Follow Me **SMP: # 4** **Math Nation - Algebra**	**MODELING STANDARD** • **identify** the variables and quantities represented in a real-world problem. • **create** one variable equations or inequalities that best models the problem. • **solve** equations or inequalities that model real-world problems	**FSA Test Item Specifications** Assessed with A-REI.2.3 and A-CED.1.4 Clarifications • Students will write an equation in one variable that represents a real-world context. Assessment Limits • In items that require the student to write an equation, equations are limited to exponential functions with one translation. • In items that require the student to write an exponential function given ordered pairs, at least one pair of consecutive values must be given. • Items may require the student to recognize equivalent expressions but may not require a student to perform an algebraic operation outside the context of Algebra 1. Stimulus Attributes • Items assessing A-CED.1.1 must be placed in real-world context. Response Attributes • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret unit • Items may require the student to choose and interpret units. • For A-CED.1.1, items may require the student to apply the basic modeling cycle. **Calculator:** Neutral

UNIT 6 – EXPONENTIAL AND RADICAL FUNCTIONS (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.A-CED.1.2 ⓒⓟⓐ★ Create equation in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **MFAS:** Loss of Fir Trees Trees in Trouble **SMP #4** **Math Nation - Algebra**	**MODELING STANDARD** • **identify** the variables and quantities represented in a real-world problem. • **create** equations with two variables. • **graph** equations on the coordinate plane that represent all possible solutions to a real-world problem using appropriate labels and scales.	**FSA Test Item Specifications** Assessed with A-REI.3.5, A-REI.3.6, and A-REI.4.12 Clarifications • Students will identify the quantities in a real-world situation that should be represented by distinct variables. Stimulus Attributes • Items assessing A-CED.1.2 must be placed in a real-world context. Response Attributes • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. • For A-CED.1.2, items may require the student to apply the basic modeling cycle. **Calculator:** Neutral

UNIT 6 – EXPONENTIAL AND RADICAL FUNCTIONS (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.F-IF.3.7e ©℗★ Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ~~a. Graph linear and quadratic functions and show intercepts, maxima, and minima.~~ ~~b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.~~ ~~c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.~~ ~~d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.~~ e. Graph exponential ~~and logarithmic~~ functions, showing intercepts and end behavior, ~~and trigonometric functions, showing period, midline, and amplitude, and using phase shift.~~ **MFAS:** Graphing an Exponential Function **SMP #7, 8** **Math Nation - Algebra**	**MODELING STANDARD** • **identify** intercepts and end behavior (horizontal asymptote) for an exponential function within the real-world context that the function represents. • **explain** that the parent function for exponentials is $f(x) = b^x$ where b is a positive number. • **determine** the domain and range of an exponential function when looking at its graph. • **classify** exponential functions in function notation as growth or decay. • **substitute** convenient values for x to generate a table and graph of an exponential function. • **explain** how a simple geometric transformation changes a growth graph to a decay graph. • **graph** exponential functions using key features including transformations. • **identify** data that displays exponential behavior.	**FSA Test Item Specifications** Assessed with F-IF.3.8 and A-APR.2.3 Clarifications • Students will identify intercepts and end behavior for an exponential function. • Students will graph an exponential function using key features. • Students will identify and interpret key features of a graph within the real-world context that the function represents. Assessment Limits • For F-IF.3.7, items are limited to linear, quadratic, and exponential functions. • For F-IF.3.7e, exponential functions are limited to simple exponential growth and decay functions and to exponential functions with one translation. Base e should not be used. Stimulus Attributes • Items may require the student to identify a correct graph. • Items may be set in a mathematical or real-world context. • For F-IF.3.7, items may use an equation or a function. Response Attributes • For F-IF.3.7, items may require the student to apply the basic modeling cycle. • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. • Items may require the student to provide the answer in a specific form. **Calculator:** Neutral

UNIT 6 – EXPONENTIAL AND RADICAL FUNCTIONS (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.F-IF.3.8b ℂ ℙ Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. ~~a. 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.~~ b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as* $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, *and* $y = (1.2)^{\frac{t}{10}}$ *and classify them as representing exponential growth or decay.* **MFAS:** Exponential Functions - 1 Exponential Functions - 2 **SMP #2, 7** **Math Nation - Algebra**	• **distinguish** between exponential functions that model exponential growth and exponential decay and give the rate of growth or decay. • **interpret** the components of an exponential function in the context of a problem *(e.g.,* $y = 5 * 1.225^{\frac{t}{3}}$ *describes a quantity that was initially 5 and increases 22.5% every three years).* • **use** the properties of exponents to rewrite an exponential function to emphasize one of its properties *(e.g.,* $y = 5 * 1.225^{\frac{t}{3}} \approx 5 * 1.07^t$*, which means that increasing 22.5% in three years is about the same as increasing 7% per year)* and **determine** which form of the function is the most appropriate for interpretation for a real-world context. • **use** the properties of exponents to transform expressions. • **use** the properties of exponents to interpret expressions for exponential functions in a real-world context. • **determine** the growth or decay rate and express the rate as a percentage rate of change.	**FSA Test Item Specifications** Assessed with F-IF.3.7 and A-APR.2.3 Clarifications • Students will classify the exponential function as exponential growth or decay by examining the base, and students will give the rate of growth or decay. • Students will use the properties of exponents to interpret exponential expressions in a real-world context. • Students will write an exponential function defined by an expression in different but equivalent forms to reveal and explain different properties of the function, and students will determine which form of the function is the most appropriate for interpretation for a real-world context. Assessment Limits • For F-IF.3.8b, exponential functions are limited to simple exponential growth and decay functions and to exponential functions with one translation. Base e should not be used. • For F-IF.3.8, items may specify a required form using an equation or using common terminology such as standard form. Stimulus Attributes • Items may be set in a mathematical or real-world context. • For F-IF.3.8, items must use function notation. Response Attributes • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to provide the answer in a specific form. **Calculator:** Neutral

