Pinellas County Schools

ALGEBRA 1 HONORS

2017-2018

August 2017

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6	7	8	9	10	11	12
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September 2017

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October 2017

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November 2017

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December 2017

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31						

Building Community in the Math Classroom

Unit 1: Functions

MAFS.912.F-IF.1.1	MAFS.912.F-IF.3.9
MAFS.912.F-IF.1.2	MAFS.912.A-SSE.1.1
MAFS.912.F-IF.2.4	MAFS.912.A-REI.4.10
MAFS.912.F-IF.2.5	MAFS.912.F-BF.1.1

Unit 2: Equations & Inequalities

MAFS.912.A-REI.1.1	MAFS.912.A-CED.1.1
MAFS.912.A-REI.2.3	MAFS.912.A-CED.1.3
MAFS.912.A-REI.4.12	MAFS.912.A-CED.1.4

Unit 3: Systems of Linear Equations & Inequalities

MAFS.912.A-REI.3.5	MAFS.912.A-CED.1.2
MAFS.912.A-REI.3.6	MAFS.912.A-CED.1.3
MAFS.912.A-REI.4.12	

Unit 4: Linear & Inverse Functions

MAFS.912.A-REI.4.10	MAFS.912.F-LE.1.1a,b
MAFS.912.A-CED.1.2	MAFS.912.F-LE.1.2
MAFS.912.F-IF.2.4	MAFS.912.F-LE.2.5
MAFS.912.F-IF.2.6	MAFS.912.S-ID.2.6
MAFS.912.F-IF.3.7a	MAFS.912.S-ID.3.7
*MAFS.912.F-BF.1.2	MAFS.912.S-ID.3.8
*MAFS.912.F-BF.2.4a	MAFS.912.S-ID.3.9

Unit 5: Exponents & Exponential Functions

MAFS.912.N-RN.1.1	MAFS.912.F-IF.3.8b
MAFS.912.N-RN.1.2	*MAFS.912.F-BF.1.2
MAFS.912.A-REI.4.11	MAFS.912.F-BF.2.3
MAFS.912.A-SSE.1.2	MAFS.912.F-LE.1.1
MAFS.912.A-SSE.2.3c	MAFS.912.F-LE.1.2
MAFS.912.F-IF.1.3	MAFS.912.F-LE.1.3
MAFS.912.F-IF.2.6	MAFS.912.F-LE.2.5
MAFS.912.F-IF.3.7e	*MAFS.912.A-SSE.2.4

Unit 6: Polynomials

MAFS.912.A-REI.1.1	MAFS.912.A-SSE.2.3a
MAFS.912.A-REI.2.4b	MAFS.912.A-APR.1.1
MAFS.912.A-SSE.1.1a	MAFS.912.A-APR.2.3
MAFS.912.A-SSE.1.2	

Semester 1 Review and Exam

Re-Building Community in the Math Classroom

Unit 7: Quadratic Functions

MAFS.912.A-REI.2.4	MAFS.912.F-IF.3.7a,b
*MAFS.912.A-REI.3.7	MAFS.912.F-IF.3.8a
MAFS.912.A-SSE.2.3b	MAFS.912.F-LE.1.1
MAFS.912.F-IF.2.4	MAFS.912.F-LE.1.2
MAFS.912.F-IF.2.6	MAFS.912.S-ID.2.6a

Unit 8: Radical Functions

MAFS.912.N-RN.1.2	MAFS.912.A-CED.1.2
MAFS.912.N-RN.2.3	MAFS.912.F-IF.2.4
MAFS.912.A-REI.2.4a	MAFS.912.F-IF.3.7b

Unit 9: Rational Functions

*MAFS.912.A-APR.2.2	*MAFS.912.A-REI.1.2
MAFS.912.A-CED.1.2	

Unit 10: Statistics & Probability

MAFS.912.S-ID.1.1	*MAFS.912.S-ID.1.4
MAFS.912.S-ID.1.2	MAFS.912.S-ID.2.5
MAFS.912.S-ID.1.3	

Unit 11: Algebra 1 Honors Extension

*MAFS.912.A-APR.3.4	*MAFS.912.F-IF.3.7c,d
*MAFS.912.A-APR.4.6	*MAFS.912.F-BF.2.4b,c,d

FSA Algebra 1 EOC

April 16, 2018 - May 11, 2018

Unit 11: Algebra 1 Honors Extension

*MAFS.912.A-APR.3.4	*MAFS.912.F-IF.3.7c,d
*MAFS.912.A-APR.4.6	*MAFS.912.F-BF.2.4b,c,d

UNIVERSAL STANDARDS

MAFS.912.N-Q-1.1	MAFS.912.N-Q.1.3
MAFS.912.N-Q.1.2	

January 2018

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February 2018

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March 2018

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April 2018

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May 2018

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Algebra 1 Honors Semester 1	**Unit 1: Functions**	Projected Time Allotment: **6 Days**
Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**	
MAFS.912.F-IF.1.1 (Assessed under F-IF.1.2) Understand that a function from one set (called a 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).*	• Items that require the student to determine the domain using equations within a context are limited to exponential functions with one translation, linear functions, or quadratic functions. • Items may present relations in a variety of formats, including sets of ordered pairs, mapping diagrams, graphs, and input/output models. • In items requiring the student to find the domain from the graphs, relationships may be on a closed or open interval. • In items requiring the student to find the domain from graphs, relationships may be discontinuous. • Items may not require students to know or use interval notation Calculator: **NEUTRAL** • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response • Table Item	
MAFS.912.F-IF.1.2 (Also assesses F-IF.1.1 and F-IF.2.5) Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	• 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. Calculator: **Neutral** • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response • Table Item	
MAFS.912.F-IF.2.4 (Also assesses F-IF.3.9) 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; symmetric; and behavior; and periodicity.	• Functions can be linear, quadratic or exponential • Functions can be represented using tables or graphs. 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 students to use or know interval notation. Calculator: **NO** • Equation Editor • GRID • Hot Text • Multiple Choice • Open Response	

Standards are not to be taught in the sequence presented but as a coherent approach through thoughtful lesson planning.
Using the textbook is not always meeting the depths of the new standards that is why other resources are provided

MAFS.912.F-IF.2.5 (Assessed under F-IF.1.2) 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 persons-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.	• Items may present relations in a variety of formats, including sets of ordered pairs, mapping diagrams, graphs, and input/output models. • 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 Calculator: **NEUTRAL** • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response • Table Item
MAFS.912.F-IF.3.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions. For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.	• Functions can be linear, quadratic or exponential • Functions can be represented using tables or graphs • Functions can have closed domains • Functions can be discontinuous • Items may not require students to use or know interval notation. Calculator: **NO** • Equation Editor • GRID • Hot Text • Multiple Choice • Open Response
MAFS.912.F-BF.1.1 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. c. Compose Functions.	• 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. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multi-Select • Open Response • Table Item
MAFS.912.A-REI.4.10 (Assessed under REI.4.11) 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).	• 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. Calculator: **NEUTRAL** • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response • Table Item

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MAFS.912.A-SSE.1.1 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 as the product of P and a factor not depending on P.	• For A-SSE.1.1, items should not ask the student to interpret zeros, the vertex, or axis of symmetry when the quadratic expression is in the form ax2 + bx + c (see F-IF.3.8). Calculator: **NEUTRAL** • Edit Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)
• 1-1 Variables and Expressions • 1-6 Relations • 1-7 Functions • 1-8 Interpreting Graphs of Functions
EngageNY Instructional Resource (may not cover all content required for the aligned standards)
• Module 3, Topic B, Lesson 8: Why Stay with Whole Numbers? • Module 3, Topic B, Lesson 9: Representing, Naming, and Evaluating Functions (part 1) • Module 3, Topic B, Lesson 10: Representing, Naming, and Evaluating Functions (part 2) • Module 3, Topic B, Lesson 11: The Graph of a Function • Module 3, Topic B, Lesson 12: The Graph of the Equations $y = f(x)$ • Module 3, Topic B, Lesson 13: Interpreting the Graph of a Function

Learning Objectives
MAFS.912.F-IF.1.1 • Students will know the definition of a function and understand function notation. • Students can describe the domain and range of a linear and non-linear graph • Students can identify that f(x) denotes the output of f corresponding to the input x. • Students can identify that f is a function and x is an element.

Instructional Resources	
Mathematics Formative Assessments (MFAS) Identifying Functions Students identify functions from tables and maps. Identifying the Graphs of a Function Students identify graphs as functions or not functions Writing Functions Students write functions in tables and maps Cafeteria Function Students are asked to decide if one variable is a function of the other in the context of a real-world problem. What is a Function? Students are asked to define the term function and describe any important properties of functions.	Additional Lesson Resources • CPalms ○ Functions: Domain and Range Lesson introduces students to function notation and the concept of domain and range at entry level. • MARS/Shell A culminating lesson task using a coherent approach to this unit ○ Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions.

Learning Objectives
MAFS.912.F-IF.1.2 • Students can evaluate functions for their inputs in their domains. • Students can evaluate and interpret functions that model a real-world context for inputs in their domain.

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Instructional Resources

Mathematics Formative Assessments (MFAS)

What is the Function Notation? Explores what function notation represents for students.

What is the Value? Students evaluate corresponding input values in a function table.

Graphs and Functions Students determine a given function at an input by inspecting its graph.

Illustrative Mathematics Assessment Tasks

The Random Walk This task requires interpreting functions.

Yam in the Oven Students practice interpreting statements using function notation.

The Parking Lot Students investigate the meaning of the definition of a function based on a situation.

Additional Lesson Resources

- CPalms
  - Domain Representations This lesson examines a variety of situations where students have to examine domain as a concept.
- MARS/Shell *A culminating lesson task using a coherent approach to this unit*
  - …Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions.

Learning Objectives

MAFS.912.F-IF.2.4

- Students will be able to interpret key features of a radical function from a graph and tables from a real world context.
- Students can identify key features of a graph: intercepts, intervals where the function is increasing, decreasing, positive, or negative, symmetry, maximum and minimums.
- ~~Students can sketch a linear and non-linear graph (linear, exponential, and quadratic)~~
- Students can interpret tables in terms of a quantity.
- 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).

Instructional Resources

Mathematics Formative Assessments (MFAS)

~~Elevation Along a Trail Students interpret key features of a graph (symmetry) in the context of a problem situation.~~

Uphill and Downhill Students interpret key features of a graph (intercepts and intervals over which the graph is increasing) in the context of a problem situation.

Taxi Ride Students sketch a graph from a verbal description.

Bike Race Students evaluate three verbal descriptions and to state why each does or does not match a given graph.

Surf's Up Students are given a table of functional values and asked to describe and interpret key features of the graph in the context of the problem.

Illustrative Mathematics Assessment Tasks

Snake on a Plane This task has students approach a function via both a recursive and an algebraic definition, in the context of a famous game.

Warming and Cooling Straightforward interpretation to read and interpret a graph.

Additional Lesson Resources

- MARS/Shell *A culminating lesson task using a coherent approach to this unit*
  - …Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions.
  - ~~Transforming Quadratics—The basics This activity introduces students to the graph of the quadratic parent function.~~
  - ~~Parts and more Parts—Parabola Fun This is an entry lesson into quadratics and their shapes.~~

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Telling a story with graphs Students examine graphs and interpret them giving a verbal description of what they see. ~~Throwing Baseballs Students compare characteristics of 2 quadratic functions~~	

Learning Objectives
MAFS.912.F-IF.2.5 • Students can write an equation in function notation given a real world application and choose a reasonable domain. • 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. • 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. • Students will determine the feasible domain of a function that models a real-world context.

Instructional Resources	
Mathematics Formative Assessments (MFAS) Describe the Domain Given verbal descriptions describe an appropriate domain. Height vs. Shoe Size Students determine the domain from a context. Car Wash Students determine the domain from a graph. Illustrative Mathematics Assessment Tasks The Canoe Trip The purpose of this task is to give students practice construction functions that represent a quantity in a context. Oakland Coliseum Students find the domain and range of the given function	Additional Lesson Resources • MARS/Shell *A culminating lesson task using a coherent approach to this unit* ○ …Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions.

Learning Objectives
MAFS.912.F-IF.3.9 • Students can compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by a verbal description) limited to linear and nonlinear. • Students will compare and contrast properties of two functions using a variety of function representations (e.g., algebraic, graphic, numeric in tables, or verbal descriptions).

Instructional Resources	
Mathematics Formative Assessments (MFAS)	Additional Lesson Resources • CPalms ○ Comparing Linear Functions – (compare their intercepts of linear functions, 2 problems) ○ ~~Comparing Linear and Exponential Functions – (linear and exponential compare the rates of change, 1 problem)~~ ○ ~~Comparing Quadratics Students are asked to compare two quadratic functions, one given by a table and the other by a function.~~ • MARS/Shell ○ Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up

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	functions.

Learning Objectives
MAFS.912.A-SSE.1.1 • Students can interpret parts of expressions such as terms, factors, and coefficients • Students will rewrite algebraic expressions in different equivalent forms by recognizing the expression's structure.

Instructional Resources	
Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
Dot Expressions Students are asked to explain how parts of an algebraic expression relate to the number and type of symbols in a sequence of diagrams. Interpreting Basic Tax Students interpret the parts of an equation used to calculate the total purchase price including tax of a set of items. What Happens? Students are asked to determine how the volume of a cone will change when its dimensions are changed. Illustrative Mathematics Assessment Tasks Animal Populations Students interpret the relative size of variable expressions involving two variables in the context of a real world situation. Mixing Fertilizer Students generalize the problem and verify conclusions using algebraic rather than numerical expressions. The Bank Account Students explore an expression that calculates the balance of a bank account with compounding interest. Cubic Identity This task presents a challenging exercise in both algebraic manipulations and seeing structure in algebraic expressions. Seeing Dots The purpose of this task is to identify the structure in the two algebraic expressions by interpreting them in terms of a geometric context.	~~• Illuminations~~ ~~○ Building Connections Students make connections among different classes of polynomial functions by exploring the graphs of the functions.~~ • MARS/Shell: ○ Sorting Equations and identities Students will be able to: Recognize the differences between equations and identities. Substitute numbers into algebraic statements in order to test their validity in special cases. Resist common errors when manipulating expressions such as $2(x-3) = 2x-3$; $(x+3)^2 = x^2+3^2$. Carry out correct algebraic manipulations. ~~• Math is Fun~~ ~~○ Multiplying Polynomials Video tutorial on multiplying polynomials.~~ ~~• OER Commons~~ ~~○ Polynomial Division Mini lesson on dividing polynomials.~~ ~~• Better Lessons~~ ~~○ Adding and Subtracting Polynomials When polynomial expressions are added the result is another polynomial expression.~~

Learning Objectives
MAFS.912.A-REI.4.10 • Students can verify if a set of ordered pairs is a solution of a function. • Students can find an approximate solution for f(x)=g(x) using a graphing tool or a table of values for both linear and nonlinear functions. • Students can justify the intersection of two functions is a solution to f(x)=g(x)

Instructional Resources	
Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
What is the Point Students are asked to explain the relationship between a point on the graph and a point not on the graph. Finding Solutions Students are asked to explain the relationship between a given linear equation and both a point on its graph and a point not on its graph Case In Point – (explain the relationship between the set of solutions and the graph of an exponential equation, 3 problems)	

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Illustrative Mathematics Assessment Tasks	
Taxi Students are asked to justify given solutions as reasonable for the situation. Collinear points—4 part task that ask students to conceptually think about nonlinear functions	

Learning Objectives
MAFS.912.F-BF.1.1 • Students can determine an explicit or recursive process and identify steps for calculation from context. • Students can write a function to model a real-world context by composing functions and using the information within the context. • Students write a function that combines functions using arithmetic operations and relate the result to the context of the problem.

