Algebra I Mathematics Curriculum Guide

Grade Level/Course Title: MS/HS Algebra I	**Quarter 1**	**Academic Year: 2015-2016**

Mathematics Focus for the Course:
For the Model Algebra I course, instructional time should focus on four critical areas: (1) deepen and extend understanding of linear and exponential relationships; (2) contrast linear and exponential relationships with each other and engage in methods for analyzing, solving, and using quadratic functions; (3) extend the laws of exponents to square and cube roots; and (4) apply linear models to data that exhibit a linear trend.

Essential Questions for this Unit:
1. How can students build on their previous learning about how to solve linear equations in one variable and having applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables?
2. How can students analyze and explain the process of solving an equation and justify the process used in solving a system of equations?
3. How can students develop fluency writing, interpreting, and translating among various forms of linear equations and inequalities, and use them to solve problems?
4. How can students master the solution of linear equations?
5. How can students build on their previous learning about how to solve linear equations in one variable and apply graphical and algebraic methods to analyze and solve systems of linear equations in two variables?

Unit (Time)	Standard	Standard Description	Strategies	Content Objectives & Resources
(August – September) **Unit 1: Equations & Inequalities** **36 days**	A-CED.1	Create equations and inequalities in one variable including ones with absolute value and use them to solve problems. Include equations arising from linear functions, and simple rational and exponential functions.	Understanding: Decomposition Inverse operations Zero pairs Bar models Justifications Syntax Equivalency Distributing a negative Equivalent forms of one Transforming equations Side by side comparisons	**** O1.2 means Objective 2 from Unit 1** **** Each objective should be taught for 1 day, unless otherwise specified.** **** "1 day" is one 55-minute period.** **** Any objective listed with (+) is "advanced" and "nice to have".** O1.1 Combine like terms O1.2 Solve $a + x = b$ and $ax = b$ using multiple methods **(2 days)** ML: Lesson 3.1; PH: Lesson 3-1, 3-2 Syntax – Expressions and Equations [L] One-Step Equations [L] Bar Models – Solving Equations [CP] O1.3 Solve $ax + b = c$ using multiple methods **(2 days)** ML: Lesson 3.2; PH: Lesson 3-3 O1.4 Solve equations with variables on both sides using multiple methods, including literal equations **(3 days)** ML: Lesson 3.4, 3.7; PH: Lesson 3-5 Solving Equations – Multiple Methods [L] Solving Equations w/Variables on Both Sides [L]
	A-CED.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.		
	A-REI.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		
	A-REI.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.		
	A-REI.3.1	Solve one-variable equations and inequalities involving absolute value, graphing the solutions and interpreting them in context.		

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Essential Questions for this Unit:
1. How can students build on their previous learning about how to solve linear equations in one variable and having applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables?
2. How can students analyze and explain the process of solving an equation and justify the process used in solving a system of equations?
3. How can students develop fluency writing, interpreting, and translating among various forms of linear equations and inequalities, and use them to solve problems?
4. How can students master the solution of linear equations?
5. How can students build on their previous learning about how to solve linear equations in one variable and apply graphical and algebraic methods to analyze and solve systems of linear equations in two variables?

Unit (Time)	Standard	Standard Description	Strategies	Content Objectives & Resources
(August – September) **Unit 1: Equations & Inequalities (continued)** **36 days**	A-CED.1	Create equations and inequalities in one variable including ones with absolute value and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.		O1.5 Solve equations and justify each step ML: Lesson 3.4; PH: Lesson 3-6 Solving Equations w/Two Column Proofs [L] O1.6 Use equations to solve word problems using multiple methods (perimeter, area, rate, etc.) **(3 days)** ML: Lesson 7.6; PH: 3-11, 8-5 Rate Problems Using Bar Models [L] **Review and Quiz (1 day)** O1.7 Write, graph and solve inequalities and interpret solutions **(2 days)** ML Lesson 4.1; PH Lesson 9-2 Inequalities Sort [L] O1.8 Explore reversing the direction of the inequality symbol ML Lesson 4.2; PH Lesson 9-2 O1.9 Solve multi-step inequalities **(2 days)** ML Lesson 4.3; PH Lesson 9-2 Solving Inequalities [L] O1.10 Solve compound inequalities ML Lesson 4.4; PH Lesson 9-2
	A-REI 3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters		
	A-REI 3.1	Solve one-variable equations and inequalities involving absolute value, graphing the solutions and interpreting them in context.		