UNIT 6 – EXPONENTIAL AND RADICAL FUNCTIONS (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.F-LE.1.2  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). **MFAS:** What is the Function Rule Writing an Exponential Function From a Description Writing an Exponential Function From a Table Writing an Exponential Function From Its Graph **SMP #2, 7, 8** **Math Nation - Algebra**	**MODELING STANDARD** • **determine** if a function is exponential (geometric sequence) given a sequence, a graph, a verbal description or a table. • **determine** the common ratio between two terms in a geometric sequence. • **write** an exponential function from a geometric sequence, graph, table of values, or a description of the relationship. • **describe** the algebraic process used to construct the exponential function that passes through two points. • **construct** geometric sequences.	**FSA Test Item Specifications** **Assessed with F-BF.1.1 and F-IF.1.3** Clarifications • Students will write an exponential function, or a geometric sequence when given a graph that models a real-world context. • Students will write an exponential function, or a geometric sequence when given a verbal description of a real-world context. • Students will write an exponential function, or a geometric sequence when given a table of values or a set of ordered pairs that model a real-world context. Assessment Limits • In items where the student constructs an exponential function, a geometric sequence, or a recursive definition from input-output pairs, at least two sets of pairs must have consecutive inputs. • In items that require the student to construct arithmetic or geometric sequences, the real-world context should be discrete. • In items that require the student to construct an exponential function, the real-world context should be continuous. Stimulus Attributes • For F-LE.1.2, items should be set in a real-world context. Response Attributes • For F-LE.1.2, items may require the student to apply the basic modeling cycle. • In items where the student writes a recursive formula, the student may be expected to give both parts of the formula. • The student may be required to determine equivalent recursive formulas or functions. • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. **Calculator:** Neutral

UNIT 6 – EXPONENTIAL AND RADICAL FUNCTIONS (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.F-LE.2.5 ℂ★ Interpret the parameters in a ~~linear or~~ exponential function in terms of a context. **MFAS:** Interpreting Exponential Functions **SMP #2, 4** **Math Nation - Algebra**	**MODELING STANDARD** • **identify** the names and definitions of the parameters $a, b,$ and c in the exponential function $f(x) = a \cdot b^x + c$ • **explain** the meaning of the constant "a" of an exponential function when the exponential function models a real-world relationship. • **explain** the meaning of the constant "c" of an exponential function when it models a real-world relationship. • **interpret** the y-intercept, and/or rate of growth or decay of an exponential function given in a real-world context. • **compose** an original problem situation and construct an exponential function to model it.	**FSA Test Item Specifications** Clarifications • Students will interpret the x-intercept, y-intercept, and/or rate of growth or decay of an exponential function given in a real-world context. Assessment Limit • Exponential functions should be in the form $a(b)^x + k$. Stimulus Attributes • Items should be set in a real-world context. • Items must use function notation. Response Attributes • Items may require the student to apply the basic modeling cycle. • Items may require the student to choose a parameter that is described within the real-world context. • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. **Calculator:** Neutral

UNIT 7 – QUADRATIC EQUATIONS AND FUNCTIONS

These standards should be included within this Unit as they apply to Quadratic Functions.

MAFS.912.F-BF.2.3 **MFAS:** Comparing Functions - Quadratic
MAFS. 912.F-IF.1.1
MAFS.912.F-IF.1.2
MAFS. 912.F-IF.2.5
MAFS. 912.F-IF.2.4
MAFS. 912.F-IF.2.6
MAFS.912.A-APR.2.3 **MFAS:** Zeros of a Quadratic

Standard ***The students will:***	**Success Criteria** ***I know I am successful when I can:***	**Instructional Notes**
MAFS.912.A-SSE.2.3a.b ©℗★ Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeroes of the function it defines. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. ~~c. Use properties of exponents to transform expressions for exponential functions. *For example the expression* 1.15^t *can be rewritten as* $(1.15^{\frac{1}{12}})^{12t} \approx (1.012)^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*~~ **MFAS:** Jumping Dolphin Rocket Town **SMP: #7** **Math Nation - Algebra**	**MODELING STANDARD** • **find** the zeros of quadratic expressions and functions. • **identify** and **factor** perfect-square trinomials and difference of squares. • **use** pictures, algebra tiles, and/or symbols to explain the concept underlying completing the square. • **complete** the square to rewrite a quadratic expression $(ax^2 + bx + c)$ with the form $a(x - h)^2 + k$. • **explain** the connection between the completed square form of a quadratic expression and the maximum or minimum values of the function it defines.	**FSA Test Item Specifications** **Also assesses A-SSE.1.1 and A-SSE.1.2** Clarifications • Students will use equivalent forms of a quadratic expression to interpret the expression's terms, factors, zeros, maximum, minimum, coefficients, or parts in terms of the real-world situation the expression represents. Assessment Limits • Items that require the student to transform a quadratic equation to vertex form, $\frac{b}{a}$ must be an even integer. • For A-SSE.2.3a, quadratic expressions should be univariate. • For A-SSE.2.3b, items should only ask the student to interpret the y-value of the vertex within a real-world context. • For A-SSE.2.3, items should require the student to choose how to rewrite the expression. • In items that require the student to write equivalent expressions by factoring, the given expression may ➢ have integral common factors ➢ be a difference of two squares up to a degree of 4 ➢ be a quadratic, $ax^2 + bx + c$, where $a > 0$ and $a, b,$ and c are integers Stimulus Attributes • Items assessing A-SSE.2.3 must be set in a real-world context. • Items that require an equivalent expression found by factoring may be in a real-world or mathematical context. • Items should contain expressions only. • Items may require the student to provide the answer in a specific form. Response Attributes • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret units. • For A-SSE.2.3, items may require the student to apply the basic modeling cycle. **Calculator:** Neutral