Instructional Resources	
Mathematics Formative Assessments (MFAS) Saving for a Car Students write an explicit function rule given a verbal description Giveaway Students write an explicit function from a verbal description and use it to answer questions. Furniture Purchase Students writes 2 explicit function from verbal descriptions and answers questions Illustrative Mathematics Assessment Tasks Graphs of Compositions Students work with compositions to address important issues around inverse functions. Sum of functions This lesson asks students to think about how adding functions works at a fundamental level.	Additional Lesson Resources

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Algebra 1 Honors Semester 1	**Unit 2: Equations & Inequalities**	Projected Time Allotment: **18 Days**

Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**
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, and simple rational~~, absolute, and ~~exponential functions~~. **Special Note:** At this point you are strictly looking at linear relationships and absolute value. Further, the assessment limits will be an important piece since this standard is touched upon again in the future.	• In items that require students to write an equation, equations are limited to linear, quadratic, and exponential. • Items may include equations or inequalities that contain variables on both sides. Calculator: Neutral • Equation Response • Graphic Response • Hot Spot Response • Movable Text Response • Multiple Choice Response • Multi-select Response • Natural Language Response • Selectable Text Response
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.	• In items that require the student to write an equation as a constraint, the equation can be a linear function. • In items that require the student to write a system of equations to represent a constraint, the system is limited to a 2x2 with integral coefficients Calculator: **Neutral** • Equation Response • Graphic Response • Hot Spot Response • Movable Text Response • Multiple Choice Response • Natural Language Response • Selectable Text Response
MAFS.912.A-CED.1.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning a in solving equations. For example, rearrange Ohm's law V=IR to highlight resistance R	• Items that involve formulas should not include overused contexts such as Fahrenheit/Celsius or three-dimensional geometry formulas. • In items that require students to solve literal equations and formulas, a linear term should be the term of interest. • Items should not require more than three 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. Calculator: Neutral • Drag and drop response • Equation Response • Hot Spot Response • Multiple Choice Response • Natural Language Response
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.	• Items will not require students to recall names of properties from memory Calculator: No • Drag and drop response • Equation Response • Movable Text Response • Multiple Choice Response • Natural Language Response • Selectable Text Response
MAFS.912.A-REI.2.3 (Assessed with MAFS.912.A-CED.1.1) Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	• In items that require students to write an equation, equations are limited to linear, quadratic, and exponential. • Items may include equations or inequalities that contain variables on both sides.

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	Calculator: Neutral • Equation Response • Graphic Response • Hot Spot Response • Movable Text Response • Multiple Choice Response • Multi-select Response • Natural Language Response • Selectable Text Response
MAFS.912.A-REI.4.12 Graph the solution 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 the corresponding half-planes~~. **Special Note:** At this point you are strictly looking at linear relationships. Further, the assessment limits will be an important piece since this standard is touched upon again in the future.	• Items that require the student to graph a system of equations or inequalities to find the solution are limited to a 2x2 system. • Items that require the student to write a system of inequalities using a real world context are limited to integral coefficients. Calculator: **Neutral** • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multi-Select • Open Response

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)
• 2-4 Solving Equations with Variables on Each Side • 2-5 Solving Equations Involving Absolute Value • 2-6 Ratios and Proportions • 2-8 Literal Equations and Dimensional Analysis • Explore: Algebra Lab – Reading Compound Statements • 5-4 Solving Compound Inequalities • 5-5 Inequalities Involving Absolute Value • 5-6 Graphing Inequalities in Two Variables
EngageNY Instructional Resource (may not cover all content required for the aligned standards)
• Module 1, Topic C, Lesson 10: True and False Equations • Module 1, Topic C, Lesson 11: Solution Sets for Equations and Inequalities • Module 1, Topic C, Lesson 12: Solving Equations • Module 1, Topic C, Lesson 13: Some Potential Dangers when Solving Equations • Module 1, Topic C, Lesson 14: Solving Inequalities • Module 1, Topic C, Lesson 15: Solution Sets of Two or More Equations (or Inequalities) Joined by "And" or "Or" • Module 1, Topic C, Lesson 16: Solving and Graphing Inequalities Joined by "And" or "Or" • Module 1, Topic C, Lesson 17: Equations Involving Factored Expressions • Module 1, Topic C, Lesson 18: Equations Involving a Variable Expression in the Denominator • Module 1, Topic C, Lesson 19: Rearranging Formulas • Module 1, Topic C, Lesson 20: Solution Sets to Equations with Two Variables • Module 1, Topic C, Lesson 21: Solution Sets to Inequalities with Two Variables

Learning Objectives
MAFS.912.A-CED.1.1 • Students can create equations in one variable and solve them. • Students will write an equation in one variable that represents a real-world context.

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- Students can create inequalities in one variable and solve them.
- Students will be able to create equations arising from laws of exponents using real world context.
- Students will create and solve equations in one variable that arise from quadratic functions.

Instructional Resources

Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
State Fair Students will model a real world equation based on a scenario and they will solve to find the cost of tickets Music Club In this exercise students will create an inequality in one variable that models a real world situation Quilts Students are asked to write and solve an equation that models a given problem. Follow Me Students are asked to write and solve an equation that models an exponential relationship between two variables **Illustrative Mathematics Assessment Tasks** Planes and wheat identifying the correct value and substituting the value in for the variable to create equations. Paying the Rent Students solve problems tracking the balance of a checking account Basketball Students set up rational equations in a real world context	

Learning Objectives

MAFS.912.A-CED.1.3

- Students can represent constraints of equations or inequalities in a real world context.
- Students can interpret solutions as viable or non-viable options in a modeling context.
- Students can write constraints for a real world context using equations, inequalities, a system of equations or a system of inequalities.
- Students can interpret the solution of a real-world context as viable or not viable.

Instructional Resources

Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
Sugar and Protein Students are asked to model a problem involving constraints using inequalities. The New School Students are asked to recognize constraints in a real world context. Constraints on Equations Students are asked to analyze constraints on equations in context and interpret the solutions as viable or not viable. **Illustrative Mathematics Assessment Tasks** Fishing Adventures 3: Students write and solve inequalities, and represent the solutions graphically.	• CPalms ○ Don't Blow the Budget: Students use systems of equations and inequalities to solve real world budgeting problems involving two variables. ○ Exploring Systems with Piggies, Pizzas, and Phones: Students develop an understanding of how to solve realistic problems using two linear equations and in the process strengthen and support the skills involved in translating situations into algebraic expressions. The lesson includes printable materials for students to use during the lesson. ○ Feasible or Non-Feasible (Graphing Systems of Linear Inequalities): 3 day lesson: Students learn how to use the graph of a system of linear inequalities to determine the feasible region. Students practice solving word problems to find the optimal solution that maximizes profits. Students will use the free application, GeoGebra (see download link under Suggested Technology) to help them create different graphs and to determine the feasible or non-feasible solutions.

Learning Objectives

MAFS.912.A-CED.1.4

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- Students can solve literal equations and rearrange formulas for a specific variable.
- Students will solve formulas and equations with coefficients represents by letters.

Instructional Resources

Mathematics Formative Assessments (MFAS)	Additioanl Lesson Resources
Solving Formulas for a Variable Students are asked to solve for a specific variable from the slope equation and slope intercept equation. Solving Literal Equations Students are given 3 variable problems and asked to solve for a specific variable. Literal Equations Students are given three variable equations and asked to solve using inverse of multiplication and division Rewriting Equations Students are asked to solve a four variable equation.	• CPalms ○ Don't Take it So Literal Students manipulate literal equations to solve for specified variables

Learning Objectives

MAFS.912.A-REI.1.1

- Students can justify each step in the process of solving an equation
- Students can solve linear equations and inequalities in one variable including literal equations

Instructional Resources

Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
Justify the Process 1 Students are asked to justify each step in the process of solving equations. Justify the Process 2 Students are asked to justify each step in the process of solving equations. Equation Logic Students are given linear equations and asked to justify each step in the process of solving. Does it Follow? Students are asked to compare two equations and determine if they are equivalent **Illustrative Mathematics Assessment Tasks** 1-2 Same Solutions? Students reason about equivalence of equations How Does the Solution Change? Students reason about their solutions.	• CPalms ○ Justly Justifying Students review the properties used in solving equations ○ Method to My Mathness Students complete proof tables to solve equations

Learning Objectives

MAFS.912.A-REI.2.3

- Student can solve linear equations and inequalities with one variables, including coefficients represented by letters. (*Literal Equations & Inequalities*)

Instructional Resources

Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
Solve for M Students are asked to solve a linear equation in one variable. Solve for N Students are asked to solve a linear equation in one variable with fractional coefficients. Solve for X Students are asked to solve a linear equation in one variable. Solve for Y Students are asked to solve a linear inequality in one variable. Solving a Literal Linear Equation Students are given a literal linear equation and asked to solve for a specific variable. Solving a Multistep Inequality Students are asked to solve a multistep inequality.	

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Learning Objectives
MAFS.912.A-REI.4.12 • ~~Students can identify the solutions to a system of inequalities.~~ • ~~Students can identify ordered pairs that are in the solution set of a system of inequalities.~~ • Students will graph the solution set of inequalities

Instructional Resources	
Mathematics Formative Assessments (MFAS) ~~Which Graph~~: ~~Students are asked to select the correct graph of the solution region of a given system of two linear inequalities.~~ ~~Graph a System of Inequalities~~: ~~Students are asked to graph a system of two linear inequalities.~~	Additional Lesson Resources • CPalms ○ Solution Sets: The purpose of this task is to give students a chance to go beyond the typical problem and make the connections between points in the coordinate plane and solutions to inequalities and equations. Students have to focus on what the graph is showing. • MARS/Shell ○ Defining Regions Using Inequalities: students are able to use linear inequalities to create a set of solutions. Assist students who have difficulties in representing a constraint by shading the correct side of the inequality line and understanding how combining inequalities affects a solution space.

Algebra 1 Honors Semester 1	**Unit 3: Systems of Equations & Inequalities**	Projected Time Allotment: **12 Days**

Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**
MAFS.912.A-CED.1.2 Create equations in two or more variable s to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	• Items that require the student to write a system of equations using a real-world context are limited to a system of 2x2 linear equations with integral coefficients if the equations are written in the form Ax+By=C. • Items that require the student to solve a system of equations are limited to a system of 2x2 linear equations with integral coefficients if the equations are written in the form Ax+By=C. • Items that require the student to graph a system of equations or inequalities to find the solution are limited to a 2x2 system. • Items that require the student to write a system of inequalities using a real-world context are limited to integer coefficients. Calculator: Neutral • Editing Task Choice • Equations Editor • GRID • Hot Text • Multiple Choice • Multiselect • Open Response
MAFS.912.A-CED.1.3 Represent Constraints of 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.	• In items that require the student to write an equation as a constraint the equation may be a linear function. • In items that require the student to write a system of equations to represent a constraint, the system is limited to a 2x2 with integral coefficients. • In items that require the student to write a system of inequalities to represent a constraint, the system is limited to a 2x2 with integral coefficients. Calculator: Neutral • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multi-Select • Open Response
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.	• Items that require the student to write as sytem of equation using a real-world context are limited to a system of 2x2 linear equations with integral coefficients if the equations are written in the form *Ax+By=C.* • Items that require the student to solve a system of equations are limited to a system of 2x2 linear equations with integral coefficients if the equations are written in the form *Ax+BY=C.* Calculator: Neutral • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multi-Select • Open Response

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MAFS.912.A-REI.3.6 Solve systems of linear equations exactly and approximately (e.g. with graphs), focusing on pairs of linear equations in two variables	• Items that require the student to write as sytem of equation using a real-world context are limited to a system of 2x2 linear equations with integral coefficients if the equations are written in the form *Ax+By=C.* • Items that require the student to solve a system of equations are limited to a system of 2x2 linear equations with integral coefficients if the equations are written in the form *Ax+BY=C.* Calculator: Neutral • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multi-Select • Open Response
MAFS.912.A-REI.4.12 Graph the solution 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 the corresponding half-planes.	• Items that require the student to graph a system of equations or inequalities to find the solution are limited to a 2x2 system. • Items that require the student to write a system of inequalities using a real world context are limited to integral coefficients. Calculator: Neutral • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multi-Select • Open Response

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)
• 6-1 Graphing Systems of Equations (*Review*) • 6-2 Substitution (*Review*) • 6-3 Elimination Using Addition and Subtraction • 6-4 Elimination Using Multiplication • 6-5 Applying Systems of Linear Equations • 6-6 Systems of Inequalities
EngageNY Instructional Resource (may not cover all content required for the aligned standards)
• Module 1, Topic C, Lesson 22: Solution Sets to Simultaneous Equations (part 1) • Module 1, Topic C, Lesson 23: Solution Sets to Simultaneous Equations (part 2) • Module 1, Topic C, Lesson 24: Applications of Systems of Equations and Inequalities

Learning Objectives
MAFS.912.A-REI.3.5 • Students can solve a system of equations using substitution and elimination • Students can provide steps in an algebraic proof that shows one equation being replaced with another to find a solution for a system of equations.

Instructional Resources	
Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
Solution Sets of Systems Students are asked to show that, given a system of two equations in two variables, replacing one equation with the sum of that equation and a multiple of another produces a system with the same solutions.	• CPalms ○ Solving Systems: students are given a system of two linear equations and asked to form a new system and explain

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Solving Systems Students are given a system of two linear equations and asked to form a new system by replacing one equation with the sum of that equation and a multiple of the other. Then students are asked to explain why the two systems have the same solutions.	why the two systems have the same solution. ○ Solution Sets of Systems: given a system of two equations in two variables (using only variables), replacing one equation with the sum of that equation and a multiple of another produces a system with the same solutions.)

Learning Objectives

MAFS.912.A-REI.3-6

- Students can solve system of linear equations.
- Students can identify systems whose solutions would be the same through examination of the coefficients.

Instructional Resources

Mathematics Formative Assessments (MFAS)

Apples and Peaches: Asked to solve a system of equations with rational solutions either algebraically or by graphing and are asked to justify the choice of method.

Solving a System of Equations 1: Students are asked to solve a system of equations both algebraically and graphically. One equation is in slope intercept form.

Solving a System of Equations 2: Students are asked to solve a system of equations both algebraically and graphically. Both equations will have to be re-arranged by the student.

Solving a System of Equations 3: Students are asked to solve a system of equations both algebraically and graphically. One equation is in slope intercept form.

Illustrative Mathematics Assessment Tasks

Cash Box: This task involves the creation and solving of a system of two equations and two unknowns. A dollar is outside the cash box, the task is to decide if the dollar should go inside the box based on ticket prices. Application of Linear Systems

Accurately Weighing Pennies 1: This problem involves solving a system of algebraic equations from a context: depending how the problem is interpreted, there may be one equation or two. Application of Linear Systems, this is a three part problem.