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Essential Questions for this Unit:
1. How can students build on their previous learning about how to solve linear equations in one variable and having applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables?
2. How can students analyze and explain the process of solving an equation and justify the process used in solving a system of equations?
3. How can students develop fluency writing, interpreting, and translating among various forms of linear equations and inequalities, and use them to solve problems?
4. How can students master the solution of linear equations?
5. How can students build on their previous learning about how to solve linear equations in one variable and apply graphical and algebraic methods to analyze and solve systems of linear equations in two variables?

Unit (Time)	Standard	Standard Description	Strategies	Content Objectives & Resources
(August – September) **Unit 1: Equations & Inequalities (continued)** **36 days**	A-REI.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.	Understanding: Infinitely many, none, and one solution options Solve using multiple methods Build flexibility in solving in all methods Relation to real world contexts	O1.11 Solve various absolute value equations: $\lvert x+a\rvert=b,\ \lvert x+a\rvert+b=c,\ a\lvert x+b\rvert=c$ **(2 days)** ML Lesson 4.5; PH Lesson 9-3 Absolute Value Equations and Inequalities [CP] O1.12 Solve absolute value inequalities ML Lesson 4.6; PH Lesson 9-4 **Review and Quiz (1 day)** O1.13 Solve linear systems w/substitution **(2 days)** ML Lesson 7.2; PH Lesson 8-2 Solving a System by Substitution [L] O1.14 Solve linear systems by adding and subtracting **(2 days)** ML Lesson 7.3; PH Lesson 8-3 O1.15 Solve linear systems by multiplying **(2 days)** ML Lesson 7.4; PH Lesson 8-3 Systems of Equations – Multiple Methods [CP] O1.16 Solve rate problems **(2 days)** ML Lesson 7.6; PH Lesson 8-5 Rate Problems Using Bar Models [L] O1.17 Solve mixture problems **(2 days)** ML Lesson 7.7; PH Lesson 9-2 Mixture Problems [L] **Review, Unit 1 Assessment, Test Corrections (3 days)**
	A-REI.6	Solve systems of linear equations exactly and approximately (e.g. with graphs), focusing on pairs of linear equations in two variables.		

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Essential Questions for this Unit:
1. How can students build on learning in earlier grades, when students learned to define, evaluate, and compare functions, and use them to model relationships between quantities?
2. How can students learn function notation and develop the concepts of domain and range?
3. How can students anticipate the graph of a function by interpreting its various forms?

Unit (Time)	Standard	Standard Description	Strategies	Content Objectives & Resources
(October) **Unit 2: Intro to Functions** **14 days**	F-IF 1	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range.	Understanding: Function notation Functions as a "rule" where each input (domain) has one distinct output (range) Key features (increasing/ decreasing intervals, intercepts, maximums, minimums, end behavior, symmetries) Vertical and horizontal shifts Linear, quadratic, cubic, absolute value, square root, cube root graph shapes	O2.1 Identify functions, domain, and range from tables, graphs and maps **(2 days)** ML Lesson 5.1; PH Lesson 12-1 & 12-2 Function – Definition & Representations [CP] O2.2 Identify key features of a graph and a table (linear, quad., cubic, (+) abs. value, (+) square root, (+) cube root) O2.3 Evaluate functions algebraically (linear, quadratic, cubic, absolute value) PH Lesson 12-1 & 12-2 Evaluating Linear Functions [L] O2.4 Evaluate functions graphically (linear, quadratic, cubic, absolute value) Evaluating Linear Functions [L] O2.5 Create input/output tables given a function *and* graph it (simple linear, quadratic, cubic, absolute value) **(2 days)** O2.6 Explore basic transformations (vertical shifts) (linear, quadratic, cubic, absolute value, exponential, (+) square root, (+) cube root) **(2 days)** O2.7 Explore basic transformations (horizontal shifts) (linear, quadratic, cubic, absolute value, exponential, (+) square root, (+) cube root) **(2 days)** **Review, Unit 2 Assessment, Test Corrections (3 days)** **Benchmark 1 includes Units 1 & 2**
	F.IF.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.		
	F.IF.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~~.*		
	F.IF.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.		
	F.IF.7a	Graph linear and quadratic functions and show intercepts, maxima, and minima.		
	F.IF.7b	Graph square root, ~~cube root, & piecewise-defined functions, including step functions &~~ absolute value functions.		