UNIT 7 – QUADRATIC EQUATIONS AND FUNCTIONS (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.A-REI.2.4 ℙ Solve quadratic equations in one variable. a. 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 this form. b. Solve quadratic equations by inspection (e.g., for $x^2=49$), 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 $a\pm bi$ for real numbers a and b. **MFAS:** Complete the Square - 1 Complete the Square - 2 Complete the Square - 3 Complex Solutions? Quadratic Formula – 1 Quadratic Formula – 2 Which Strategy? **SMP: #7, 8** **Math Nation - Algebra**	• **solve** quadratic equations by inspection, finding square roots, completing the square, quadratic formula, and factoring. • **explain** why taking the square root of both sides when solving a quadratic equation will yield two solutions. • **use** pictures, algebra tiles, and/or symbols to explain the concept underlying completing the square. • **derive** the quadratic formula by completing the square of ax^2+bx+c. • **determine** and **justify** the best method to solve a quadratic equation in one variable.	**FSA Test Item Specifications** Clarifications • Students will rewrite a quadratic equation in vertex form by completing the square. • Students will use the vertex form of a quadratic equation to complete steps in the derivation of the quadratic formula. • Students will solve a simple quadratic equation by inspection or by taking square roots. • Students will solve a quadratic equation by choosing an appropriate method (i.e., completing the square, the quadratic formula, or factoring). • Students will validate why taking the square root of both sides when solving a quadratic equation will yield two solutions. • Students will recognize that the quadratic formula can be used to find complex solutions. Assessment Limits • In items that require the student to transform a quadratic equation to vertex form, b/a must be an even integer. • In items that require the student to solve a simple quadratic equation by inspection or by taking square roots, equations should be in the form $ax^2=c$ or $ax^2+d=c$, where $a, c,$ and d are rational numbers and where c is not an integer that is a perfect square and $c-d$ is not an integer that is a perfect square. • In items that allow the student to choose the method for solving a quadratic equation, equations should be in the form $ax^2+bx+c=d$, where a, b, c and d are integers. • Items may require the student to recognize that a solution is nonreal but should not require the student to find a nonreal solution. Stimulus Attributes • The formula must be given in the item for items that can only be solved using the quadratic formula. • Items should be set in a mathematical context. • Items may use function notation.

		<u>Response Attributes</u> • Items may require the student to complete a missing step in the derivation of the quadratic formula. • Items may require the student to provide an answer in the form $(x-p)^2=q$. • Items may require the student to recognize equivalent solutions to the quadratic equation. • Responses with square roots should require the student to rewrite the square root so that the radicand has no square factors. **Calculator:** Neutral **Coherence:** • 8.EE.1.2 Students solve equations containing square roots.

UNIT 7 - QUADRATIC EQUATIONS AND FUNCTIONS

Standard ***The students will:***	**Success Criteria** ***I know I am successful when I can:***	**Instructional Notes**
MAFS.912.F-IF.3.8a ℂ ℙ Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. 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. ~~b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as* $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, *and* $y = (1.2)^{\frac{t}{10}}$ *and classify them as representing exponential growth or decay.*~~ **MFAS:** Launch From a Hill A Home for Fido **SMP #2, 7** **Math Nation - Algebra**	• **explain** that there are three forms of quadratic functions: standard form $f(x) = ax^2 + bx + c$, vertex form $f(x) = a(x - h)^2 + k$ where the vertex is located at the point (h, k), and factored form $f(x) = a(x - x_1)(x - x_2)$ where x_1 and x_2 are x-intercepts of the function and that the graph of a quadratic function is a parabola. • **identify** and **graph** key features (zeros, intervals of increasing/decreasing, extrema, and axis of symmetry) of a quadratic when written in one of the three forms (x-intercepts, axis of symmetry, vertex) • **convert** a standard form quadratic to factored form by factoring and to vertex form by completing the square. • **write** the function that describes a parabola in all three forms when given a graph with x-intercepts, y-intercept, and vertex labeled. • **demonstrate** that the three forms of a quadratic produce the same values for the key features.	**FSA Test Item Specifications** **Assessed with F-IF.3.8 and A-APR.2.3** Clarifications • Students will identify zeros, extreme values, and symmetry of a quadratic function written symbolically. Assessment Limits • For F-IF.3.8a, items that require the student to transform a quadratic equation to vertex form, b/a must be an even integer. • For F-IF.3.8, items may specify a required form using an equation or using common terminology such as standard form. In items that require the student to interpret the vertex or a zero of a quadratic function within a real-world context, the student should interpret both the x-value and the y-value. Stimulus Attributes • Items may be set in a mathematical or real-world context. • For F-IF.3.8, items must use function notation. Response Attributes • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret units. • Items may require the student to provide the answer in a specific form. • Responses with square roots should require the student to rewrite the square root so that the radicand has no square factors. **Calculator:** Neutral

UNIT 7 - QUADRATIC EQUATIONS AND FUNCTIONS (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.A-CED.1.2 ⓒⓟⓐ★ Create equation in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **MFAS:** Hotel Swimming Pool Model Rocket **SMP #4** **Math Nation - Algebra**	**MODELING STANDARD** • **graph** equations on the coordinate plane that represent all possible solutions to a real-world problem using appropriate labels and scales	**FSA Test Item Specifications** Assessed with A-REI.3.5, A-REI.3.6, and A-REI.4.12 Clarifications • Students will identify the quantities in a real-world situation that should be represented by distinct variables. Stimulus Attributes • Items assessing A-CED.1.2 must be placed in a real-world context. Response Attributes • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • For A-CED.1.2, items may require the student to apply the basic modeling cycle. **Calculator:** Neutral