Quinoa Pasta 2: Students are given all the relevant information on the nutritional labels of quinoa, but they have to figure out how to use this information. They have to come up with the idea that they can set up two equations in two unknowns to solve the problem.

Pairs of Whole Numbers: Students will solve systems of linear equations exactly, and provide a simple example of a system with three equations and three unknown. Application problem using three equations.

Find a System: The purpose of this task is to encourage students to think critically about both the algebraic and graphical interpretation of systems of linear equations. They are expected to take what they know about systems and reverse the process.

Estimating a Solution via Graphs: The purpose of this task is to examine, via graphing, whether or not a solution to a system of two equations is accurate or not. The equations have been chosen so that finding the exact solution requires significant calculations so that it is easy to make an error.

Additional Lesson Resources

- Illuminations
  - The Candy Problem: Students solve a multiple step system of equations.
  - Talk or Text: Students compare different costs associated with two cell phone plans. They write equations with 2 variables and graph to find the solution of the system of equations. They then analyze the meaning of the graph and discuss other factors involved in choosing a cell phone plan.
- CPalms
  - **Graphing vs. Substitution: Which Would You Choose?** Students will compare and contrast how to solve a system of equations using the two methods: graphing and substitution. The students will work one problem using both methods.
  - **Exploring Systems of Equations using Graphing:** Introduces the concept of graphing a system of linear equations. Students will use graphing technology and graph paper to explore the meaning of the solution of a linear system including solutions that correspond to intersecting lines, parallel lines, and coinciding lines.
  - **When Two Lines Meet:** Graph a system of two equations in two variables, and find the solution(s), if one exists. The students do a group activity graphing systems and a summative assessment is included.
  - **Classifying Solutions to Systems of Equations:** Mathematics Assessment Project lesson; Assist students who have difficulties in using substitution to complete a table of values for a linear equation, identifying a linear equation from a given table of values and graphing and solving linear equations.
  - **Systems of the Linear Roundtable:** Students will solve by graphing, elimination, and substitution in a group setting. Each student will also perform error analysis on the work from their peers, which will allow them to help each other to correct those mistakes. Class will use data from error analysis to create a plan of action to decrease errors in their work
- MARS/Shell

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	○ Optimizing Problems: Boomerangs – Students will develop a system of equations from a linear application. ○ Solving Linear Equations in Two Variables: This lesson unit is intended to help you assess how well students are able to formulate and solve problems using algebra and, in particular, to identify and help students who have the following difficulties with systems of equations.

Learning Objectives	
MAFS.912.A-REI.4.12 • Students can identify the solutions to a system of inequalities. • Students can 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	
Instructional Resources	
Mathematics Formative Assessments (MFAS) Which Graph: Students are asked to select the correct graph of the solution region of a given system of two linear inequalities. Graph a System of Inequalities: Students are asked to graph a system of two linear inequalities.	Additional Lesson Resources • CPalms ○ Solution Sets: The purpose of this task is to give students a chance to go beyond the typical problem and make the connections between points in the coordinate plane and solutions to inequalities and equations. Students have to focus on what the graph is showing. • MARS/Shell ○ Defining Regions Using Inequalities: students are able to use linear inequalities to create a set of solutions. Assist students who have difficulties in representing a constraint by shading the correct side of the inequality line and understanding how combining inequalities affects a solution space.

Learning Objectives	
MAFS.912.A-CED.1.2 • Students will create equations to represent relationships between two quantities with two or more variables. • Students will graph equations with labels and scales.	
Instructional Resources	
Mathematics Formative Assessments (MFAS) Hotel Swimming Pool Students are asked to write an equation in two variables given a verbal description of the relationship among the variables. Loss of Fir Trees Students are asked to sketch a graph that depicts the exponential decline in the population of fir trees in a forest. Model Rocket Students are asked to graph a function in two variables given in context. Tech Repairs Students are asked to write an equation in two variables from a verbal description. Tech Repairs Graph Students are asked to graph an equation in two variables given in context. Tee It Up Students are asked to write an equation in three variables from a verbal description. Trees in Trouble Students are asked to write a function that represents an annual loss of 3% per year.	Additional Lesson Resources

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Learning Objectives

MAFS.912.A-CED.1.3

- Students can represent constraints of equations or inequalities in a real world context.
- Students can interpret solutions as viable or non-viable options in a modeling context.
- Students can write constraints for a real world context using equations, inequalities, a system of equations or a system of inequalities.
- Students can interpret the solution of a real-world context as viable or not viable.

Instructional Resources

Mathematics Formative Assessments (MFAS)

Sugar and Protein Students are asked to model a problem involving constraints using inequalities.

The New School Students are asked to recognize constraints in a real world context.

Constraints on Equations Students are asked to analyze constraints on equations in context and interpret the solutions as viable or not viable.

Illustrative Mathematics Assessment Tasks

Fishing Adventures 3: Students write and solve inequalities, and represent the solutions graphically.

Additional Lesson Resources

- CPalms
  - Don't Blow the Budget: Students use systems of equations and inequalities to solve real world budgeting problems involving two variables.
  - Exploring Systems with Piggies, Pizzas, and Phones: Students develop an understanding of how to solve realistic problems using two linear equations and in the process strengthen and support the skills involved in translating situations into algebraic expressions. The lesson includes printable materials for students to use during the lesson.
  - Feasible or Non-Feasible (Graphing Systems of Linear Inequalities): 3 day lesson: Students learn how to use the graph of a system of linear inequalities to determine the feasible region. Students practice solving word problems to find the optimal solution that maximizes profits. Students will use the free application, GeoGebra (see download link under Suggested Technology) to help them create different graphs and to determine the feasible or non-feasible solutions.

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Algebra 1 Honors Semester 1	**Unit 4: Linear & Inverse Functions**	Projected Time Allotment: **14 Days**

Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**
MAFS.912.A-CED.1.2 Create equations in two or more variable s to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	• Items that require the student to write a system of equations using a real-world context are limited to a system of 2x2 linear equations with integral coefficients if the equations are written in the form Ax+By=C. • Items that require the student to solve a system of equations are limited to a system of 2x2 linear equations with integral coefficients if the equations are written in the form Ax+By=C. • Items that require the student to graph a system of equations or inequalities to find the solution are limited to a 2x2 system. • Items that require the student to write a system of inequalities using a real-world context are limited to integer coefficients. Calculator: Neutral • Editing Task Choice • Equations Editor • GRID • Hot Text • Multiple Choice • Multiselect • Open Response
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). At this point you are demonstrating depth of this standard to nonlinear relationships.	• The following function types can be used: Linear, quadratic, and exponential. Calculator: Neutral • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Mutliselect • Open Response • Table Item
MAFS.912.F-IF.2.4 (Also assesses F-IF.3.9) 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; symmetric; and behavior; and periodicity.	• Functions can be linear, quadratic or exponential • Functions can be represented using tables or graphs. 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 students to use or know interval notation. Calculator: No • Equation Editor • GRID • Hot Text • Multiple Choice • Open Response

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MAFS.912.F-IF.2.6 (Also assesses MAFS.912.S-ID.3.7) 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.	• Items requiring the student to calculate the rate of change will give a specified interval that is both continuous and differentiable. • Items should not require the student to find an equation of a line. • Items assessing F-IF.2.6 should not be linear. Calculator: Neutral • Equation Editor • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
MAFS.912.F-IF.3.7a 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 Special Note: Crossed out sections will be done in future units.	• 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. Calculator: Neutral • Equation Editor • GRID • Hot Text • Multiple Choice • Multiselect • Open Response
MAFS.912.F-BF.1.2 (Algebra 2 tested standard) Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.	• Calculator: •
MAFS.912.F-BF.2.4 (Algebra 2 tested standard) Find inverse functions. a. Solve an equation of the form f(x)=c for a simple function f that has an inverse and write an expression for the inverse. For example, f(x)=2x^3 or f(x) = (x+1)/(x-1) for ≠1.	• Calculator: •
MAFS.912.-LE.1.1 Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.	• Exponential functions should be in the form $a(b)^x + k$. Calculator: **NO** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multi-select • Open response

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MAFS.912.F-LE.1.2 (*Testing also assesses MAFS.912.F-BF.1.1, MAFS.912.F-IF.1.3*) Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph and a description of a relationship or two input-output pairs (include reading these from a table.)	• 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 a linear or exponential function, the real-world context should be continuous. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multi-Select • Open Response • Table Item
MAFS.912.F-LE.2.5 Interpret the parameters in a linear or exponential function in terms of a context.	• Exponential functions should be in the form $a(b)^x + k$. Calculator: **NO** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multi-select • Open response
MAFS.912.S-ID.2.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a) Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models. b) Informally assess the fit of a function by plotting and analyzing residuals. Fit a linear function for a scatter plot that suggests a linear association	• In items that require the student to interpret or use the correlation coefficient, the value of the correlation coefficient must be given in the stem. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response • Table Item
MAFS.912.S-ID.3.7 In items that require the student to interpret or use the correlation coefficient, the value of the correlation coefficient must be given in the stem.	• 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 yintercept should have a value with at least a hundredths place value. Calculator: **NEUTRAL** • Equation Editor • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response

MAFS.912.S-ID.3.8 Compute (using technology) and interpret the correlation coefficient of a linear fit. Assessed with MAFS.912.S-ID.2.6	• In items that require the student to interpret or use the correlation coefficient, the value of the correlation coefficient must be given in the stem. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response • Table Item
MAFS.912.S-ID.3.9 Distinguish between correlation and causation. Assessed with MAFS.912.S-ID.2.6	• In items that require the students to interpret or use the correlation coefficient, the value of the correlation must be given in the stem. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)

- 3-1 Graphing Linear Equations
- Explore: Algebra Lab – Rate of Change of a Linear Functions
- 3-3 Rate of Change and Slope
- 3-4 Direct Variation
- 3-5 Arithmetic Sequences as Linear Functions
- 3-6 Proportional and Nonproportional Relationships
- Explore: Graphing Technology Lab – Investigating Slope-Intercept Form
- 4-1 Graphing Equations in Slope-Intercept Form
- 4-5 Scatter Plots and Lines of Fit
- Extend: Algebra Lab – Correlation and Causation
- 4-6 Regression and Median-Fit Lines
- 4-7 Inverse Linear Functions

EngageNY Instructional Resource (may not cover all content required for the aligned standards)

- Module 2, Topic D, Lesson 12: Relationships Between Two Numerical Variables (part 1)
- Module 2, Topic D, Lesson 13: Relationships Between Two Numerical Variables (part 2)
- Module 2, Topic D, Lesson 14: Modeling Relationships with a Line
- Module 2, Topic D, Lesson 15: Interpreting Residual from a Line
- Module 2, Topic D, Lesson 16: More on Modeling Relationships with a Line
- Module 2, Topic D, Lesson 17: Analyzing Residuals (part 1)
- Module 2, Topic D, Lesson 18: Analyzing Residuals (part 2)
- Module 2, Topic D, Lesson 19: Interpreting Correlation
- Module 2, Topic D, Lesson 20: Analyzing Data Collected on Two Variables
- Module 3, Topic A, Lesson 1: Integer Sequences – Should You Believe in Patterns?
- Module 3, Topic A, Lesson 2: Recursive Formulas for Sequences
- Module 3, Topic A, Lesson 3: Arithmetic and Geometric Sequences

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- Module 3, Topic A, Lesson 4: Why Do Banks Pay YOU to Provide Their Services?
- Module 3, Topic C, Lesson 15: Piecewise Functions
- Module 3, Topic C, Lesson 16: Graphs Can Solve Equations Too
- Module 3, Topic C, Lesson 17: Four Interesting Transformations of Functions (part 1)
- Module 3, Topic C, Lesson 18: Four Interesting Transformations of Functions (part 2)
- Module 3, Topic C, Lesson 19: Four Interesting Transformations of Functions (part 3)
- Module 3, Topic C, Lesson 20: Four Interesting Transformations of Functions (part 4)

Learning Objectives

MAFS.912.A-REI.4.10

- Students can verify if a set of ordered pairs is a solution of a function.
- Students can find an approximate solution for f(x)=g(x) using a graphing tool or a table of values for both linear and nonlinear functions.
- Students can justify the intersection of two functions is a solution to f(x)=g(x)

Instructional Resources

Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
What is the Point Students are asked to explain the relationship between a point on the graph and a point not on the graph. Finding Solutions Students are asked to explain the relationship between a given linear equation and both a point on its graph and a point not on its graph Case In Point – (explain the relationship between the set of solutions and the graph of an exponential equation, 3 problems) Illustrative Mathematics Assessment Tasks Taxi Students are asked to justify given solutions as reasonable for the situation. Collinear points—4 part task that ask students to conceptually think about nonlinear functions	

Learning Objectives

MAFS.912.A-CED.1.2

- Students will create equations to represent relationships between two quantities with two or more variables.
- Students will graph equations with labels and scales.

Instructional Resources

Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
Hotel Swimming Pool Students are asked to write an equation in two variables given a verbal description of the relationship among the variables. Loss of Fir Trees Students are asked to sketch a graph that depicts the exponential decline in the population of fir trees in a forest. Model Rocket Students are asked to graph a function in two variables given in context. Tech Repairs Students are asked to write an equation in two variables from a verbal description. Tech Repairs Graph Students are asked to graph an equation in two variables given in context. Tee It Up Students are asked to write an equation in three variables from a verbal description.	

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Trees in Trouble Students are asked to write a function that represents an annual loss of 3% per year.	

Learning Objectives

MAFS.912.F-IF.2.4

- Students will be able to interpret key features of a radical function from a graph and tables from a real world context.
- Students can identify key features of a graph: intercepts, intervals where the function is increasing, decreasing, positive, or negative, symmetry, maximum and minimums.
- Students can sketch a linear and non-linear graph (linear, exponential, and quadratic)
- Students can interpret tables in terms of a quantity.
- 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).

Instructional Resources

Mathematics Formative Assessments (MFAS)

Elevation Along a Trail Students interpret key features of a graph (symmetry) in the context of a problem situation.

Uphill and Downhill Students interpret key features of a graph (intercepts and intervals over which the graph is increasing) in the context of a problem situation.

Taxi Ride Students sketch a graph from a verbal description.

Bike Race Students evaluate three verbal descriptions and to state why each does or does not match a given graph.

Surf's Up Students are given a table of functional values and asked to describe and interpret key features of the graph in the context of the problem.

Illustrative Mathematics Assessment Tasks

Snake on a Plane This task has students approach a function via both a recursive and an algebraic definition, in the context of a famous game.

Warming and Cooling Straightforward interpretation to read and interpret a graph.

Telling a story with graphs Students examine graphs and interpret them giving a verbal description of what they see.

Throwing Baseballs Students compare characteristics of 2 quadratic functions

Additional Lesson Resources

- MARS/Shell *A culminating lesson task using a coherent approach to this unit*
  - ...Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions.
  - Transforming Quadratics—The basics This activity introduces students to the graph of the quadratic parent function.
  - Parts and more Parts—Parabola Fun This is an entry lesson into quadratics and their shapes.

Learning Objectives

MAFS.912.F-IF.2.6

- Students can calculate and 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.