Algebra I Mathematics Curriculum Guide

Grade Level/Course Title: MS/HS Algebra I	**Quarter 2**	**Academic Year: 2015-2016**

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Essential Questions for this Unit:
1. How can students use graphical representations and knowledge of context to make judgments about the appropriateness of linear models, and with linear models, look at residuals to analyze the goodness of fit?
2. How can students focus on linear functions; interpret functions given graphically, numerically, symbolically, and verbally; translate between representations; and understand the limitations of various representations?
3. How can students develop fluency writing, interpreting, and translating between various forms of linear equations and inequalities, and using them to solve problems?
4. How can students explore systems of equations and inequalities, and they find and interpret their solutions?

Unit (Time)	Standard	Standard Description	Strategies	Content Objectives & Resources
(November – December) **Unit 3: Linear Functions** **30 days** **(+): Add 1 day**	F-IF.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology in more complicated cases.	Understanding: Solutions to a linear equation as points on the line and vice versa Creating equations Reasoning with equations and inequalities Interpreting functions Multiple ways to present data (equations, tables, graphs) Average rate of change of linear functions as a constant (slope)	O3.1 Transformations of linear functions Graphing Family of Functions [L] Families of Functions Sort [L] Family of Functions Graphing Worksheet [L] O3.2 Investigate and graph solutions to linear functions **(2 days)** ML Lesson 5.3; PH Lesson 7-2 O3.3 Identify *x* and *y*-intercepts from a graph and from an equation. Graph from standard form. **(2 days)** ML Lesson 5.4; PH Lesson 7-3 O3.4 Graph proportional relationships & write equations of the form $y = mx$ O3.5 Identify average rate of change (slope) for linear functions from tables, graphs, and equations **(2 days)** ML Lesson 5.5, 5.6; PH Lesson 7-4, 7-5, 7-6 Discovering Slope [L] O3.6 Graph linear functions using slope-intercept form ML Lesson 5.6, PH Lesson 7-5 Slope-Intercept Sort [L] O3.7(+) Find the inverse of linear functions given a table, graph, or rule. **Review and Quiz (2 days)**
	A-REI.10	Understand that the graph of an equation in two variables is the set of all it solutions plotted in the coordinate plane.		
	F-IF.6	Calculate and interpret the average rate of change of a function over a specified interval. Estimate the rate of change from a graph.		
	S-ID.7	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.		

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Essential Questions for this Unit:
1. How can students use graphical representations and knowledge of context to make judgments about the appropriateness of linear models, and with linear models, look at residuals to analyze the goodness of fit?
2. How can students focus on linear functions; interpret functions given graphically, numerically, symbolically, and verbally; translate between representations; and understand the limitations of various representations?
3. How can students develop fluency writing, interpreting, and translating between various forms of linear equations and inequalities, and using them to solve problems?
4. How can students explore systems of equations and inequalities, and they find and interpret their solutions?