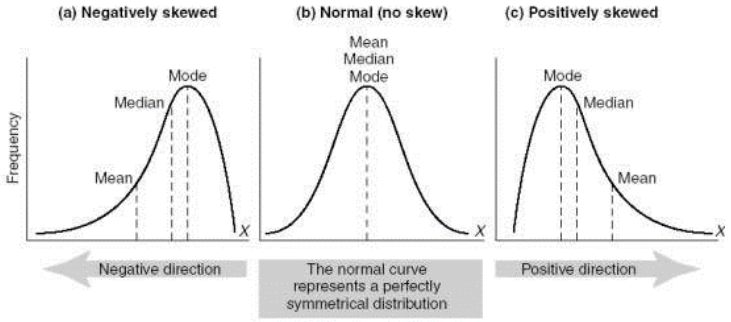
UNIT 7 - QUADRATIC EQUATIONS AND FUNCTIONS (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.F-IF.3.7a ℂ ℙ ★ Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated functions. a. Graph ~~linear and~~ quadratic functions and show intercepts, maxima, and minima. ~~b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.~~ ~~c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.~~ ~~d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.~~ ~~e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude, and using phase shift.~~ **MFAS:** Graphing a Quadratic Function **SMP: #7, 8** **Math Nation - Algebra**	**MODELING STANDARD** • **identify** the key features of a function by looking at its graph. • **explain** that the parent function for quadratic functions is the parabola $f(x) = x^2$. • **explain** that the minimum or maximum of a quadratic is called the vertex. • **identify** whether the vertex of a quadratic will be a minimum or maximum by looking at the equation. • **find** the y-intercept of a quadratic by substituting 0 for x and evaluating. • **estimate** the vertex of a quadratic by evaluating different values of x. • **graph** a quadratic function using key features. • **identify** and **interpret** key features of a graph within the real-world context that the function represents.	**FSA Test Item Specifications** Assessed with F-IF.3.8 and A-APR.2.3 Clarifications • Students will identify zeros, extreme values, and symmetry of the graph of a quadratic function. • Students will graph a quadratic function using key features. • Students will identify and interpret key features of a graph within the real-world context that the function represents. Assessment Limits • For F-IF.3.7, items are limited to linear, quadratic, and exponential functions. • For F-IF.3.7a, quadratic functions that are given in the form $y = ax^2 + bx + c$, $a, b,$ and c must be integers. Quadratic functions given in vertex form $y = a(x - h)^2 + k$, $a, h,$ and k must be integers. Quadratic functions given in other forms should be able to be rewritten and adhere to one of the two previous forms. Stimulus Attributes • Items may require the student to identify a correct graph. • Items may be set in a mathematical or real-world context. • For F-IF.3.7, items may use an equation or a function. Response Attributes • For F-IF.3.7, items may require the student to apply the basic modeling cycle. • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. • Items may require the student to provide the answer in a specific form. **Calculator:** Neutral

UNIT 8 – STATISTICS

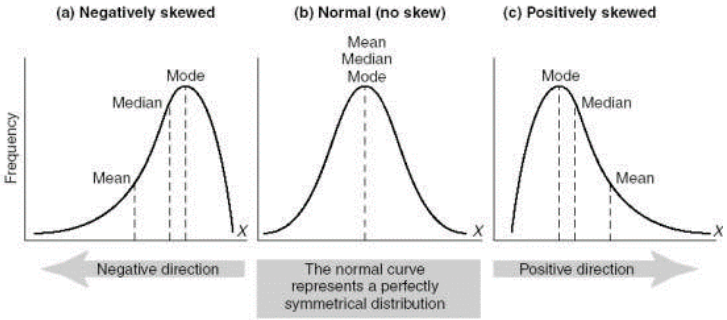
Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.S-ID.1.1  Represent data with plots on the real number line (dot plots, histograms, and box plots). **MFAS:** A Tomato Garden Flowering Trees Trees in the Park Winning Seasons **SMP #1, 5** **Math Nation - Algebra**	**MODELING STANDARD** • **choose** the best representation (dot plot, histogram, box plot) for a set of data. • **decide** if a representation preserves all the data values or presents only the general characteristics of a data set. • **construct** a histogram for a set of data. • **construct** a dot plot for a set of data and **choose** the appropriate scale to represent data on a number line. • **construct** a box plot based on the 5-number summary.	**FSA Test Item Specifications** Clarification • Students will represent data using a dot plot, a histogram, or a box plot. Stimulus Attribute • Items should use real-world data and be set in a real-world context. Response Attributes • Items may require the student to apply the basic modeling cycle. • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. **Calculator:** Neutral **Coherence:** • 6.SP.2.4 Students represent and interpret data on dot plots, box plots (also known as box and whisker plots), and histograms.

UNIT 8 – STATISTICS (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.S-ID.1.2 ©℗Ⓐ★ Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. **MFAS:** How Many Jeans Texting During Lunch Texting During Lunch Histograms **SMP #1, 5** **Math Nation - Algebra**	**MODELING STANDARD** • **identify** and **interpret** the similarities and differences in the shape, center, and spread of a data set and within real-world context if given. • **describe** the center of the data distribution (mean or median). • **choose** the histogram with the largest mean when shown several histograms. • **describe** the spread of the data distribution (interquartile range or standard deviation). • **choose** the histogram with the greatest standard deviation when shown several histograms. • **choose** the box-and-whisker plot with the greatest interquartile range when shown several box-and-whisker plots. • **understand** and be able to **identify** which measure of center and spread are appropriate depending of the shape of the distribution. • **recognize** the mean moves towards a skew or extreme value.  • **identify** the outliers for the data set. • **predict** the effect an outlier will have on the shape, center, and spread of a data set. • **decide** whether to include the outliers as part of the data set or to remove them. • **use** their understanding of normal distribution and the empirical rule to answer questions about data sets.	**FSA Test Item Specifications** Clarifications • Students will identify similarities and differences in shape, center, and spread when given two or more data sets. Assessment Limits • Items may require the student to calculate mean, median, and interquartile range for the purpose of identifying similarities and differences. • Items should not require the student to calculate the standard deviation. • Items should not require the student to fit normal curves to data. Data distributions should be approximately normal. • Data sets should be real-world and quantitative. Stimulus Attributes • In items that require standard deviation, the value should be given in the stem. • Items should use real-world data and be set in a real-world context. Response Attributes • Items may require the student to apply the basic modeling cycle. • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. • Items should not require the student to determine whether a distribution is left- or right-skewed. **Calculator:** Neutral **Coherence:**

		• 6.SP.1.2 Students describe the center, spread, and overall shape of a set of data. Students create a line plot, histogram, and box plot. • 6.SP.1.3 Students calculate measures of center (mean, median, mode) and measure of spread (range). • 6.SP.2.5 Students collect, organize, and analyze data. Students calculate the Mean Absolute Deviation (MAD). • 7.SP.2.3 Students compare statistics on two data sets. • 7.SP.2.4 Students draw comparative inferences about two populations.