Instructional Resources

Mathematics Formative Assessments (MFAS)

Pizza Palace – (Rate of change, 2 problems)

Identifying Rate of Change – (Identifying Rate of Change, 3

Additional Lesson Resources

- CPalms
  - The High School Gym—this task looks at functions

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problems)

Air Cannon – (Rate of change given exponential graph, 3 problems)

Estimating the Average Rate of Change – (Non-linear rate of change, 3 problems)

Illustrative Mathematics Assessment Tasks

The High School Gym—task build student reasoning skills for examining linear and non linear relationships

Mathmafish Population—interpreting a real world problem for linear relationships at intervals.

in regard to temperature

- MARS/Shell
  - Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions.

Learning Objectives

MAFS.912.F-IF.3.7a

- Students can graph functions symbolically that are linear showing intercepts, maxima, and minima.
- Students can show key features of graphs by hand in simple cases and using technology for more complicated cases of linear functions.
- Students can Students will identify the x-and y-intercepts and the slope of a linear function.
- Students can graph a linear function using key features.
- Students can graph an exponential function using key features
- Students can identify and interpret key features o a graph within the real-world context that the function represents.
- Students can graph linear and quadratic functions and show intercepts, maxima, and minima.
- Students can graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions (using technology to meet this goal speeds up student understanding through discovery)
- ~~Students will identify zeros, extreme values, and symmetry of a quadratic function written symbolically~~.

Instructional Resources

Mathematics Formative Assessments (MFAS)

Graphing a Step Function students graph a step function state the domain and identify intercepts.

~~Graphing a Quadratic Function~~ ~~Students graph a quadratic function and identify the intercepts and the maxima or mimima.~~

Graphing a Rational Function Students graph equations using technology and answer questions about key features.

Graphing a Linear Function Students are given equations and asked to identify domains and with limits what are the maximum and minimum and intercepts.

Graphing a Root Function Students answer questions about the domain, maxima and minima of Root functions.

Illustrative Mathematics Assessment Tasks

~~Graphs of Quadratic Functions~~ ~~Students compare graphs of different quadratic functions, then produce equations of their own to satisfy given conditions.~~

Additional Lesson Resources

- MARS/Shell *A culminating lesson task using a coherent approach to this unit*
  - ...Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions.
  - ~~Forming Quadratics~~ ~~This lesson unit is intended to help you assess how well students are able to understand what the different algebraic forms of a quadratic function reveal about the properties of its graphical representation~~
- ~~CPalms~~
  - ~~Graphing Quadratics Made Easy~~ ~~This lesson covers quadratic translations as they relate to vertex form of a quadratic equation.~~
  - ~~Graphing Quadratic Equations~~ ~~This is an introductory lesson to graphing quadratic equations~~
  - ~~Quadratic Functions~~ ~~This worksheet gives students one place to show all transformations (reflections, vertical stretches/compressions, and translations) for the quadratic function.~~

Learning Objectives

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MAFS.912.F-BF.1.2

- Students will write a geometric sequence using a recursive formula to model a real-world context.
- Students will write a geometric sequence using an explicit formula to model a real-world context.
- Students will rewrite recursive formulas using an explicit formula and vice versa.
- Students will write an explicit function, define a recursive process, or complete a table of calculations

Instructional Resources

Illustrative Mathematics Assessment Tasks	Additional Lesson Resources
Snake on a Plane Students look at functions via recursive and algebraic definitions.	• CPalms ○ Temperatures in Degrees Fahrenheit and Celsius The first part of this task provides an opportunity to construct a linear function given two input-output pairs. The second part investigates the inverse of a linear function while the third part requires reasoning about quantities and/or solving a linear equation. ○ Plants versus Pollutants Model Eliciting Activity Students work together to clean up toxins through mathematical analysis identifying sequence.

Learning Objectives

MAFS.912.F-BF.2.4a

- Students will find the inverse of a function. (Algebra 2 standard limit)

Instructional Resources

Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
	• MARS/Shell ○ Generalizing Patterns—this task ask students to explain their rational behind their method in describing patterns

Learning Objectives

MAFS.912.F-LE.1.1a,b

- Students can determine whether the real world context can be represented by a linear function ~~or exponential function~~.
- Students can choose an explanation as to why a context can be modeled by a linear function ~~or an exponential function~~.
- Students can interpret the rate of change and intercepts of a linear function when given an equation that models a real world context.

Instructional Resources

Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
Linear of Exponential? – (identify each verbal description as linear or exponential, 4 problems) Prove Linear – (prove that a linear function grows by equal differences, 2 problems) ~~Prove Exponential – (prove that an exponential function grows by equal factors, 2 problems)~~	• CPalms ○ What function do two graph points determine? Students compare three different equations for graphing relationship. ○ Equal differences or Equal Intervals 1 Students interpret the relationship of slope.

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How Does Your Garden Grow? – (compare the rate of change in linear and exponential, 4 problems) Illustrative Mathematics Assessment Tasks In the billions and linear modeling Deeper connections for real world application of nonlinear functions. Linear or Exponential Students analyze linear functions and nonlinear functions to determine understanding. ~~Exponential Functions Task asks students to think about the exponential function increases by a multiplicative factor of b when x increases by 1.~~ ~~U.S Population 1982-1988 Students look at a linear model to examine population growth.~~ ~~Equal Factors over Equal intervals Helps deepen understanding of Exponential functions with introducing "successive quotient" terminology.~~	○ Identifying Functions—Students examine differences in domains and ranges that makeup linear and nonlinear functions. • MARS/Shell ○ Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions. ○ Comparing Investments Helps students interpret and analyze contextual exponential and linear functions

Learning Objectives
MAFS.912.F-LE.1.2 • Students can write a linear function, an arithmetic sequence, an exponential function, or a geometric sequence when given a graph that models a real-world context. • Students can write a linear function, an arithmetic sequence, an exponential function, or a geometric sequence when given a graph that verbal description of a real-world context. • Students can write a linear function, an arithmetic sequence, an exponential function, or a geometric sequence when given a table of values or a set of ordered pairs that models a real-world context.

Instructional Resources	
Mathematics Formative Assessments (MFAS) Write an Exponential Function from a Table Students write an exponential function from two points in a table. Writing an Exponential Function From its Graph Students examine a graph and find the function that relates to the curve based on the given points. Illustrative Mathematics Assessment Tasks Rumors Looks at exponential growth as a matter of rumors spreading. To Points determine an Exponential Function Problem asks students to examine a graph and find an equation of the problem given two points.	Additional Lesson Resources • CPalms ○ Write an Exponential Function from a Table Students write an exponential function from two points in a table. ○ Writing an Exponential Function From its Graph Students examine a graph and find the function that relates to the curve based on the given points. • MARS/Shell ○ Comparing Investments Helps students interpret and analyze contextual exponential and linear functions

Learning Objectives
MAFS.912.F-LE.2.5 • Students will choose an explanation as to why a context may be modeled by a linear function or an exponential function. • Students will interpret the rate of change and intercepts of a linear function when given an equation that models a real-world context.

Instructional Resources	
Mathematics Formative Assessments (MFAS) Lunch Account Students are asked to interpret linear functions parameters in a context.	Additional Lesson Resources • MARS/Shell ○ Comparing Investments Helps students interpret

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Computer Repair Students are expected to interpret a linear function in context to a real world situation. Interpreting Exponential Functions Students are asked to interpret parameters of an exponential function in context.	and analyze contextual exponential and linear functions

Learning Objectives
MAFS.912.S-ID.2.6 • Students will represent data on a scatter plot. • Students will identify a linear function, a quadratic function, or an exponential function that was found using regression. • Students will use a regression equation to solve problems in the context of the data. • Students will calculate residuals. • Students will create a residual plot and determine whether a function is an appropriate fit for the data.

Instructional Resources	
Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
Swimming Prediction Students are asked to use a linear model to make and interpret predictions in the context of the data. Fit a Function Students are given a set of data and are asked to use technology to create a scatter plot and write a function that fits the data set. Residuals Students are asked to compute, graph, and interpret the residuals associated with a line of best fit. House Prices Students are asked to informally fit a line to model the relationship between two quantitative variables in a scatterplot, write the equation of the line, and use it to make a prediction.	• Illuminations ○ Barbee Bungee In this lesson students collect data using a rubber band bungee cord and a Barbie doll, construct a scatter plot, generate a line of best fit, and consequently examine linear functions • CPalms ○ Doggie Data: It's a dogs life This lesson allows students to use real-world data to construct and interpret scatter plots using technology. • MARS/Shell ○ Devising a Measure for Correlation This lesson unit is intended to help you assess how well students understand the notion of correlation.

Learning Objectives
MAFS.912.S-ID.3.7 • Students will represent data on a scatter plot. • Students will identify a linear function, a quadratic function, or an exponential function that was found using regression. • Students will use a regression equation to solve problems in the context of the data.

Instructional Resources	
Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
Intercept for Life Expectancy Students are asked to interpret the intercept of a linear model of life expectancy data. Slope for Foot Length model Students are asked to interpret the meaning of the slope of the graph of a linear model. Slope For Life Expectancy Students are asked to interpret the meaning of the slope of the graph of a linear model. Bungee Cord Model Students are asked to interpret the meaning of the constant term in a linear model.	• CPalms ○ Don't Mope over Slope This is an introductory lesson designed to help students have a better understanding of the interpretation of the slope (rate of change) of a graph. ○ Spaghetti Bridges Students use data collection from their spaghetti bridge activity to write linear equations, graph the data, and interpret the data. ○ Scatter Plots , Spaghetti and Predicting the future Students will construct a scatter plot from given data. They will identify the correlation, sketch an approximate trend line, and find the equation of the trend line.

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Learning Objectives
MAFS.912.S-ID.3.8 • Students will determine the fit of a function by analyzing the correlation coefficient.

Instructional Resources	
Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
July December Correlation Students are asked to compute and interpret the correlation coefficient for a given set of data. How Big are Feet Students are asked to compute and interpret the correlation coefficient for a given set of data. Correlation Order Students are asked to estimate a correlation coefficient for each of four data sets and then order the coefficients from least to greatest in terms of the strength of relationship. Correlation for Life Expectancy Students are asked to compute and interpret the correlation coefficient for a given set of data.	• CPalms ○ Why Correlations? This lesson is an introductory lesson to correlation coefficients. Students will engage in research prior to the teacher giving any direct instruction. ○ Scatterplots and Correlation In this lesson, students will interpret and analyze data to create a scatter plot and line of best fit. Students will make predictions for the number of views of a video for any given number of weeks on the charts. ○ Scrambled Coefficient Students explore correlation of data through an activity allowing them to order situations from negative correlation to positive correlation. ○ How Technology Can make My life Easier Students will use GeoGebra software to explore the concept of correlation coefficient in graphical images of scatter plots.

Learning Objectives
MAFS.912.S-ID.3.9 • Students will distinguish between situations where correlation does not imply causation. • Students will distinguish variables that are correlated because one is the cause of another

Instructional Resources	
Mathematics Formative Assessments (MFAS)	Additional Lesson Resources
Sleep and Reading Students are asked to interpret a correlation coefficient in context and describe a possible causal relationship. Does Studying Pay? Students are given a scenario describing an association between two variables and are asked to determine if one variable is a cause of the other. Listing All Possible Causal Relationships Students are asked to identify all possible causal relationships between two correlated variables. Illustrative Mathematics Assessment Tasks Coffee and Crime This problem solving task asks students to examine the relationship between shops and crimes by using a correlation coefficient. Golf and Divorce This is a simple task addressing the distinction between correlation and causation. Students are given information indicating a correlation between two variables, and are asked to reason out whether or not a causation can be inferred.	• CPalms ○ Is Milk Killing People Students will explore correlation and causation from data through class discussions of real world examples. ○ Correlation or Causation: That is the Question Students will learn how to analyze whether two events/properties demonstrate a correlation or causation or both. ○ Smarter than a Statistician: Correlations Using Cornell Notes and a PowerPoint Presentation, students will learn to distinguish between correlation and causation. ○ What's so funny about Correlations? Students construct arguments in favor of and against causal relationships between two strongly correlated events and decide which one is more reasonable.

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Algebra 1 Honors Semester 1	**Unit 5: Exponents & Exponential Functions**	Projected Time Allotment: **10 Days**

Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**
MAFS.912.N-RN.1.1 Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define* $5^{1/3}$ *to be the cube root of 5 because we want* $(5^{1/3})^3 = 5^{(1/3)3}$ *to hold, so* $(5^{1/3})^3$ *must equal 5.*	• Expressions should contain no more than three variables. Calculator: **NO** • Editing Task • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
MAFS.912.N-RN.1.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents. `	• Expressions should contain no more than three variables. • For N-RN.1.2, items should not require the student to do more than two operations Calculator: **NO** • Editing Task • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
MAFS.912.A-SSE.1.2 Use the structure of an expression to identify ways to rewrite it. For example, see x4 – y 4 as $(x^2)^2 – (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$.	• Calculator: **NEUTRAL** • Edit Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
MAFS.912.A-SSE.2.3c Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. c) Use the properties of exponents to transform expressions for exponential functions. For example, the expression 1.15t can be rewritten as (1.151/12) 12 ≈ (1.012)12t to reveal the approximate equivalent monthly interest rate if the annual rate is 15%	• For A-SSE.2.3, items should require the student to choose how to rewrite the expression. Calculator: **NEUTRAL** • Editing Task • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
MAFS.912.A-SSE.2.4 **(Algebra 2 tested standard)** Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems.	• Calculator: •

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MAFS.912.A-REI.4.11 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 equations 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.	• In items where a function is represented by a graph or table, the function may be any continuous function. Calculator: Neutral • Equation Editor • GRID • Hot Text • Multiple Item • Multiple Choice • Multi-Select • Open Response • Table Item
MAFS.912.F-IF.1.3 Recognize that sequences are functions, sometimes defined recursively whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by f(0)=f(1)-1, f(n+1)=f(n)+f(n-1) for n ≥ 1	• In items where the student constructs an exponential function, a geometric sequence in a recursive definition from input-output pairs, at least two sets of pairs must have consecutive inputs. Calculator: Neutral • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multi-Select • Open Response • Table Item
MAFS.912.F-IF.2.6 (Also assesses MAFS.912.S-ID.3.7) 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.	• Items requiring the student to calculate the rate of change will give a specified interval that is both continuous and differentiable. • Items should not require the student to find an equation of a line. • Items assessing F-IF.2.6 should not be linear. Calculator: Neutral • Equation Editor • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
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. e) Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude and using phase shift.	• For F-IF.3.7e and 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. Calculator: **NEUTRAL** • Equation Editor • GRID • Hot Text • Multiple Choice • Multiselect • Open Response

MAFS.912.F-IF.3.8b (Also assesses MAFS.912.F-IF.3.7a,b,c,e and MAFS.912.A-APR.2.3) b. Use the properties of exponents to interpret expressions for exponential functions.	• For F-IF.3.7e and 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. • 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. Calculator: Neutral • Equation Editor • GRID • Hot Text • Multiple Choice • Multiselect • Open Response
MAFS.912.F-BF.1.2 (Algebra 2 tested standard) Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.	• Calculator: •
MAFS.912.F-BF.2.3 Identify the effect on the graph of replacing the f(x) by f(x) + k,k f(x), f(kx) and f(x +k), for specific values of k (both positive and negative); find the value of k given he 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.	• 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. Calculator: Neutral • Equation Editor • GRID • Matching Item • Multiple Choice • Open Response • Table Item
MAFS.912.F-LE.1.1 Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	• Exponential functions should be in the form $a(b)^x + k$. Calculator: **NO** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multi-select • Open response