Unit (Time)	Standard	Standard Description	Strategies	Content Objectives & Resources
(November – December) **Unit 3: Linear Functions (continued)** **30 days** **(+): Add 1 day**	F-BF.1	Write a function that describes a relationship between two quantities.	Understanding: Interpreting functions Multiple ways to present data (equations, tables, graphs) Advantages of the various forms of a linear function	O3.8 Write linear equations in slope-intercept form given a slope and *y*-intercept, graph, table, two data points, or a context problem **(3 days)** ML Lessons 6.1, 6.2; PH Lesson 7.6 O3.9 Write linear equations in point-slope form given a slope and *y*-intercept, graph, table, or two data points **(2 days)** ML Lesson 6.3; PH Lesson 7-6 O3.10 Write linear equations in standard form and use them to solve problems ML Lesson 6.4 Three Forms of an Equation of a Line [L] Equations – Multiple Representations and What We Know [L] O3.11 Write arithmetic sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. **(2 days)** Arithmetic Sequences [L] **Review and Quiz (1 day)**
	F-BF.1a	Determine an explicit expression, a recursive process, or steps for calculation from a context.		
	F-BF.2	Write arithmetic and ~~geometric~~ sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.		
	A-CED.2	Create equations and inequalities in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.		
	F-LE.2	Construct linear functions given a graph, a description of a relationship, or two input-output pairs (including reading these from a table.)		

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Essential Questions for this Unit:
1. How can students use graphical representations and knowledge of context to make judgments about the appropriateness of linear models, and with linear models, look at residuals to analyze the goodness of fit?
2. How can students focus on linear functions; interpret functions given graphically, numerically, symbolically, and verbally; translate between representations; and understand the limitations of various representations?
3. How can students develop fluency writing, interpreting, and translating between various forms of linear equations and inequalities, and using them to solve problems?
4. How can students explore systems of equations and inequalities, and they find and interpret their solutions?

Unit (Time)	Standard	Standard Description	Strategies	Content Objectives & Resources
(November – December) **Unit 3: Linear Functions (continued)** **30 days** **(+): Add 1 day**	A-REI.11	Explain why the *x*-coordinate of the points where the graphs of the equation $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.	Understanding: Solution as the point where the lines cross & is true for both equations Intersecting, parallel, and coinciding lines Equivalent equations Boundary lines Half plane Test point (0,0) and other test points Solid lines, and shaded regions are solutions Dashed lines, and un-shaded regions are not solutions Build flexibility in solving in all methods Relation to real world contexts	O3.12 Solve linear systems by graphing ML Lesson 7.1; PH Lesson 8-1 Graphing Systems [L] O3.13 Identify number of solutions in linear systems **(2 days)** ML Lesson 7.5; PH Lesson 8-1 O3.14 Graph linear inequalities in two variables **(2 days)** ML Lesson 7.8; PH Lesson 9-5 Graphing Linear Inequalities Sort [L] O3.15 Solve systems of linear inequalities **(2 days)** ML Lesson 7.9; PH Lesson 9-6 Solving Systems of Inequalities [L] **Review, Unit 3 Assessment, Test Corrections (3 days)**
	A-REI.12	Graph the solutions to a linear inequality in two variables as a half-plane and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.		

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Essential Questions for this Unit:
1. How can students extend the laws of exponents to rational exponents involving square and cube roots and apply this new understanding of number; and strengthen their ability to see structure in and create quadratic and exponential expressions?
2. How can students become facile with algebraic manipulation, including rearranging and collecting terms, and factoring, identifying, and canceling common factors in rational expressions?

Unit (Time)	Standard	Standard Description	Strategies	Content Objectives & Resources
(January) **Unit 4: Polynomials** **18 days**	N-RN.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.	Understanding: Definition of an exponent Decomposition Equivalent forms of one Area models Using generic rectangles Algebra tiles	O4.1 Simplify expressions by applying exponent properties with products ML Lesson 8.1; PH Lesson 5-1, 5-2, 5-3 O4.2 Simplify expressions by applying exponent properties with quotients ML Lesson 8.2; PH Lesson 5-1, 5-2, 5-3 Quotient of Powers [L] O4.3 Add and subtract polynomials ML Lesson 9.1: PH Lesson 5-5, 5-6, 5-7, 5-8 O4.4 Multiply polynomials using multiple methods **(2 days)** ML Lesson 9.2, 9.3; PH Lesson 5-9, 5-10 Connecting Binomial Multiplication and Factoring Trinomials Using Algebra Tiles [L] O4.5 Apply the zero product property to solve equations ML Lesson 9.5; PH Lesson 6-8 examples 1 & 2
	N-RN.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.		
	A-APR.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		
	A-SSE.3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.		
	A-SSE.3c	Use the properties of exponents to transform expressions for exponential functions.		