UNIT 8 – STATISTICS (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.S-ID.1.3 ©★ Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). **MFAS:** Comparing Distributions Total Points Scored Using Centers to Compare Tree Heights Using Spread to Compare Tree Heights **SMP #1, 5** **Math Nation - Algebra**	• **identify** and **interpret** the similarities and differences in the shape, center, and spread of a data set and within real-world context if given. • **describe** the center of the data distribution (mean or median). • **choose** the histogram with the largest mean when shown several histograms. • **describe** the spread of the data distribution (interquartile range or standard deviation). • **choose** the histogram with the greatest standard deviation when shown several histograms. • **choose** the box-and-whisker plot with the greatest interquartile range when shown several box-and-whisker plots. • **understand** and be able to **identify** which measure of center and spread are appropriate depending of the shape of the distribution. • **recognize** the mean moves towards a skew or extreme value.  • **identify** the outliers for the data set. • **predict** the effect an outlier will have on the shape, center, and spread of a data set. • **decide** whether to include the outliers as part of the data set or to remove them. • **use** their understanding of normal distribution and the empirical rule to answer questions about data sets.	**FSA Test Item Specifications** Clarifications • Students will predict the effect that an outlier will have on the shape, center, and spread of a data set. • Students will interpret similarities and differences in shape, center, and spread when given two or more data sets within the real-world context given. Assessment Limits • Items may require the student to calculate mean, median, and interquartile range for the purpose of identifying similarities and differences. • Items should not require the student to calculate the standard deviation. • Items should not require the student to fit normal curves to data. Data distributions should be approximately normal. • Data sets should be real-world and quantitative. Stimulus Attributes • In items that require standard deviation, the value should be given in the stem. • Items should use real-world data and be set in a real-world context. Response Attributes • Items may require the student to apply the basic modeling cycle. • Items may require the student to choose an appropriate level of accuracy. • Items may require the student to choose and interpret the scale in a graph. • Items may require the student to choose and interpret units. • Items should not require the student to determine whether a distribution is left- or right-skewed. **Calculator:** Neutral **Coherence:** • 6.SP.1.2 Students describe the center, spread, and overall shape of a set of data. Students create a line plot, histogram, and box plot. • 6.SP.2.5 Students collect, organize, and analyze data. Students calculate the Mean Absolute Deviation (MAD).

UNIT 8 – STATISTICS (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.S-ID.1.4 ©℗Ⓐ★ Use the mean and standard deviation data set to fit it to a normal distribution and to estimate population percentages. 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. **SMP #2, 7** **Math Nation - Algebra**	**MODELING STANDARD** • **use** the mean and standard deviation of a set of data to fit the data to a normal curve • **use** the 68-95-99.7 Empirical Rule to estimate the percent of a normal population that falls within 1, 2, 3 standard deviations of the mean • **recognize** that normal distributions are only appropriate for unimodal and symmetric shapes • **estimate** the area under a normal curve using a calculator, table, or spreadsheet	

UNIT 9 – Definitions and Constructions

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.G-CO.1.1 © Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. **MFAS:** Definition of Angle Definition of a Circle Definition of Perpendicular Lines Definition of Parallel Lines Definition of Line Segment **Math Nation - Geometry** **SMP #6**	• **identify** the undefined notions used in geometry (point, line, plane, distance) and describe their characteristics • **identify** angles, perpendicular lines, parallel lines, rays, and line segments. • **define** angles, perpendicular lines, parallel lines, rays, and line segments precisely using the undefined terms and "if-then" (conditional) and "if-and-only-if" (bi-conditional) statements.	Note: Address converse statements, but not inverse nor contrapositive statements. Clarification • Students will use the precise definitions of angles, circles, perpendicular lines, parallel lines, and line segments, basing the definitions on the undefined notions of point, line, distance along a line, and distance around a circular arc. Stimulus Attributes • Items may be set in a real-world or mathematical context • Items may require the student to analyze possible definitions to determine mathematical accuracy. • Items may require the student to use definitions for justifications when choosing examples or nonexamples. • Items may require the student to use properties of rotations, reflections, and translations as steps to a formal definition. **Calculator:** Neutral

UNIT 9 – Definitions and Constructions (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.G-CO.1.4 © Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. **MFAS:** Define a Rotation Define a Reflection Define a Translation **Math Nation - Geometry** **SMP #6**	• **define** pre-image and image, and use correct notation (A vs. A') • **mode**l the reflection definition by connecting any point on the pre-image to its corresponding point on the reflected image and describing the line segment's relationship to the line of reflection. • **model** the translation definition by connecting any point on the pre-image to its corresponding point on the translated image, and connecting a second point on the pre-image to its corresponding point on the translated image, and describing how the two segments are equal in length, point in the same direction, and are parallel. • **model** the rotation definition by connecting the center of rotation to any point on the pre-image and to its corresponding point on the rotated image, and describing the measure of the angle formed and the equal measures of the segments that formed the angle as part of the definition.	**Assessed with G-CO.1.2** Clarification • Students will use definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments. Stimulus Attributes • Items may ask the student to determine if steps that are given can be used to develop a definition of an angle, a circle, perpendicular lines, parallel lines, or line segments by using rotations, reflections, and translations. Response Attributes • Items may require the student to determine if a verbal description of a definition is valid. • Items may require the student to determine any flaws in a verbal description of a definition. • Items may require the student to be familiar with slope-intercept form of a line, standard form of a line, and point-slope form of a line. • Items may require the student to give a line of reflection and/or a degree of rotation that carries a figure onto itself. • Items may require the student to draw a figure using a description of a translation. **Calculator:** Neutral **Coherence:** • 7.G.1.1 Introduced dilations. • 8.G.1.1 Introduced rotations, reflections, and translations.