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MAFS.912.F-LE.1.2 (*Testing also assesses MAFS.912.F-BF.1.1, MAFS.912.F-IF.1.3*) Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph and a description of a relationship or two input-output pairs (include reading these from a table.)	• 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 a linear or exponential function, the real-world context should be continuous. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multi-Select • Open Response • Table Item
MAFS.912.F-LE.1.3 Observing using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	• Exponential functions represented in graphs or tables should be able to be written in the form $a(b)^x + k$. • For exponential relationships, tables or graphs must contain at least one pair of consecutive values. Calculator: **NO** • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multi-Select • Open-Response
MAFS.912.F-LE.2.5 Interpret the parameters in a linear or exponential function in terms of a context.	• Exponential functions should be in the form $a(b)^x + k$. Calculator: **NO** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multi-select • Open response

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)
• 7-1 Multiplication Properties of Exponents • 7-2 Division Properties of Exponents • 7-3 Rational Exponents • Explore: Graphing Technology Lab – Family of Exponential Functions • 7-5 Exponential Functions • Extend: Graphing Technology Lab – Solving Exponential Equations and Inequalities • 7-6 Growth and Decay • Extend: Algebra Lab – Transforming Exponential Expressions • 7-7 Geometric Sequences as Exponential Functions • Extend Algebra Lab – Average Rate of Change of Exponential Functions • 7-8 Recursive Formulas
EngageNY Instructional Resource (may not cover all content required for the aligned standards)
• Module 3, Topic A, Lesson 5: The Power of Exponential Growth • Module 3, Topic A, Lesson 6: Exponential Growth – U.S. Population and World Population

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- Module 3, Topic A, Lesson 7: Exponential Decay
- Module 3, Topic D, Lesson 21: Comparing Linear and Exponential Models Again
- Module 3, Topic D, Lesson 22: Modeling an Invasive Species Population
- Module 3, Topic D, Lesson 23: Newton's Law of Cooling
- Module 3, Topic D, Lesson 24: Piecewise and Step Functions in Context

Learning Objectives
MAFS.912.N-RN.1.1 • Students will apply the properties of operations of integer exponents to expressions with rational exponents. • Students will apply the properties of operations of integer exponents to radical expressions.
Instructional Resources

Illustrative Mathematics Assessment Tasks	Lesson Resources
Evaluating a Special Exponential Expression Three students disagree about what value to assign to the expression 00. In each case, critically analyze the student's argument. Evaluating Exponential Expressions This task is to use properties of exponents for whole numbers in order to explain how expressions with fractional exponents are defined. Checking a Calculation of a Decimal Exponent This task is to connect properties of fractional exponents with ordering of real numbers. Extending the Definitions of Exponents, Variation 2 Students will develop an understanding of why rational exponents are defined as they are.	• MARS/Shell ○ Manipulating Radicals Students will use the properties of exponents, including rational exponents and manipulate algebraic statements involving radicals. Discriminate between equations and identities.

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Illustrative Mathematics Assessment Tasks	Lesson Resources
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Learning Objectives
MAFS.912.A-SSE.1.2 • Students will rewrite algebraic expressions in different equivalent forms using factoring techniques (e.g., common factors, grouping, the difference of two squares, the sum or difference of two cubes, or a combination of methods to factor completely) or simplifying expressions (e.g., combining like terms, using the distributive property, and other operations with polynomials).
Instructional Resources

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Mathematics Formative Assessments (MFAS)	Lesson Resources
Finding Missing Values Students rewrite quadratic expressions and identify parts of the expressions. Determine the Width Students find the width of a rectangle whose area and length are given as polynomials. Rewriting Numerical Expressions Students are asked to rewrite numerical expressions to find efficient ways to calculate. **Illustrative Mathematics Assessment Tasks** Equivalent Expressions Students must understand the need to transform the factored form of the quadratic expression (a product of sums) into a sum of products in order to easily see *a*, the coefficient of the x2 term; *k*, the leading coefficient of the *x* term; and *n*, the constant term.	

Learning Objectives
MAFS.912.A-SSE.2.3c • Students will use equivalent forms of an exponential expression to interpret the expressions terms, factors, coefficients, or parts in terms of the real-world situation the expression represents. • Students will rewrite algebraic expressions in different equivalent forms by recognizing the expressions structure.
Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
Jumping Dolphin Students are asked to find the zeros of a quadratic function in the context of a modeling problem. Rocket Town Students are asked to rewrite a quadratic expression in vertex form to find maximum and minimum values. Population Drop Students are asked to use the properties of exponents to show that two expressions are equivalent and compare the two functions in terms of what each reveals. College Costs Students are asked to transform an exponential expression so that the rate of change corresponds to a different time interval.	

Learning Objectives
MAFS.912.A-SSE.2.4 *(Algebra 2 Standard)* • Students will find and use the formula for the sum of a finite geometric series to solve problems.
Instructional Resources

	Lesson Resources
	• must be supplemented

Learning Objectives
MAFS.912.A-REI.4.11 • 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. • 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.
Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
Graphs and Solutions: Students are given a graph and asked to	

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explain why the x-coordinate of the intersection of two functions , f and g, is a solution of the equation f(x) = g(x). f(x) is linear and g(x) is cubic. Graphs and Solutions 2: Students are asked to find the solution(s) of the equation f(x) = g(x) given the graphs of f and g and explain their reasoning. F(x) is linear and g(x) is a parabola. Using Tables: Students are asked to find solutions of the equation f(x) = g(x) for two given functions, f and g, by constructing a table of values. Using Technology: Students are asked to use technology (e.g., spreadsheet, graphing calculator, or dynamic geometry software) to estimate the solutions of the equation f(x) = g(x) for given functions f and g. f(x) is linear and g(x) is exponential.	

Learning Objectives
MAFS.912.F-IF.1.3 • Students will recognize sequences are functions. • Students will recognize recursive sequences/functions.
Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
Recursive Sequences Students are asked to find the first five terms of a sequence recursively, explain why the sequence is a function, and describe its domain. Which Sequences are Functions? Students are asked to determine if each of two sequences is a function and to describe its domain, if it is a function.	

Learning Objectives
MAFS.912.F-IF.2.6 • Students can calculate and 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.
Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
Pizza Palace – (Rate of change, 2 problems) Identifying Rate of Change – (Identifying Rate of Change, 3 problems) Air Cannon – (Rate of change given exponential graph, 3 problems) Estimating the Average Rate of Change – (Non-linear rate of change, 3 problems) **Illustrative Mathematics Assessment Tasks** The High School Gym—task build student reasoning skills for examining linear and non linear relationships Mathmafish Population—interpreting a real world problem for linear relationships at intervals.	• CPalms ○ The High School Gym—this task looks at functions in regard to temperature • MARS/Shell ○ Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions.

Learning Objectives
MAFS.912.F-IF.3.7e • 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

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function is the most appropriate for interpretation for a real-world context.
- Students will identify and interpret key features of a graph within the real-world context that the function represents.
- Students will graph an exponential function using key features.
- Students will identify intercepts and end behavior for an exponential function.
- Students will identify and interpret key features of a graph within the real-world context that the function represents.

Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
Graphing an Exponential Function Students graph an exponential function and to determine if the function is an example of exponential growth or decay, describe any intercepts, and describe the end behavior of the graph. Exponential Graphing using Technology Allows students to use technology to examine what happens when values are changed and how it affects the graph.	• Illuminations ○ Predicting your Financial future This lesson examines exponential growth through financial opportunities. • MARS/Shell ○ Comparing Investments Helps students interpret and analyze contextual exponential and linear functions

Learning Objectives

MAFS.912.F-IF.3.8b
- 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.

Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
Exponential Functions 1 Students are asked to identify the percent rate of change and determine if it is decay or growth. Exponential Functions 2 Students are asked to identify the percent rate of change and determine if it is decay or growth.	• CPalms • Exponential Growth Using Technology Hands on approach for students to test their understanding and discover depth of exponential functions determining behavior and growth and decay.

Learning Objectives

MAFS.912.F-BF.1.2
- Students will write a geometric sequence using a recursive formula to model a real-world context.
- Students will write a geometric sequence using an explicit formula to model a real-world context.
- Students will rewrite recursive formulas using an explicit formula and vice versa.
- Students will write an explicit function, define a recursive process, or complete a table of calculations

Instructional Resources

Illustrative Mathematics Assessment Tasks	Lesson Resources
Snake on a Plane Students look at functions via recursive and algebraic definitions.	• McGraw-Hill • 3-5 • 7-7, 7-8 • CPalms ○ Temperatures in Degrees Fahrenheit and Celsius The first part of this task provides an opportunity to construct a linear function given two input-output pairs. The second part investigates the inverse of a linear function while the third part requires reasoning about quantities and/or solving a linear equation.

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	○ Plants versus Pollutants Model Eliciting Activity Students work together to clean up toxins through mathematical analysis identifying sequence.

Learning Objectives
MAFS.912.F-BF.2.3 • Students can determine the value of k when given a graph of the function and its transformation. • Students can identify differences and similarities between a function and its transformation. • Students can identify a graph of a function given a graph or a table of a transformation and the type of transformation that is represented. • Students can graph by applying a given transformation to a function. • Students can identify ordered pairs of a transformed graph. • Students can complete a table for a transformed function.

Instructional Resources	

Mathematics Formative Assessments (MFAS)
Write the equation Students are asked to write the function of three absolution value graphs.
Comparing functions Students are asked to compare functions to a given function to help see transformations
Comparing Functions - Quadratic Students compare the graphs of quadratics to the parent graph.
 	
Illustrative Mathematics Assessment Tasks
Medieval Archer This activity helps examine the vertical and horizontal changes placed upon the changing functions.
Transforming the graph of a function Allows students to follow the shifts and recognize patterns in terms of functions.
Building a Quadratic Function from f(x)=x^2 This task aims for students to understand the quadratic formula in a geometric way in terms of the graph of a quadratic function.
Medieval Archer Students will 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).
Building a General Quadratic Function This task is for instructional purposes only and builds on "Building an explicit quadratic function."
	Lesson Resources
	• CPalms
	  • Translating Quadratic Functions Students will examine what happens to the graph as it is modified in four different ways
	  • Graphing Quadratic Equations This lesson uses graphing technology to examine the differences between quadratic equations and linear equations.

Learning Objectives
MAFS.912.F-LE.1.1 • Students can determine whether the real world context can be represented by a linear function or exponential function. • Students can choose an explanation as to why a context can be modeled by a linear function or an exponential function. • Students can interpret the rate of change and intercepts of a linear function when given an equation that models a real world context.

Instructional Resources	
Mathematics Formative Assessments (MFAS)	Lesson Resources

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Linear of Exponential? – (identify each verbal description as linear or exponential, 4 problems)
Prove Linear – (prove that a linear function grows by equal differences, 2 problems)
Prove Exponential – (prove that an exponential function grows by equal factors, 2 problems)
How Does Your Garden Grow? – (compare the rate of change in linear and exponential, 4 problems)
Predicting your Financial Future Students can use the formula to predict future value of an investment

Illustrative Mathematics Assessment Tasks

In the billions and linear modeling Deeper connections for real world application of nonlinear functions.
Linear or Exponential Students analyze linear functions and nonlinear functions to determine understanding.
Exponential Functions Task asks students to think about the exponential function increases by a multiplicative factor of b when x increases by 1.
U.S Population 1982-1988 Students look at a linear model to examine population growth.
Equal Factors over Equal intervals Helps deepen understanding of Exponential functions with introducing "successive quotient" terminology.

- CPalms
  - What function do two graph points determine? Students compare three different equations for graphing relationship.
  - Equal differences or Equal Intervals 1 Students interpret the relationship of slope.
  - Identifying Functions—Students examine differences in domains and ranges that makeup linear and nonlinear functions.
- MARS/Shell
  - Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions.
  - Comparing Investments Helps students interpret and analyze contextual exponential and linear functions

Learning Objectives

MAFS.912.F-LE.1.2

- Students can write a linear function, an arithmetic sequence, an exponential function, or a geometric sequence when given a graph that models a real-world context.
- Students can write a linear function, an arithmetic sequence, an exponential function, or a geometric sequence when given a graph that verbal description of a real-world context.
- Students can write a linear function, an arithmetic sequence, an exponential function, or a geometric sequence when given a table of values or a set of ordered pairs that models a real-world context.

Instructional Resources

Mathematics Formative Assessments (MFAS)

Write an Exponential Function from a Table Students write an exponential function from two points in a table.
Writing an Exponential Function From its Graph Students examine a graph and find the function that relates to the curve based on the given points.

Illustrative Mathematics Assessment Tasks

Rumors Looks at exponential growth as a matter of rumors spreading.
To Points determine an Exponential Function Problem asks students to examine a graph and find an equation of the problem given two points.

Lesson Resources

- CPalms
  - Write an Exponential Function from a Table Students write an exponential function from two points in a table.
  - Writing an Exponential Function From its Graph Students examine a graph and find the function that relates to the curve based on the given points.
- MARS/Shell
  - Comparing Investments Helps students interpret and analyze contextual exponential and linear functions

Learning Objectives

MAFS.912.F-LE.1.3

- Students can write a recursive definition for a sequence that is presented as a sequence, a graph, or

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table.

- Students will compare a quadratic function and an exponential function given in real-world context by interpreting the functions' graphs.
- Students will compare a quadratic function and an exponential function given in a real-world context through tables

Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources

Compare Quadratic and Exponential functions Students are asked to explain characteristics relating to the graph and interpret the graph.
Compare Linear and Exponential Functions Students are asked to compare linear and exponential functions from a graph in context.
 	
Illustrative Mathematics Assessment Tasks
Exponential Growth verse Linear Growth Helps students to discover how an exponential function surpasses a linear function.
	• CPalms
	  ○ Compare Quadratic and Exponential functions Students are asked to explain characteristics relating to the graph and interpret the graph.
	  ○ Compare Linear and Exponential Functions Students are asked to compare linear and exponential functions from a graph in context.
	• MARS/Shell
	  ○ Comparing Investments Helps students interpret and analyze contextual exponential and linear functions

Learning Objectives

MAFS.912.F-LE.2.5

- Students will choose an explanation as to why a context may be modeled by a linear function or an exponential function.
- Students will interpret the rate of change and intercepts of a linear function when given an equation that models a real-world context.

Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
Lunch Account Students are asked to interpret linear functions parameters in a context. Computer Repair Students are expected to interpret a linear function in context to a real world situation. Interpreting Exponential Functions Students are asked to interpret parameters of an exponential function in context.	• MARS/Shell ○ Comparing Investments Helps students interpret and analyze contextual exponential and linear functions

Algebra 1 Honors Semester 1	**Unit 6: Polynomials**	Projected Time Allotment: **20 Days**

Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**
MAFS.912.A-SSE.1.1 Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients.	• For A-SSE.1.1, items should not ask the student to interpret zeros, the vertex, or axis of symmetry when the quadratic expression is in the form $ax^2 + bx + c$ (see F-IF.3.8). Calculator: **NEUTRAL** • Edit Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
MAFS.912.A-SSE.1.2 Use the structure of an expression to identify ways to rewrite it. For example, see x4 – y 4 as $(x^2)^2 – (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$.	• Calculator: **NEUTRAL** • Edit Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
MAFS.912.A-SSE.2.3a 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 zeros of the function it defines.	• For A-SSE.2.3, items should require the student to choose how to rewrite the expression. Calculator: **NEUTRAL** • Editing Task • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
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.	• Items set in a real-world context should not result in a non-real 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. Calculator: **NO** • Edit Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response

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MAFS.912.A-APR.2.3 Identify zeros of polynomials when suitable factorizations are available and use the zeros to construct a rough graph of the function defined by the polynomial.	• Students will find the zeros of a polynomial function when the polynomial is in factored form. • Students will create a rough graph of a polynomial function in factored form by examining the zeros of the function. • Students will use the x-intercepts of a polynomial function and end behavior to graph the function. Calculator: **NEUTRAL** • Edit Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
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.	• Items will not require students to recall names of properties from memory Calculator: No • Drag and drop response • Equation Response • Movable Text Response • Multiple Choice Response • Natural Language Response • Selectable Text Response
MAFS.912.A-REI.2.4 Solve quadratic equations in one variable. 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 ± bi for real numbers a and b.	• In items that require the student to transform a quadratic equation to vertex form, the coefficient of the linear term must be an even factor of the coefficient of the quadratic term. • 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 ax2 = c or ax2 + 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 ax2 + 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. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)
• 8-1 Adding and Subtracting Polynomials • 8-2 Multiplying a Polynomial by a Monomial • 8-3 Multiplying Polynomials • 8-4 Special Products • 8-5 Using the Distributive Property • 8-6 Solving $x^2 + bx + c = 0$ (extend to include finding the Zeros once factored : A-APR.2.3) • 8-7 Solving $ax^2 + bx + c = 0$ (extend to include finding the Zeros once factored : A-APR.2.3)

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- 8-8 Difference of Squares
- 8-9 Perfect Squares

EngageNY Instructional Resource (may not cover all content required for the aligned standards)

- Module 1, Topic B, Lesson 6: Algebraic Expressions – The Distributive Property
- Module 1, Topic B, Lesson 8: Adding & Subtracting Polynomials
- Module 1, Topic B, Lesson 9: Multiplying Polynomials
- Module 4, Topic A, Lesson 1: Multiplying and Factoring Polynomial Expressions (part 1)
- Module 4, Topic A, Lesson 2: Multiplying and Factoring Polynomial Expressions (part 2)
- Module 4, Topic A, Lesson 3: Advanced Factoring Strategies for Quadratic Expressions (part 1)
- Module 4, Topic A, Lesson 4: Advanced Factoring Strategies for Quadratic Expressions (part 2)
- Module 4, Topic A, Lesson 5: The Zero Product Property

Learning Objective

MAFS.912.A-SSE.1.1a

- Students can interpret parts of expressions such as terms, factors, and coefficients
- Students will rewrite algebraic expressions in different equivalent forms by recognizing the expression's structure.

Instructional Resources

Mathematics Formative Assessments (MFAS)

Dot Expressions Students are asked to explain how parts of an algebraic expression relate to the number and type of symbols in a sequence of diagrams.

Mathematics Formative Assessments (MFAS)

Interpreting Basic Tax Students interpret the parts of an equation used to calculate the total purchase price including tax of a set of items.

Dot Expressions Students are asked to explain how parts of an algebraic expression relate to the number and type of symbols in a sequence of diagrams.

What Happens? Students are asked to determine how the volume of a cone will change when its dimensions are changed.

Illustrative Mathematics Assessment Tasks

Animal Populations Students interpret the relative size of variable expressions involving two variables in the context of a real world situation.

Mixing Fertilizer Students generalize the problem and verify conclusions using algebraic rather than numerical expressions.

The Bank Account Students explore an expression that calculates the balance of a bank account with compounding interest.

Cubic Identity This task presents a challenging exercise in both algebraic manipulations and seeing structure in algebraic expressions.

Seeing Dots The purpose of this task is to identify the structure in the two algebraic expressions by interpreting them in terms of a geometric context.

Lesson Resources

- Illuminations
  - Building Connections Students make connections among different classes of polynomial functions by exploring the graphs of the functions.
- MARS/Shell:
  - Sorting Equations and identities Students will be able to: Recognize the differences between equations and identities. Substitute numbers into algebraic statements in order to test their validity in special cases. Resist common errors when manipulating expressions such as $2(x-3) = 2x-3$; $(x+3)^2 = x^2 + 3^2$. Carry out correct algebraic manipulations.
- Math is Fun
  - Multiplying Polynomials Video tutorial on multiplying polynomials.
- OER Commons
  - Polynomial Division Mini lesson on dividing polynomials.
- Better Lessons
  - Adding and Subtracting Polynomials When polynomial expressions are added the result is another polynomial expression.

Learning Objective

MAFS.912.A-SSE.1.2

- Students will rewrite algebraic expressions in different equivalent forms using factoring techniques (e.g., common factors, grouping, the difference of two squares, the sum or difference of two cubes, or a combination of methods to factor completely) or simplifying expressions (e.g., combining like terms,

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using the distributive property, and other operations with polynomials).

Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
Finding Missing Values Students rewrite quadratic expressions and identify parts of the expressions. Determine the Width Students find the width of a rectangle whose area and length are given as polynomials. Rewriting Numerical Expressions Students are asked to rewrite numerical expressions to find efficient ways to calculate. Illustrative Mathematics Assessment Tasks Equivalent Expressions Students must understand the need to transform the factored form of the quadratic expression (a product of sums) into a sum of products in order to easily see *a*, the coefficient of the x2 term; *k*, the leading coefficient of the *x* term; and *n*, the constant term.	

Learning Objective

MAFS.912.A-SSE.2.3a

- Student will factor a quadratic expression to find the zeros of the function.

Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
Jumping Dolphin Students are asked to find the zeros of a quadratic function in the context of a modeling problem.	

Learning Objective

MAFS.912.A-APR.1.1

- 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

Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
Adding Polynomials Students find the sum of two polynomials and explain if the sum of polynomials always results in a polynomial. Subtracting Polynomials Students find the difference of two polynomials and explain if the difference of polynomials will always result in a polynomial. Multiplying Polynomials 1 Students multiply polynomials and explain if the product of polynomials always results in a polynomial. Multiplying Polynomials 2 Students multiply polynomials and explain if the product of two polynomials always results in a polynomial.	

Learning Objective

MAFS.912.A-APR.2.3

- Students will find the zeros of a polynomial function when the polynomial is in factored form.
- Students will create a rough graph of a polynomial function in factored form by examining the zeros of

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the function.

Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
Zeros of a Quadratic Students are asked to identify the zeros of polynomials, without the use of technology, and then describe what the zeros of a polynomial indicate about its graph. Zeros of a Cubic Students are asked to identify the zeros of cubic polynomials, without the use of technology, and then describe what the zeros indicate about the graph. Use Zeros to Graph Students are given the factored form of a cubic polynomial and are asked to use the zeros to sketch the graph between two given points on the coordinate plane without the use of technology	• CPalms ○ Building Connections This learning activity guides students to make connections between linear and polynomial functions through exploring their graphs ○ Representing Polynomials This lesson unit is intended to help you assess how well students are able to translate between graphs and algebraic representations of polynomials.

Learning Objective

MAFS.912.A-REI.1.1

- Students can justify each step in the process of solving an equation
- Students can solve linear equations and inequalities in one variable including literal equations

Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
Justify the Process 1 Students are asked to justify each step in the process of solving equations. Justify the Process 2 Students are asked to justify each step in the process of solving equations. Equation Logic Students are given linear equations and asked to justify each step in the process of solving. Does it Follow? Students are asked to compare two equations and determine if they are equivalent **Illustrative Mathematics Assessment Tasks** 1-2 Same Solutions? Students reason about equivalence of equations How Does the Solution Change? Students reason about their solutions.	• CPalms ○ Justly Justifying Students review the properties used in solving equations ○ Method to My Mathness Students complete proof tables to solve equations

Learning Objectives

MAFS.912.A-REI.2.4b

- Students will solve quadratic equations (inspection, taking square roots, completing the square, quadratic formula and factoring).
- Students will recognize when the quadratic formula gives complex solutions.

Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
Complex Solutions? Students are asked to explain how to recognize when the quadratic formula results in complex solutions. Quadratic Formula-2 Students are asked to complete the derivation of the quadratic formula. Which Strategy? Students are shown four quadratic equations and asked to choose the best method for solving each equation.	

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Algebra 1 Honors Semester 2	**Unit 7: Quadratic Functions**	Projected Time Allotment: **16 Days**

Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**
MAFS.912.A-SSE.2.3b Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.	• For A-SSE.2.3, items should require the student to choose how to rewrite the expression. Calculator: **NEUTRAL** • Editing Task • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
MAFS.912.A-REI.2.4 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 ± bi for real numbers a and b.	• In items that require the student to transform a quadratic equation to vertex form, the coefficient of the linear term must be an even factor of the coefficient of the quadratic term. • 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 ax2 = c or ax2 + 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 ax2 + 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. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
MAFS.912.A-REI.3.7 (Algebra 2 standard not tested) Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line y = - 3x and the circle $x^2 + y^2 = 3$.	• Items that require a student to graph a system of equations are limited to a 2 x 2 system. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multiselect • Open Response
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	• 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;

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	intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior. Calculator: No • Equation Editor • GRID • Hot Text • Multiple Choice • Multiselect • Open Response
MAFS.912.F-IF.2.6 (Also assesses MAFS.912.S-ID.3.7) 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.	• Items requiring the student to calculate the rate of change will give a specified interval that is both continuous and differentiable. • Items should not require the student to find an equation of a line. • Items assessing F-IF.2.6 should not be linear. Calculator: Neutral • Equation Editor • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
MAFS.912.F-IF.3.7a,b 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.	• 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. Calculator: **NEUTRAL** • Equation Editor • GRID • Hot Text • Multiple Choice • Multiselect • Open Response
MAFS.912.F-IF.3.8a (Also assesses MAFS.912.F-IF.3.7a,b,c,e and MAFS.912.A-APR.2.3) 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.	• Students will identify zeros, extreme values, and symmetry of a quadratic functions written symbolically. • For F-IF.3.8, items may specify a required form using an equation or using common terminology such as standard form. • 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. Calculator: Neutral • Equation Editor • GRID • Hot Text • Multiple Choice • Multiselect • Open Response

MAFS.912.F-LE.1.1 Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	• Exponential functions should be in the form $a(b)^x + k$. Calculator: **NO** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multi-select • Open response
MAFS.912.F-LE.1.2 (*Testing also assesses MAFS.912.F-BF.1.1, MAFS.912.F-IF.1.3*) Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph and a description of a relationship or two input-output pairs (include reading these from a table.)	• 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 a linear or exponential function, the real-world context should be continuous. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multi-Select • Open Response • Table Item
MAFS.912.S-ID.2.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models.	• In items that require the student to interpret or use the correlation coefficient, the value of the correlation coefficient must be given in the stem. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response • Table Item

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)
• 9-1 Graphing Quadratic Functions • 9-2 Solving Quadratic Equations by Graphing • 9-3 Transformations of Quadratic Functions • Extend: Graphing Technology Lab – Systems of Linear and Quadratic Equations • 9-4 Solving Quadratic Equations by Completing the Square • Extend: Algebra Lab – Finding the Maximum or Minimum Value • 9-5 Solving Quadratic Equations by Using the Quadratic Formula • 9-6 Analyzing Functions with Successive Differences • Extend: Graphing Technology Lab – Curve Fitting • 9-7 Special Functions • Extend: Graphing Technology Lab – Piecewise-Linear Functions
EngageNY Instructional Resource (may not cover all content required for the aligned standards)
• Module 4, Topic A, Lesson 6: Solving Basic One-Variable Quadratic Equations • Module 4, Topic A, Lesson 7: Creating and Solving Quadratic Equations in One Variable

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- Module 4, Topic A, Lesson 8: Exploring the Symmetry in Graphs of Quadratic Functions
- Module 4, Topic A, Lesson 9: Graphing Quadratic Functions from Factored Form, $f(x) = a(x - m)(x - n)$
- Module 4, Topic A, Lesson 10: Interpreting Quadratic Functions from Graphs and Tables
- Module 4, Topic B, Lesson 11: Completing the Square (part 1)
- Module 4, Topic B, Lesson 12: Completing the Square (part 2)
- Module 4, Topic B, Lesson 13: Solving Quadratic Equations by Completing the Square
- Module 4, Topic B, Lesson 14: Deriving the Quadratic Formula
- Module 4, Topic B, Lesson 15: Using the Quadratic Formula
- Module 4, Topic B, Lesson 16: Graphing Quadratic Equations from the Vertex Form, $y = a(x - h)^2 + k$
- Module 4, Topic B, Lesson 17: Graphing Quadratic Equations from the Standard Form, $f(x) = ax^2 + bx + c$
- Module 4, Topic C, Lesson 21: Transformations of the Quadratic Parent Function, $f(x) = x^2$

Learning Objective

MAFS.912.A-SSE.2.3b

- 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.

Instructional Resources

Mathematics Formative Assessments (MFAS)

Rocket Town Students are asked to rewrite a quadratic expression in vertex form to find maximum and minimum values.

Jumping Dolphin Students are asked to find the zeros of a quadratic function in the context of a modeling problem.

Illustrative Mathematics Assessment Tasks

Building a General Quadratic Function In this resource, a method of deriving the quadratic formula from a theoretical standpoint is demonstrated.

Graphs of Quadratic Functions Students compare graphs of different quadratic functions, then produce equations of their own to satisfy given conditions.

Lesson Resources

- CPalms
  - Using Algebra Tiles and Tables to Factor Trinomials Students will use algebra tiles to visually see how to factor trinomials.
  - Hip to be (Completing the)Square This lesson is an introduction to completing the square
  - Differences of Squares This lesson uses generalized arithmetic to ground a series of computations and then abstract them into a single idea

Learning Objective

MAFS.912.A-REI.2.4

- Students will transform a quadratic equation with the same solutions, using completing the square method, into an equation in the form $(x-p)^2=q$.
- Students will derive the quadratic formula from this form.
- Students will solve quadratic equations (inspection, taking square roots, completing the square, quadratic formula and factoring).
- Students will recognize when the quadratic formula gives complex solutions.

Instructional Resources

Mathematics Formative Assessments (MFAS)

Complete the Square-1 Students are asked to solve a quadratic equation by completing the square.

Complete the Square-2 Students are asked to solve a quadratic equation by completing the square.

Lesson Resources

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Complete the Square-3 Students are asked to solve a quadratic equation by completing the square. Quadratic Formula-1 Students are asked to derive the quadratic formula by completing the square. Complex Solutions? Students are asked to explain how to recognize when the quadratic formula results in complex solutions. Quadratic Formula-2 Students are asked to complete the derivation of the quadratic formula. Which Strategy? Students are shown four quadratic equations and asked to choose the best method for solving each equation.	

Learning Objective

MAFS.912.A-REI.3.7

- Students will interpret the solution of a real-world context as viable or not viable.
- Students will solve a simple system of a linear equation and a quadratic equation in two variables algebraically.
- Students will solve a simple system of a linear equation and a quadratic equation in two variables graphically

Instructional Resources

Illustrative Mathematics Assessment Tasks	Lesson Resources
A Linear and Quadratic System This task asks students to consider the linear and quadratic functions shown on a graph, and use quadratic functions to find the coordinates. The Circle and the Line This lesson is assessing a simple but important piece of conceptual understanding, namely the correspondence between intersection points of the two graphs and solutions of the system	

Learning Objective

MAFS.912.F-IF.2.4

- Students will be able to interpret key features of a radical function from a graph and tables from a real world context.
- Students can identify key features of a graph: intercepts, intervals where the function is increasing, decreasing, positive, or negative, symmetry, maximum and minimums.
- Students can sketch a linear and non-linear graph (linear, exponential, and quadratic)
- Students can interpret tables in terms of a quantity.
- 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).

Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
Elevation Along a Trail Students interpret key features of a graph (symmetry) in the context of a problem situation. Uphill and Downhill Students interpret key features of a graph (intercepts and intervals over which the graph is increasing) in the context of a problem situation. Taxi Ride Students sketch a graph from a verbal description.	• MARS/Shell *A culminating lesson task using a coherent approach to this unit* ○ …Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions. ○ Transforming Quadratics—The basics This

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Bike Race Students evaluate three verbal descriptions and to state why each does or does not match a given graph. Surf's Up Students are given a table of functional values and asked to describe and interpret key features of the graph in the context of the problem. Illustrative Mathematics Assessment Tasks Snake on a Plane This task has students approach a function via both a recursive and an algebraic definition, in the context of a famous game. Warming and Cooling Straightforward interpretation to read and interpret a graph. Telling a story with graphs Students examine graphs and interpret them giving a verbal description of what they see. Throwing Baseballs Students compare characteristics of 2 quadratic functions	activity introduces students to the graph of the quadratic parent function. ○ Parts and more Parts—Parabola Fun This is an entry lesson into quadratics and their shapes.

Learning Objective
MAFS.912.F-IF.2.6 • Students can calculate and 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.

Instructional Resources	
Mathematics Formative Assessments (MFAS) Pizza Palace – (Rate of change, 2 problems) Identifying Rate of Change – (Identifying Rate of Change, 3 problems) Air Cannon – (Rate of change given exponential graph, 3 problems) Estimating the Average Rate of Change – (Non-linear rate of change, 3 problems) Illustrative Mathematics Assessment Tasks The High School Gym—task build student reasoning skills for examining linear and non linear relationships Mathmafish Population—interpreting a real world problem for linear relationships at intervals.	Lesson Resources • CPalms ○ The High School Gym—this task looks at functions in regard to temperature • MARS/Shell ○ Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions.

Learning Objective
MAFS.912.F-IF.3.7a,b • Students can graph functions symbolically that are linear showing intercepts, maxima, and minima. • Students can show key features of graphs by hand in simple cases and using technology for more complicated cases of linear functions. • Students can Students will identify the x-and y-intercepts and the slope of a linear function. • Students can graph a linear function using key features. • Students can graph an exponential function using key features • Students can identify and interpret key features o a graph within the real-world context that the function represents. • Students can graph linear and quadratic functions and show intercepts, maxima, and minima. • Students can graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions (using technology to meet this goal speeds up student understanding through discovery)

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- Students will identify zeros, extreme values, and symmetry of a quadratic function written symbolically.

Instructional Resources

Mathematics Formative Assessments (MFAS)

Graphing a Step Function students graph a step function state the domain and identify intercepts.

Graphing a Quadratic Function Students graph a quadratic function and identify the intercepts and the maxima or mimima.

Graphing a Rational Function Students graph equations using technology and answer questions about key features.

Graphing a linear Function Students are given equations and asked to identify domains and with limits what are the maximum and minimum and intercepts.

Graphing a Root Function Students answer questions about the domain, maxima and minima of Root functions.

Illustrative Mathematics Assessment Tasks

Graphs of Quadratic Functions Students compare graphs of different quadratic functions, then produce equations of their own to satisfy given conditions.

Lesson Resources

- MARS/Shell *A culminating lesson task using a coherent approach to this unit*
  - …Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions.
  - Forming Quadratics This lesson unit is intended to help you assess how well students are able to understand what the different algebraic forms of a quadratic function reveal about the properties of its graphical representation
- CPalms
  - Graphing Quadratics Made Easy This lesson covers quadratic translations as they relate to vertex form of a quadratic equation.
  - Graphing Quadratic Equations This is an introductory lesson to graphing quadratic equations
  - Quadratic Functions This worksheet gives students one place to show all transformations (reflections, vertical stretches/compressions, and translations) for the quadratic function.

Learning Objective

MAFS.912.F-IF.3.8a

- 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 identify zeros, extreme values, and symmetry of a quadratic function written symbolically.

Instructional Resources

Mathematics Formative Assessments (MFAS)

Exponential Functions 1 Students are asked to identify the percent rate of change and determine if it is decay or growth.

Exponential Functions 2 Students are asked to identify the percent rate of change and determine if it is decay or growth.

Launch from a Hill Students are asked to factor and find the zeros of a polynomial function given in context.

A Home for Fido Students are asked to rewrite a quadratic function in an equivalent form by completing the square and to use this form to identify the vertex of the graph and explain its meaning in context.

Illustrative Mathematics Assessment Tasks

Springboard Dive The student will gain valuable experience applying the quadratic formula and the exercise also gives a possible implementation of completing the square.

Which Function The task addresses knowledge related to interpreting forms of functions derived by factoring or completing the square.

Lesson Resources

- CPalms
  - Exponential Growth Using Technology Hands on approach for students to test their understanding and discover depth of exponential functions determining behavior and growth and decay.

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Learning Objective

MAFS.912.F-LE.1.1a

- Students can determine whether the real world context can be represented by a linear function or exponential function.
- Students can choose an explanation as to why a context can be modeled by a linear function or an exponential function.
- Students can interpret the rate of change and intercepts of a linear function when given an equation that models a real world context.

Instructional Resources

Mathematics Formative Assessments (MFAS)

Linear of Exponential? – (identify each verbal description as linear or exponential, 4 problems)

Prove Linear – (prove that a linear function grows by equal differences, 2 problems)

Prove Exponential – (prove that an exponential function grows by equal factors, 2 problems)

How Does Your Garden Grow? – (compare the rate of change in linear and exponential, 4 problems)

Predicting your Financial Future Students can use the formula to predict future value of an investment

Illustrative Mathematics Assessment Tasks

In the billions and linear modeling Deeper connections for real world application of nonlinear functions.

Linear or Exponential Students analyze linear functions and nonlinear functions to determine understanding.

Exponential Functions Task asks students to think about the exponential function increases by a multiplicative factor of b when x increases by 1.

U.S Population 1982-1988 Students look at a linear model to examine population growth.

Equal Factors over Equal intervals Helps deepen understanding of Exponential functions with introducing "successive quotient" terminology.

Lesson Resources

- CPalms
  - What function do two graph points determine? Students compare three different equations for graphing relationship.
  - Equal differences or Equal Intervals 1 Students interpret the relationship of slope.
  - Identifying Functions—Students examine differences in domains and ranges that makeup linear and nonlinear functions.
- MARS/Shell
  - Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions.
  - Comparing Investments Helps students interpret and analyze contextual exponential and linear functions

Learning Objective

MAFS.912.F-LE.1.2

- Students can write a linear function, an arithmetic sequence, an exponential function, or a geometric sequence when given a graph that models a real-world context.
- Students can write a linear function, an arithmetic sequence, an exponential function, or a geometric sequence when given a graph that verbal description of a real-world context.
- Students can write a linear function, an arithmetic sequence, an exponential function, or a geometric sequence when given a table of values or a set of ordered pairs that models a real-world context.

Instructional Resources

Mathematics Formative Assessments (MFAS)

Write an Exponential Function from a Table Students write an exponential function from two points in a table.

Writing an Exponential Function From its Graph Students examine a graph and find the function that relates to the curve based on the

Lesson Resources

- CPalms
  - Write an Exponential Function from a Table Students write an exponential function from two points in a table.

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given points. Illustrative Mathematics Assessment Tasks Rumors Looks at exponential growth as a matter of rumors spreading. To Points determine an Exponential Function Problem asks students to examine a graph and find an equation of the problem given two points.	○ Writing an Exponential Function From its Graph Students examine a graph and find the function that relates to the curve based on the given points. • MARS/Shell ○ Comparing Investments Helps students interpret and analyze contextual exponential and linear functions

Learning Objective
MAFS.912.S-ID.2.6a • Students will represent data on a scatter plot. • Students will identify a linear function, a quadratic function, or an exponential function that was found using regression. • Students will use a regression equation to solve problems in the context of the data. • Students will calculate residuals. • Students will create a residual plot and determine whether a function is an appropriate fit for the data.

Instructional Resources	
Mathematics Formative Assessments (MFAS) Scatter plots, spaghetti, and predicting the future. Students will construct a scatter plot from given data. They will identify the correlation, sketch an approximate trend line, and find the equation of the trend line. Swimming Prediction Students are asked to use a linear model to make and interpret predictions in the context of the data. Fit a Function Students are given a set of data and are asked to use technology to create a scatter plot and write a function that fits the data set. Residuals Students are asked to compute, graph, and interpret the residuals associated with a line of best fit. House Prices Students are asked to informally fit a line to model the relationship between two quantitative variables in a scatterplot, write the equation of the line, and use it to make a prediction.	Lesson Resources • Illuminations ○ Barbee Bungee In this lesson students collect data using a rubber band bungee cord and a Barbie doll, construct a scatter plot, generate a line of best fit, and consequently examine linear functions • CPalms ○ Doggie Data: It's a dogs life This lesson allows students to use real-world data to construct and interpret scatter plots using technology. • MARS/Shell ○ Devising a Measure for Correlation This lesson unit is intended to help you assess how well students understand the notion of correlation.

Algebra 1 Honors Semester 2	**Unit 8: Radical Functions**	Projected Time Allotment: **9 Days**

Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**
MAFS.912.N-RN.1.2 Rewrite expressions involving radicals and rational exponents using the properties of exponents. `	• Expressions should contain no more than three variables. • For N-RN.1.2, items should not require the student to do more than two operations Calculator: **NO** • Editing Task • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
MAFS.912.N-RN.2.3 Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.	• Expressions should contain no more than three variables. Calculator: **NO** • Editing Task • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
MAFS.912.A-CED.1.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	• In items that require the student to write an equation as a constraint the equation may be a linear function. • In items that require the student to write a system of equations to represent a constraint, the system is limited to a 2x2 with integral coefficients. • In items that require the student to write a system of inequalities to represent a constraint, the system is limited to a 2x2 with integral coefficients. Calculator: Neutral • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multi-Select • Open Response

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MAFS.912.A-REI.2.4 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.	• In items that require the student to transform a quadratic equation to vertex form, the coefficient of the linear term must be an even factor of the coefficient of the quadratic term. • 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 ax2 = c or ax2 + 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 ax2 + 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. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
MAFS.912.F-IF.2.4 (Also assesses F-IF.3.9) 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; symmetric; and behavior; and periodicity.	• Functions can be linear, quadratic or exponential • Functions can be represented using tables or graphs. 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 students to use or know interval notation. Calculator: No • Equation Editor • GRID • Hot Text • Multiple Choice • Open Response
MAFS.912.F-IF.3.7b Graph functions expressed symbolically and show key features of the graph by hand in simple cases and using technology for more complicated cases. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.	• 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. Calculator: Neutral • Equation Editor • GRID • Hot Text • Multiple Choice • Multiselect • Open Response

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)
• 10-1 Square Root Functions • 10-2 Simplifying Radical Expressions • Extend: Algebra Lab – Rational and Irrational Numbers • 10-3 Operations with Radical Expressions • Extend: Algebra Lab – Simplifying n^{th} Root Expressions

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- 10-4 Radical Equations

Learning Objectives
MAFS.912.N-RN.1.1 • Students will apply the properties of operations of integer exponents to expressions with rational exponents. • Students will apply the properties of operations of integer exponents to radical expressions.

Instructional Resources	
Illustrative Mathematics Assessment Tasks	Lesson Resources
Evaluating a Special Exponential Expression Three students disagree about what value to assign to the expression 00. In each case, critically analyze the student's argument. Evaluating Exponential Expressions This task is to use properties of exponents for whole numbers in order to explain how expressions with fractional exponents are defined. Checking a Calculation of a Decimal Exponent This task is to connect properties of fractional exponents with ordering of real numbers. Extending the Definitions of Exponents, Variation 2 Students will develop an understanding of why rational exponents are defined as they are.	• MARS/Shell ○ Manipulating Radicals Students will use the properties of exponents, including rational exponents and manipulate algebraic statements involving radicals. Discriminate between equations and identities.

Learning Objectives
MAFS.912.N-RN.2.3 • Students will write algebraic proofs that show that a sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational

Instructional Resources	
Mathematics Formative Assessments (MFAS)	Lesson Resources
Sum of Rational and Irrational Numbers Students are asked to describe the difference between rational and irrational numbers and then explain why the sum of a rational and an irrational number is irrational. Product of Rational Numbers Students are asked to define a rational number and then explain why the product of two rational numbers is rational. Sum of Rational Numbers Students are asked to define a rational number and then explain why the sum of two rational numbers is rational. Product of Non-Rational Zero Numbers Students are asked to describe the difference between rational and irrational numbers, and then explain why the product of a non-zero rational and an irrational number is irrational. Illustrative Mathematics Assessment Tasks Calculating the Square root of 2 This task is intended for instructional purposes so that students can become familiar and confident with using a calculator and understanding what it can and cannot do. Operations with Rational and Irrational Numbers This task has students experiment with the operations of addition and multiplication, as they relate to the notions of rationality and irrationality.	

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Learning Objectives
MAFS.912.A-CED.1.2 • Students will create equations to represent relationships between two quantities with two or more variables. • Students will graph equations with labels and scales.

Instructional Resources	
Mathematics Formative Assessments (MFAS)	Lesson Resources
Hotel Swimming Pool Students are asked to write an equation in two variables given a verbal description of the relationship among the variables. Loss of Fir Trees Students are asked to sketch a graph that depicts the exponential decline in the population of fir trees in a forest. Model Rocket Students are asked to graph a function in two variables given in context. Tech Repairs Students are asked to write an equation in two variables from a verbal description. Tech Repairs Graph Students are asked to graph an equation in two variables given in context. Tee It Up Students are asked to write an equation in three variables from a verbal description. Trees in Trouble Students are asked to write a function that represents an annual loss of 3% per year.	

Learning Objectives
MAFS.912.A-REI.2.4a • Students will transform a quadratic equation with the same solutions, using completing the square method, into an equation in the form $(x-p)^2=q$. • Students will derive the quadratic formula from this form.

Instructional Resources	
Mathematics Formative Assessments (MFAS)	Lesson Resources
Complete the Square-1 Students are asked to solve a quadratic equation by completing the square. Complete the Square-2 Students are asked to solve a quadratic equation by completing the square. Complete the Square-3 Students are asked to solve a quadratic equation by completing the square. Quadratic Formula-1 Students are asked to derive the quadratic formula by completing the square.	

Learning Objectives
MAFS.912.F-IF.2.4 • Students will be able to interpret key features of a radical function from a graph and tables from a real world context. • Students can identify key features of a graph: intercepts, intervals where the function is increasing, decreasing, positive, or negative, symmetry, maximum and minimums. • Students can sketch a linear and non-linear graph (linear, exponential, and quadratic) • Students can interpret tables in terms of a quantity. • 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

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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).

Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
Elevation Along a Trail Students interpret key features of a graph (symmetry) in the context of a problem situation. Uphill and Downhill Students interpret key features of a graph (intercepts and intervals over which the graph is increasing) in the context of a problem situation. Taxi Ride Students sketch a graph from a verbal description. Bike Race Students evaluate three verbal descriptions and to state why each does or does not match a given graph. Surf's Up Students are given a table of functional values and asked to describe and interpret key features of the graph in the context of the problem. **Illustrative Mathematics Assessment Tasks** Snake on a Plane This task has students approach a function via both a recursive and an algebraic definition, in the context of a famous game. Warming and Cooling Straightforward interpretation to read and interpret a graph. Telling a story with graphs Students examine graphs and interpret them giving a verbal description of what they see. Throwing Baseballs Students compare characteristics of 2 quadratic functions	• MARS/Shell *A culminating lesson task using a coherent approach to this unit* ○ …Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions. ○ Transforming Quadratics—The basics This activity introduces students to the graph of the quadratic parent function. ○ Parts and more Parts—Parabola Fun This is an entry lesson into quadratics and their shapes.

Learning Objectives

MAFS.912.F-IF.3.7b

- Students can graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions (using technology to meet this goal speeds up student understanding through discovery)

Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
Graphing a Step Function students graph a step function state the domain and identify intercepts. Graphing a Quadratic Function Students graph a quadratic function and identify the intercepts and the maxima or mimima. Graphing a Rational Function Students graph equations using technology and answer questions about key features.	• MARS/Shell *A culminating lesson task using a coherent approach to this unit* ○ …Functions and Everyday Situations This is a lesson that develops depth of understanding of functions through interpretation, identifying and analyzing situations that make up functions.

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Algebra 1 Honors Semester 2	**Unit 9: Rational Functions**	Projected Time Allotment: **18 Days**

Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**
MAFS.912.A-CED.1.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	• In items that require the student to write an equation as a constraint the equation may be a linear function. • In items that require the student to write a system of equations to represent a constraint, the system is limited to a 2x2 with integral coefficients. • In items that require the student to write a system of inequalities to represent a constraint, the system is limited to a 2x2 with integral coefficients. Calculator: Neutral • Editing Task Choice • Equation Editor • GRID • Hot Text • Multiple Choice • Multi-Select • Open Response
MAFS.912.A-APR.2.2 (Algebra 2 standard not tested) Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x – a is p(a), so p(a) = 0 if and only if (x – a) is a factor of p(x).	• The polynomial that is the dividend should have a degree no less than 3 and no greater than 6. • The polynomial that is the divisor should have a degree of 1, 2, or 3. Calculator: **NO** • Equation Editor • Hot Text • Multiple Choice • Multiselect • Open Response
MAFS.912.A-REI.1.2 (Algebra 2 standard not tested) Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	• Calculator: •

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)
• 11-1 Inverse Variation • 11-2 Rational Functions • 11-3 Simplifying Rational Expressions • 11-4 Multiplying and Dividing Rational Expressions • 11-5 Dividing Polynomials • 11-6 Adding and Subtracting Rational Expressions • 11-7 Mixed Expressions and Complex Fractions • 11-8 Rational

Learning Objectives
MAFS.912.A-CED.1.2 • Students will create equations to represent relationships between two quantities with two or more variables. • Students will graph equations with labels and scales.

Instructional Resources	
Mathematics Formative Assessments (MFAS)	Lesson Resources
Hotel Swimming Pool Students are asked to write an equation in	

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two variables given a verbal description of the relationship among the variables. Loss of Fir Trees Students are asked to sketch a graph that depicts the exponential decline in the population of fir trees in a forest. Model Rocket Students are asked to graph a function in two variables given in context. Tech Repairs Students are asked to write an equation in two variables from a verbal description. Tech Repairs Graph Students are asked to graph an equation in two variables given in context. Tee It Up Students are asked to write an equation in three variables from a verbal description. Trees in Trouble Students are asked to write a function that represents an annual loss of 3% per year.	

Learning Objectives
MAFS.912.A-APR.2.2 *(Algebra 2 Standard)* • Students will use the Remainder Theorem to determine if (x – a) is a factor of a polynomial. • Students will use the Remainder Theorem to determine the remainder of p(x)/(x – a).
Instructional Resources

Illustrative Mathematics Assessment Tasks	Lesson Resources
Zeros and Factorizations of Quadratic Polynomials 1 Each of the questions in this task could be formulated as an if and only if statement but the other implication, namely that $f(x)$ is divisible by $x-r$ if and only if r is a root of f. Zeros and Factorizations of Quadratic Polynomials 2 This task continues "Zeroes and factorization of a quadratic polynomial I." The argument here generalizes, as shown in "Zeroes and factorization of a general polynomial" to show that a polynomial of degree d can have at most d roots. The Missing Coefficient The purpose of this task is to emphasize the use of the Remainder Theorem Zeros and Factorizations of general Polynomials In this task, students are asked to show or verify four theorems related to roots, zeroes, and factors of polynomial functions. Zeros and Factorization of a non-polynomial function For a polynomial function f, if f(0)=0 then the polynomial f(x) is divisible by x.	

Learning Objectives
MAFS.912.A-REI.1.2 *(Algebra 2 Standard)* • Students will solve simple rational and radical equations in one variable. • Students will give example showing how extraneous solutions may arise.
Instructional Resources

	Lesson Resources

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Algebra 1 Honors Semester 2	**Unit 10: Statistics and Probability**	Projected Time Allotment: **13 Days**

Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**
MAFS.912.S-ID.1.1 Represent data with plots on the real number line (dot plots, histograms, and box plots).	• None Calculator: **NEUTRAL** • GRID • Hot Text • Multiple Choice • Multiselect • Open Response
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.	• 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. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
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).	• 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. Calculator: **NEUTRAL** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response
MAFS.912.S-ID.1.4 (Algebra 2 standard not tested) Use the mean and standard deviation of a 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	• Students will calculate the z-score and use it to compare a data point to the population. • Students will calculate the z-score and use it to compare two data points. Calculator: **NEUTRAL** • Equation Editor • GRID • Matching Item • Multiple Choice • Multiselect • Open Response • Table item

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MAFS.912.S-ID.2.5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data	• In data with only two categorical variables, items should require the student to determine relative frequencies and use the frequencies to complete the table or to answer questions. Calculator: **YES** • Editing Task Choice • Equation Editor • GRID • Hot Text • Matching Item • Multiple Choice • Multiselect • Open Response • Table Item

McGraw-Hill Instructional Resource (may not cover all content required for the aligned standards)

- 12-1 Samples and Studies
- 12-2 Statistics and Parameters
- 12-3 Distributions of Data
- 12-4 Comparing Sets of Data
- Extend: Algebra Lab – Two-Way Frequency Tables

EngageNY Instructional Resource (may not cover all content required for the aligned standards)

- Module 2, Topic A, Lesson 1: Distributions and Their Shapes
- Module 2, Topic A, Lesson 2: Describing the Center of Distribution
- Module 2, Topic A, Lesson 3: Estimating Centers and Interpreting the Mean as a Balance Point
- Module 2, Topic B, Lesson 4: Summarizing Deviations from the Mean
- Module 2, Topic B, Lesson 5: Measuring Variability for Symmetrical Distributions
- Module 2, Topic B, Lesson 6: Interpreting the Standard Deviation
- Module 2, Topic B, Lesson 7: Measuring Variability for Skewed Distributions (Interquartile Range)
- Module 2, Topic B, Lesson 8: Comparing Distributions
- Module 2, Topic C, Lesson 9: Summarizing Bivariate Categorical Data
- Module 2, Topic C, Lesson 10: Summarizing Bivariate Categorical Data with Relative Frequencies
- Module 2, Topic C, Lesson 11: Conditional Relative Frequencies and Association

Learning Objectives

MAFS.912.S-ID.1.1

- Students will represent data using a dot plot, a histogram, or a box plot.

Instructional Resources

Mathematics Formative Assessments (MFAS)

A Tomato Garden Students are asked to construct a dot plot corresponding to a given set of data

Flowering Trees Students are asked to determine whether each of two given dot plots are consistent with a given histogram.

Winning Season Students are asked to construct a histogram corresponding to a given set of data.

Trees in the Park Students are asked to construct a box plot corresponding to a given set of data.

Illustrative Mathematics Assessment Tasks

Lesson Resources

- ***must be supplemented***
- CPalms
  - Homework or Play Students will be given data and then plot the data using a graphical method of choice (dot plot, bar graph, box plot, etc.)
  - Florida Manatee Population Students will use box plots to identify data on the past and present manatee populations on both coasts of Florida during the winter months, January through March.
  - Representing Data 1 Using Frequency Graphs This lesson unit is intended to help you assess how well students are able to use frequency graphs to identify a range of measures,

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Speed Trap The purpose of this task is to allow students to demonstrate an ability to construct boxplots and to use boxplots as the basis for comparing distributions.	○ Interpreting Box Plots Students will analyze various real world scenario data sets and create, analyze, and interpret the components of the box plots

Learning Objectives

MAFS.912.S-ID.1.2

- Students will identify similarities and differences in shape, center, and spread when given two or more data sets.
- Students will predict the effect that an outlier will have on the shape, center, and spread of a data set.

Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
How Many Jeans Students are asked to select a measure of center to compare data displayed in dot plots and to justify their choice. Texting During Lunch Students are asked to select a measure of center to compare data displayed in frequency tables and to justify their choice. Texting During Lunch Histograms Students are asked to select measures of center and spread to compare data displayed in histograms and to justify their choices. **Illustrative Mathematics Assessment Tasks** Hair Cut Costs This problem could be used as an introductory lesson to introduce group comparisons and to engage students in a question they may find amusing and interesting.	• CPalms ○ Sweet Statistics- A candy Journey Students will sort pieces of candy by color then calculate statistical information such as mean, median, mode, interquartile range, and standard deviation. ○ Representing Data 1: Using Frequency Graphs This lesson unit is intended to help you assess how well students are able to use frequency graphs to identify a range of measures, make sense of this data in a real-world context, and understand that a large number of data points allow a frequency graph to be approximated by a continuous distribution. ○ A MEANingful Discussion about Central Tendency This is a discovery lesson to deepen the understanding of central tendency (mean, median) by posing relevant scenarios ○ Exploring Box Plots This lesson involves real world data situations. Students will take the data and create, explore, and compare the key components of a box plot. ○ The Debate: Who is a better Baller? In this activity the students will use NBA statistics on Lebron James and Tim Duncan who were key players in the 2014 NBA Finals, to calculate, compare, and discuss mean, median, interquartile range, variance, and standard deviation.

Learning Objectives

MAFS.912.S-ID.1.3

- Students will interpret similarities and differences in shape, center, and spread when given two or more data sets within the real-world context given.
- Students will use their understanding of normal distribution and the empirical rule to answer questions about data sets

Instructional Resources

Mathematics Formative Assessments (MFAS)	Lesson Resources
Using Centers to Compare Tree Heights Students are asked to compare the centers of two data distributions displayed using box plots. Using Spread to Compare Tree Heights Students are asked to compare the spread of two data distributions displayed using box plots. Comparing Distributions Students are given two histograms and are asked to describe the differences in shape, center, and spread. Total Points Scored Students are given a set of data and are asked to determine how the mean is affected when an outlier is removed.	• CPalms ○ House Hunting Students will use criteria such as median home price, neighborhood safety, and likelihood of evacuation during a hurricane to rank a list of neighborhoods in which to shop for a home.

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Learning Objectives

MAFS.912.S-ID.1.4

- Students will calculate the z-score and use it to compare a data point to the population.
- Students will calculate the z-score and use it to compare two data points.

Instructional Resources

Mathematics Formative Assessments (MFAS)

Range of testing Thread Students are asked to find the probability that an outcome of a normally distributed variable is between two given values.

Label a Normal Curve Students are asked to scale and label a normal curve given the mean and standard deviation of a data set with a normal distribution.

Area Under the Normal Curve Students are asked to find the probability that an outcome of a normally distributed variable is between two given values using both a Standard Normal Distribution Table and technology.

Algebra Test Scores Students are asked to select a histogram for which it would be appropriate to apply the 68-95-99.7 rule.

Probability of your Next Texting Thread Students are asked to find the probability that an outcome of a normally distributed variable is greater than a given value.

Illustrative Mathematics Assessment Tasks

SAT Scores This problem solving task challenges students to answer probability questions about SAT scores, using distribution and mean to solve the problem.

Do You Fit in This Car? This task requires students to use the normal distribution as a model for a data distribution. Students must use given means and standard deviations to approximate population percentages

Lesson Resources

- ***must be supplemented***
- CPalms
  - Representing Data 1: Using Frequency Graphs This lesson unit is intended to help you assess how well students are able to use frequency graphs to identify a range of measures, make sense of this data in a real-world context, and understand that a large number of data points allow a frequency graph to be approximated by a continuous distribution.
  - Representing Data 2: Using Box Plots This lesson unit is intended to help you assess how well students are able to interpret data using frequency graphs and box plots.

Learning Objectives

MAFS.912.S-ID.2.5

- Students will create or complete a two-way frequency table to summarize categorical data.
- Students will determine if associations/trends are appropriate for the data.
- Students will interpret data displayed in a two-way frequency table.
- Students will calculate joint, marginal, and conditional relative frequencies.

Instructional Resources

Mathematics Formative Assessments (MFAS)

Breakfast Drink Preference Students are asked to use data from a survey to create a two-way frequency table.

Who is Vegetarian Students are given a two-way frequency table and asked to determine if there is a relationship between the two variables.

Conditional Relative Frequency Students are asked to use a two-way frequency table to interpret two different conditional relative frequencies.

Marginal and Joint Frequency Students are asked to use a two-way frequency table to interpret marginal and joint relative frequencies.

Illustrative Mathematics Assessment Tasks

Musical Preferences This problem solving task asks students to make deductions about what kind of music students like by examining a table with data.

Lesson Resources

- CPalms
  - The Music is On and Popping This MEA is designed to have teams of 4 students look at data in a two-way table.
  - Show me the Money This lesson is an application activity in which students will use relative frequencies to support an argument.
  - Devising a Measure for Correlation This lesson unit is intended to help you assess how well students understand the notion of correlation

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Can You Make Heads or Tails of It? This is a lesson for teaching students how to make Two-Way Frequency and Relevant Frequency tables and to use the data collected and displayed in the tables for interpretation and prediction.	

Algebra 1 Honors Semester 2	**Unit 11: Algebra 1 Honors Extension**	Projected Time Allotment: **8 Days**

Standards/Learning Goals:	**Content Limits, Assessment Types, Calculator**
MAFS.912.A-APR.3.4 (Algebra 2 standard not tested) Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 – y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.	• Calculator: •
MAFS.912.A-APR.4.6 (Algebra 2 standard not tested) Rewrite simple rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using inspection, long division, or, for the more complicated examples, a computer algebra system.	• Calculator: •
MAFS.912.F-IF.3.7 (Algebra 2 standard not tested) Graph functions expressed symbolically and show key features of the graph by hand in simple cases and using technology for more complicated cases. 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.	• Calculator: •
MAFS.912.F-BF.2.4 (Algebra 2 tested standard) Find inverse functions. b. Verify by composition that one function is the inverse of another. c. Read values of an inverse function from a graph or a table, given that the function has an inverse. d. Produce an invertible function from a non-invertible function by restricting the domain.	• Calculator: •

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