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Essential Questions for this Unit:
1. How can students extend the laws of exponents to rational exponents involving square and cube roots and apply this new understanding of number; and strengthen their ability to see structure in and create quadratic and exponential expressions.
2. How can students become facile with algebraic manipulation, including rearranging and collecting terms, and factoring, identifying, and canceling common factors in rational expressions?

Unit (Time)	Standard	Standard Description	Strategies	Content Objectives & Resources
(January) **Unit 4: Polynomials (continued)** **18 days**	A-SSE.1	Interpret expressions that represent a quantity in terms of its context.	Understanding: Multiple ways of factoring: grouping, GFC & generic rectangle, guess & check Quadratic, linear, and constant terms Difference of squares	O4.6 Use the GCF to factor monomials **(2 days)** ML Lesson 9.5; PH 6-1 O4.7 Solve equations in the form $ax^2 + bx = 0$ by factoring ML Lesson 9.5; PH 13-1 O4.8 Factor $x^2 + bx + c$. Solve $x^2 + bx + c = 0$ by factoring **(2 days)** ML Lesson 9.6; PH Lesson 6-4, 13-1 Factoring Quadratics – Class Notes [L] Factoring: GCF, Trinomials, Difference of Squares, Flowchart [CP] O4.9 Factor ax^2+bx+c. Solve $ax^2+bx+c = 0$ by factoring ML Lesson 9.7; PH Lesson 6-5, 13-1 O4.10 Identify patterns to factor special products ML Lesson 9.8; PH Lesson 6-2, 6-3 O4.11 Factor polynomials completely **(2 days)** ML Lesson 9.9; PH Lesson 6-6, 6-7 **Review, Unit 4 Assessment, Test Corrections (3 days)** **Benchmark 2 includes Units 3 & 4**
	A-SSE.1a	Interpret parts of an expression, such as terms, factors, and coefficients.		
	A-SSE.1b	Interpret complicated expressions by viewing one or more of their parts as a single entity.		
	A-SSE.2	Use the structure of an expression to identify ways to rewrite it.		
	A-SSE.3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.		
	A-APR.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		
	A-SSE.3a	Factor a quadratic expression to reveal the zeros of the function it defines.		

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Essential Questions for this Unit:
1. How can students create and solve equations, inequalities, and systems of equations involving quadratic expressions?
2. How can students focus on quadratic function; interpret functions given graphically, numerically, symbolically, and verbally; translate between representations; and understand the limitations of various representations?
3. How can students consider quadratic functions, comparing the key characteristics of quadratic functions to those of linear and exponential functions, and select from among these functions to model phenomena?
4. How can students learn to anticipate the graph of a quadratic function by interpreting various forms of quadratic expressions, and in particular, identify the real solutions of a quadratic equation as the zeros of a related quadratic function?

Unit (Time)	Standard	Standard Description	Strategies	Content Objectives & Resources
(February – early March) **Unit 5: Quadratics** **28 days**	A-REI.4a	Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form	Understanding: Scaffold simplifying expressions of the same form as the quadratic formula before showing students the quadratic formula	O5.1 Simplify radical expressions ML Lesson 8.4; PH Lesson 11-4, 11-5 Simplifying Radicals - Day 1 [L] O5.2 Solve quadratic equations using square roots **(2 days)** ML Lesson 10.5; PH Lesson 13-2 Square and Square Roots [L] O5.3 Solve vertical motion problems using quadratic equations **(3 days)** ML Lessons 9.5 – 10.7; PH Lesson 13-2 O5.4 Solve quadratic equations by completing the square **(2 days)** ML Lesson 10.6; PH Lesson 13-3 Quadratics – Solving by Completing the Square, Factoring, Formula [CP] O5.5 Solve quadratic equations by the q. formula **(2 days)** ML Lesson 10.7; PH Lesson 13-4 Derivation of Quadratic Formula [L] O5.6 Interpret the discriminant & determine the number of solutions to a quadratic equation ML Lesson 10.8; PH Lesson 13-4 Investigating the Discriminant [L]
	A-REI.4b	Solve quadratic equations by inspection, taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. ~~Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.~~		
	A-LE.6	Apply quadratic functions to physical problems, such as the motion of an object under the force of gravity.		