UNIT 9 – Definitions and Constructions (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.G-CO.1.3 © Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself. **MFAS:** Transformations of Rectangles and Squares Transformations of Parallelograms and Rhombi Transformations of Trapezoids Transformations of Regular Polygons **Math Nation - Geometry** **SMP #7**	• **describe** and **illustrate** how a rectangle, parallelogram, and trapezoid are mapped onto themselves using transformations. • **calculate** the number of lines of reflection symmetry and the degree of rotational symmetry of any regular polygon.	**Assessed with G-CO.1.5** Clarifications • Students will specify a sequence of transformations that will carry a figure onto another. • Students will describe rotations and reflections that carry a geometric figure onto itself. Assessment Limits • Items should not require the student to find the distance between points. • Items may require the student to be familiar with using the algebraic description $(x, y) \rightarrow (x + a, y + b)$ for a translation, and $(x, y) \rightarrow (kx, ky)$ for a dilation when given the center of dilation. Items may require the student to be familiar with the algebraic description for a 90-degree rotation about the origin, $(x, y) \rightarrow (-y, x)$, for a 180-degree rotation about the origin, $(x, y) \rightarrow (-x, -y)$, and for a 270-degree rotation about the origin, $(x, y) \rightarrow (y, -x)$. Items that use more than one transformation may ask the student to write a series of algebraic descriptions. • Items must not use matrices to describe transformations. • In items in which the line of reflection is given, it must be in slope-intercept form. • In items in which the line of reflection is given, any form of a line may be used. If the line is not a vertical line or a horizontal line, then the line of reflection must be graphed as a dotted line. Stimulus Attributes • Items may be set in a real-world or mathematical context. • Items may require the student to provide a sequence of transformations. • Items may require the student to determine if an attribute of a figure is the same after a sequence of transformations has been applied. Response Attributes • Items may require the student to use a function, e.g., $y = k(f(x + a)) + b$, to describe a transformation. • Items may require the student to give a line of reflection and/or a degree of rotation that carries a figure onto itself. • Items may require the student to draw a figure using a description of a transformation.

		• Items may require the student to graph a figure using a description of a rotation and/or reflection. • In items in which the student has to write the line of reflection, any line may be used. • Items may require the student to be familiar with slope-intercept form of a line, standard form of a line, and point-slope form of a line. • Items may require the student to write a line of reflection that will carry a figure onto itself. • Items may require the student to give a degree of rotation that will carry a figure onto itself. **Calculator:** Neutral

UNIT 9 – Definitions and Constructions (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.G-CO.4.12 ℙ Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.) *This includes: copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.* **MFAS:** Constructing a Congruent Segment Constructing a Congruent Angle Bisecting a Segment and an Angle Constructions for Parallel Lines Constructions for Perpendicular Lines **Math Open Reference – Equilateral Triangle** **Math Nation - Geometry**	• **identify** the tools used in formal constructions. • **use** tools and methods to precisely copy a segment. • **use** tools and methods to precisely copy an angle. • **use** tools and methods to precisely bisect a segment. • **use** tools and methods to precisely bisect an angle. • **construct** perpendicular lines and bisectors. • **construct** a line parallel to a given line through a point not on the line.	Constructions are limited to: copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; constructing a line parallel to a given line through a point not on the line **Assessed with G-CO.4.13** Clarifications • Students will identify the result of a formal geometric construction. • Students will determine the steps of a formal geometric construction. Assessment Limits • Constructions are limited to copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; constructing a line parallel to a given line through a point not on the line • Constructions are limited to the use of a formal compass and a straightedge. • Items should not ask student to find values or use properties of the geometric figure that is constructed. Stimulus Attribute • Items may be set in a real-world or mathematical context. Response Attributes • Items may require the student to justify why a construction results in the geometric figure. • Items may require the student to use or choose the correct unit of measure. • Items may require the student to provide steps for a construction. **Calculator:** Neutral

UNIT 9 – Definitions and Constructions (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.G-CO.4.13 ℙ Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle. **MFAS:** Construct the Center of a Circle Regular Hexagon in a Circle Equilateral Triangle in a Circle Square in a Circle **Math Nation - Geometry** **SMP #5, #6**	• **define** inscribed polygons. • **construct** an equilateral triangle, a square, a hexagon inscribed in a circle.	Constructions are limited to: constructing an equilateral triangle inscribed in a circle; constructing a square inscribed in a circle; and a regular hexagon inscribed in a circle. **Assessed with G-CO.4.12** Clarifications • Students will identify the result of a formal geometric construction. • Students will determine the steps of a formal geometric construction. Assessment Limits • Constructions are limited to constructing an equilateral triangle inscribed in a circle; constructing a square inscribed in a circle; and a regular hexagon inscribed in a circle. • Constructions are limited to the use of a formal compass and a straightedge. • Items should not ask student to find values or use properties of the geometric figure that is constructed. Stimulus Attribute • Items may be set in a real-world or mathematical context. Response Attributes • Items may require the student to justify why a construction results in the geometric figure. • Items may require the student to use or choose the correct unit of measure. • Items may require the student to provide steps for a construction. **Calculator:** Neutral

UNIT 10 – Similarity

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.G-SRT.1.2 © Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides. **MFAS:** To Be or Not To Be Similar The Consequences of Similarity Showing Similarity **Math Nation - Geometry** **SMP #3**	• **define** similarity as a composition of rigid motions followed by dilations in which angle measure is preserved and side length is proportional. • **identify** corresponding sides and corresponding angles of similar triangles. • **demonstrate** that in a pair of similar triangles, corresponding angles are congruent (angle measure is preserved) and corresponding sides are proportional. • **determine** that two figures are similar by verifying that angle measure is preserved, and corresponding sides are proportional.	Clarifications • Students will use the definition of similarity in terms of similarity transformations to decide if two figures are similar. • Students will explain using the definition of similarity in terms of similarity transformations that corresponding angles of two figures are congruent and that corresponding sides of two figures are proportional. Assessment Limit • Items may require the student to be familiar with using the algebraic description $(x, y) \rightarrow (x + a, y + b)$ for a translation, and $(x, y) \rightarrow (kx, ky)$ for a dilation when given the center of dilation. Items may require the student to be familiar with the algebraic description for a 90-degree rotation about the origin, $(x, y) \rightarrow (-y, x)$ for a 180-degree rotation about the origin, $(x, y) \rightarrow (-x, -y)$, and for a 270-degree rotation about the origin, $(x, y) \rightarrow (y, -x)$. Items that use more than one transformation may ask the student to write a series of algebraic descriptions. Stimulus Attribute • Items may be set in a real-world or mathematical context. Response Attribute • Items may ask the student to determine if given information is sufficient to determine similarity. **Calculator**: Neutral **Coherence:** • 8.G.1.4 Introduced that similar figures are formed using transformations of a pre-image.

UNIT 10 – Similarity (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.G-SRT.1.3 © Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. **MFAS:** Describe the AA Similarity Theorem Justifying a Proof of the AA Similarity Theorem Prove the AA SimilarityTheorem **Math Nation - Geometry** **SMP #3**	• **show** and **explain** that when two angle measures are known (AA), the third angle measure is also known (Third Angle Theorem). • **conclude** and **explain** that AA, SSS, and SAS similarity are sufficient conditions for two triangles to be similar.	**Assessed with G-SRT.2.4** Clarifications • Students will explain using properties of similarity transformations why the AA criterion is sufficient to show that two triangles are similar. Assessment Limit • Items may require the student to be familiar with using the algebraic description $(x, y) \rightarrow (x + a, y + b)$ for a translation, and $(x, y) \rightarrow (kx, ky)$ for a dilation when given the center of dilation. Items may require the student to be familiar with the algebraic description for a 90-degree rotation about the origin, $(x, y) \rightarrow (-y, x)$ for a 180-degree rotation about the origin, $(x, y) \rightarrow (-x, -y)$, and for a 270-degree rotation about the origin, $(x, y) \rightarrow (y, -x)$. Items that use more than one transformation may ask the student to write a series of algebraic descriptions. Stimulus Attribute • Items may be set in a real-world or mathematical context. **Calculator**: Neutral **Coherence:** • 8.G.1.5 introduced facts about angle sum and exterior angles of triangles, parallel lines cut by transversals, and the AA criterion for similarity of triangles.

UNIT 10 – Similarity (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.G-SRT.2.4 ℂℙ Prove theorems about triangles. *Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.* **MFAS:** Triangle Proportionality Theorem Converse of the Triangle Proportionality Theorem **Math Nation - Geometry** **SMP #3**	• **apply** theorems, postulates, or definitions to prove theorems about triangles and proportional parts of parallel lines, including: a) Triangle Proportionality Theorem- A line parallel to one side of a triangle divides the other two proportionally (Side Splitter Theorem). b) Converse of Proportionality Theorem- If a line divides two sides of a triangle proportionally, then it is parallel to the third side c) Triangle Midsegment Theorem– a midsegment of a triangle is parallel to one side of a triangle and its length is one-half the length of that side.	**Assessed with G-SRT.1.3** Clarifications • Students will use triangle similarity to prove theorems about triangles. Assessment Limit • Items may require the student to be familiar with using the algebraic description $(x, y) \rightarrow (x + a, y + b)$ for a translation, and $(x, y) \rightarrow (kx, ky)$ for a dilation when given the center of dilation. Items may require the student to be familiar with the algebraic description for a 90-degree rotation about the origin, $(x, y) \rightarrow (-y, x)$ for a 180-degree rotation about the origin, $(x, y) \rightarrow (-x, -y)$, and for a 270-degree rotation about the origin, $(x, y) \rightarrow (y, -x)$. Items that use more than one transformation may ask the student to write a series of algebraic descriptions. Stimulus Attribute • Items may be set in a real-world or mathematical context. **Calculator**: Neutral **Coherence:** • **8.G.2.6** Explain the proof of the Pythagorean Theorem and its converse. • **8.G.2.7** Use the Pythagorean Theorem to solve problems. • **8.EE.1.2** Solve equations containing square roots.
MAFS.912.G-SRT.2.5 ℂℙ𝔸 Use congruence and **similarity** criteria for triangles to solve problems and to prove relationships in geometric figures. **MFAS:** Basketball Goal County Fair Similar Triangles 1 Prove Rhombus Diagonals Bisect Angles Similar Triangles 2 **Math Nation - Geometry** **SMP #1**	• **use** triangle similarity to solve problems • **use** triangle similarity to prove relationships in geometric figures.	Clarifications • Students will use congruence criteria for triangles to solve problems. • Students will use congruence criteria for triangles to prove relationships in geometric figures. Assessment Limit • Items may use geometric figures of any shape if the figure can be deconstructed to form a triangle. Stimulus Attribute • Items may be set in a real-world or mathematical context. Response Attribute • Items may require the student to use or choose the correct unit of measure. **Calculator**: Neutral

UNIT 11 – Two-Dimensional Shapes

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.G-MG.1.1 ©℗Ⓐ★ Use geometric shapes, their measures, and their properties to describe objects. **MFAS:** Camping Calculations Estimating Area **Math Nation - Geometry** **SMP #4**	**MODELING STANDARD** • **represent** real-world objects as geometric figures. • **estimate** measures (circumference, area, perimeter) of real-world objects using comparable geometric shapes. • **apply** the properties of geometric figures to comparable real-world objects. • **find** area of a figure using nets	Clarifications • Students will use geometric shapes to describe objects found in the real world. • Students will use measures of geometric shapes to find the area, volume, surface area, perimeter, or circumference of a shape found in the real world. • Students will apply properties of geometric shapes to solve real-world problems. Assessment Limits • Items may require the student to use knowledge of other Geometry standards. • Items may include composite figures. • Items must not also assess G-GMD.1.3 or G-MG.1.3. Stimulus Attribute • Items must be set in a real-world context. Response Attributes • Items may require the student to use or choose the correct unit of measure. • Items may require the student to apply the basic modeling cycle. **Calculator:** Neutral
MAFS.912.G-MG.1.2 ©Ⓐ★ Apply concepts of density based on **area** and volume in modeling situations (e.g., persons per square mile). **MFAS:** Population of Utah How Many Trees **Math Nation - Geometry** **SMP #1, #4**	**MODELING STANDARD** • **decide** whether it is best to calculate or estimate the area of a geometric figure and perform the calculation or estimation. • **break** composite geometric figures into manageable pieces. • **convert** units of measure. • **apply** area to situations involving density (population density).	Clarifications • Students will apply concepts of density based on area in modeling situations. • Students will apply concepts of density based on volume in modeling situations. Assessment Limit • Items may require the student to use knowledge of other Geometry standards. Stimulus Attribute • Items must be set in a real-world context. Response Attributes • Items may require the student to apply the basic modeling cycle. • Items may require the student to use or choose the correct unit of measure. **Calculator:** Neutral