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Essential Questions for this Unit:
1. How can students create and solve equations, inequalities, and systems of equations involving quadratic expressions?
2. How can students focus on quadratic function; interpret functions given graphically, numerically, symbolically, and verbally; translate between representations; and understand the limitations of various representations?
3. How can students consider quadratic functions, comparing the key characteristics of quadratic functions to those of linear and exponential functions, and select from among these functions to model phenomena?
4. How can students learn to anticipate the graph of a quadratic function by interpreting various forms of quadratic expressions, and in particular, identify the real solutions of a quadratic equation as the zeros of a related quadratic function?

Unit (Time)	Standard	Standard Description	Strategies	Content Objectives & Resources
(February – early March) **Unit 5: Quadratics (continued)** **28 days**	F-IF.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.	Understanding: Axis of Symmetry Maximum or Minimum Roots Zeros Concavity Critical Points (x-intercept, y-intercept, vertex)	O5.7 Graph $y = ax^2$ by hand and with a graphing calculator. Explore transformations of quadratic functions. (**2 days)** ML Lesson 10.1 Graphing Family of Functions [L] Families of Functions Sort [L] Family of Functions – Graphing Calculator Lesson [L] Family of Functions Graphing Worksheet [L] O5.8: Identify key features of quadratic functions. (Domain, Range, Intercepts, Increasing/Decreasing on intervals, Maximum/Minimum values (vertex), Axis of symmetry, Concave up/down) **(2 days)** Key Features of Graphs (quadratics only) (L) O5.9: Find the average rate of change over an interval from a quadratic graph and from a quadratic equation. **Scaffolding includes function notation and evaluating functions. Average Rate of Change (pg 7–10) (L) O5.10 Graph $y = ax^2 + bx + c$ ML Lesson 10.2; PH Lesson 12-4 Quadratics – Matching Game [L] Family of Functions and their Graphs [CP] Quadratic Equations – What We Know [L]
	F-IF.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.		
	F-IF.7a	Graph linear and quadratic functions and show intercepts, maxima, and minima.		
	F-IF.8a	Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.		
	F-IF.9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).		
	A-REI.7	Solve a simple system consisting of a linear equations and quadratic equation in two variables algebraically and graphically.		

Grade Level/Course Title: MS/HS Algebra I	**Quarter 3**	**Academic Year: 2015-2016**

Mathematics Focus for the Course:
For the Model Algebra I course, instructional time should focus on four critical areas: (1) deepen and extend understanding of linear and exponential relationships; (2) contrast linear and exponential relationships with each other and engage in methods for analyzing, solving, and using quadratic functions; (3) extend the laws of exponents to square and cube roots; and (4) apply linear models to data that exhibit a linear trend.

Essential Questions for this Unit:

5. How can students create and solve equations, inequalities, and systems of equations involving quadratic expressions?
6. How can students focus on quadratic function; interpret functions given graphically, numerically, symbolically, and verbally; translate between representations; and understand the limitations of various representations?
7. How can students consider quadratic functions, comparing the key characteristics of quadratic functions to those of linear and exponential functions, and select from among these functions to model phenomena?
8. How can students learn to anticipate the graph of a quadratic function by interpreting various forms of quadratic expressions, and in particular, identify the real solutions of a quadratic equation as the zeros of a related quadratic function?

Unit (Time)	Standard	Standard Description	Strategies	Content Objectives & Resources
(February – early March) **Unit 5: Quadratics (continued)** **28 days**	F-IF.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.	Understanding: Critical Points (x-intercept, y-intercept, vertex) Scale factor (narrowing/ widening of the parabola) Solutions of linear-quadratic systems	O5.11 Graph $y = a(x - p)(x - q)$ **(2 days)** ML Lesson 10.3 O5.12 Solve quadratic equations by graphing & review all key features of quadratic graphs **(3 days)** ML Lesson 10.4 Quadratics – Matching Game [L] O5.13 Solve linear-quadratic systems graphically O5.14 Solve linear-quadratic systems algebraically **(2 days)** **Review, Unit 5 Assessment, Test Corrections (3 days)**
	F-IF.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.		
	F-IF.7a	Graph linear and quadratic functions and show intercepts, maxima, and minima.		
	F-IF.8a	Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.		
	A-REI.7	Solve a simple system consisting of a linear equations and quadratic equation in two variables algebraically and graphically.		