UNIT 11 – Two-Dimensional Shapes (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.G-MG.1.3  Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). **MFAS:** Land for the Twins The Sprinters Race Softball Complex Duplex **Math Nation - Geometry** **SMP #1, #4**	**MODELING STANDARD** • **create** a visual representation of a design problem. • **solve** design problems using a geometric model (graph, equation, table, formula). • **interpret** the results and make conclusions based on the geometric model.	Clarification • Students will apply geometric methods to solve design problems. Assessment Limits • Items may require the student to use knowledge of other Geometry standards. • Items that use volume should not also assess G-GMD.1.3 or GMG.1.1. Stimulus Attribute • Items must be set in a real-world context. Response Attributes • Items may require the student to interpret the results of a solution within the context of the modeling situation. • Items may require the student to apply the basic modeling cycle. • Items may require the student to use or choose the correct unit of measure. **Calculator:** Neutral

UNIT 12 – Three-Dimensional Shapes

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.G-GMD.1.3 ℙ Ⓐ ★ Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. **SMP #4** **Math Nation - Geometry** **MFAS:** Sports Drinks Snow Cones Do not Spill the Water! The Great Pyramid	**MODELING STANDARD** • **calculate** the volume of a cylinder, pyramid, cone, and sphere and use the volume formulas to solve problems. • **find** the volume when one or more dimensions are changed.	Clarification • Students will use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. Assessment Limits • Items may require the student to recall the formula for the volume of a sphere. • Items may require the student to find a dimension. • Items that involve cones, cylinders, and spheres should require the student to do more than just find the volume. • Items may include composite figures, including three-dimensional figures previously learned. • Items may not include oblique figures. • Items may require the student to find the volume when one or more dimensions are changed. • Items may require the student to find a dimension when the volume is changed. Stimulus Attributes • Items must be set in a real-world context. • Items may require the student to apply the basic modeling cycle. Response Attributes • Items may require the student to use or choose the correct unit of measure. • Items may require the student to apply the basic modeling cycle. **Calculator:** Neutral **Coherence:** • **8.G.3.9** Know the formulas for the volumes of cones, cylinders, and spheres.

UNIT 12 – Three-Dimensional Shapes (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.G-GMD.2.4 Ⓒ Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects. **SMP #4, #7** **Math Nation - Geometry** **MFAS:** Slice It Slice of a Cone Inside the Box 2D Rotations Of Triangles 2D Rotations of Rectangles Working Backwards - 2D Rotations	• **identify** the shapes of the two-dimensional cross-sections of three-dimensional objects. • **rotate** a two-dimensional figure and identify the three-dimensional object that is formed.	Clarifications • Students will identify the shape of a two-dimensional cross-section of a three-dimensional object. • Students will identify a three-dimensional object generated by a rotation of a two-dimensional object. Assessment Limits • Items may include vertical, horizontal, or other cross-sections. • Items may include more than one three-dimensional shape. Stimulus Attributes • Items may be set in a real-world or mathematical context. • A verbal description of a cross-section or a three-dimensional shape may be used. Response Attribute • Items may require the student to draw a line that shows the location of a cross-section. **Calculator:** Neutral **Coherence:** • **7.G.1.3** Relate the two-dimensional shape that results from slicing a three-dimensional figure.
MAFS.912.G-MG.1.1 ⒸⓅⒶ★ Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). **SMP #4** **Math Nation - Geometry** **MFAS:** Size It Up Estimating Volume	**MODELING STANDARD** • **describe** real world objects using geometric figures. • **use** measures of geometric shapes to **find** volume, surface area and lateral area of real-world objects. • **apply** the properties of geometric figures to solve real-world problems. • **decompose** a figure in smaller parts to describe the properties of the object.	Clarifications • Students will use geometric shapes to describe objects found in the real world. • Students will use measures of geometric shapes to find the area, volume, surface area, perimeter, or circumference of a shape found in the real world. • Students will apply properties of geometric shapes to solve real-world problems. Assessment Limits • Items may require the student to use knowledge of other Geometry standards. • Items may include composite figures. • Items must not also assess G-GMD.1.3 or G-MG.1.3. Stimulus Attribute • Items must be set in a real-world context. Response Attributes • Items may require the student to use or choose the correct unit of measure. • Items may require the student to apply the basic modeling cycle. **Calculator:** Neutral

UNIT 12 – Three-Dimensional Shapes (continued)

Standard *The students will:*	Success Criteria *I know I am successful when I can:*	Instructional Notes
MAFS.912.G-MG.1.2 ©Ⓐ★ Apply concepts of density based on area and **volume** in modeling situations (e.g., BTUs per cubic foot). **SMP #1, #4** **Math Nation - Geometry** **MFAS:** Mudslide	• **convert** units of measure. • **apply** volume involving density in real-world context.	Clarifications • Students will apply concepts of density based on area in modeling situations. • Students will apply concepts of density based on volume in modeling situations. Assessment Limit • Items may require the student to use knowledge of other Geometry standards. Stimulus Attribute • Items must be set in a real-world context. Response Attributes • Items may require the student to apply the basic modeling cycle. • Items may require the student to use or choose the correct unit of measure. **Calculator:** Neutral
MAFS.912.G-MG.1.3 Ⓐ Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). **SMP #1, #4** **Math Nation - Geometry** **MFAS:** Land for the Twins The Sprinters Race Softball Complex Duplex	• **create** a visual representation of a design problem. • **solve** design problems using a geometric model (graph, equation, table, formula). • **interpret** the results and make conclusions based on the geometric model.	Clarification • Students will apply geometric methods to solve design problems. Assessment Limits • Items may require the student to use knowledge of other Geometry standards. • Items that use volume should not also assess G-GMD.1.3 or GMG.1.1. Stimulus Attribute • Items must be set in a real-world context. Response Attributes • Items may require the student to interpret the results of a solution within the context of the modeling situation. • Items may require the student to apply the basic modeling cycle. • Items may require the student to use or choose the correct unit of measure. **Calculator:** Neutral