Grade Level/Course Title: MS/HS Algebra I	**Quarter 4**	**Academic Year: 2015-2016**

Mathematics Focus for the Course:
For the Model Algebra I course, instructional time should focus on four critical areas: (1) deepen and extend understanding of linear and exponential relationships; (2) contrast linear and exponential relationships with each other and engage in methods for analyzing, solving, and using quadratic functions; (3) extend the laws of exponents to square and cube roots; and (4) apply linear models to data that exhibit a linear trend.

Essential Questions for this Unit:
1. How can students focus on linear, quadratic, and exponential functions, including sequences, and also explore absolute value, step, and piecewise-defined functions; interpret functions given graphically, numerically, symbolically, and verbally; translate between representations; and understand the limitations of various representations?
2. How can students build on and extend their understanding of integer exponents to consider exponential functions, and compare and contrast linear and exponential functions, distinguishing between additive and multiplicative change?
3. How can students expand their experience with functions to include more specialized functions—absolute value, step, and those that are piecewise-defined?
4. How can students interpret arithmetic sequences as linear functions and geometric sequences as exponential functions?
5. How can students consider quadratic functions, comparing the key characteristics of quadratic functions to those of linear and exponential functions, and select from among these functions to model phenomena?

Unit (Time)	Standard	Standard Description	Strategies	Content Objectives & Resources
(March – April) **Unit 6: Exponential Functions** **20 days**	F-IF.7e	Graph exponential ~~and logarithmic~~ functions, showing intercepts and end behavior~~, and trigonometric functions, showing period, midline, and amplitude.~~	Understand: Graph of simple exponential function Relate models with tables, functions and graphs Key features of the graph Graphing using transformations Average rate of change over intervals	O6.1 Define/use zero and negative exponents ML Lesson 8.3; PH Lesson 5-2 Zero and Negative Exponents [L] O6.2 Use cube roots & fractional exponents **(2 days)** ML Lesson 8.6; PH Lesson 11-3 Fractional Exponents [L] O6.3: Graph by hand $f(x) = a^x$ using a table, for both cases of $a > 1$ and $0 < a < 1$. (include paper-folding activity) **(2 days)** O6.4: Graph $f(x) = b \cdot a^x$ relating modeled situation with table and graph. (investment, population growth, carbon dating) **(2 days)** Exponential Functions [CP] O6.5: Transformations of exponential functions: $f(x) = a^{x-h} + k$ O6.6: Identify key features of exponential functions. (Domain, Range, Intercepts, end behavior, asymptote) **(2 days)** Key Features of Graphs (exponentials only) (L) O6.7: Find the average rate of change over an interval from a quadratic graph and from a quadratic equation. **Scaffolding includes function notation and evaluating functions. Average Rate of Change (L) **Review and Quiz (1 day)**
	F-IF.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.		
	F-IF.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.		
	F-LE.1c	Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.		
	F-BF.3	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).		

Grade Level/Course Title: MS/HS Algebra I	Quarter 4	Academic Year: 2015-2016

Mathematics Focus for the Course:
For the Model Algebra I course, instructional time should focus on four critical areas: (1) deepen and extend understanding of linear and exponential relationships; (2) contrast linear and exponential relationships with each other and engage in methods for analyzing, solving, and using quadratic functions; (3) extend the laws of exponents to square and cube roots; and (4) apply linear models to data that exhibit a linear trend.

Essential Questions for this Unit:
1. How can students focus on linear, quadratic, and exponential functions, including sequences, and also explore absolute value, step, and piecewise-defined functions; interpret functions given graphically, numerically, symbolically, and verbally; translate between representations; and understand the limitations of various representations?
2. How can students build on and extend their understanding of integer exponents to consider exponential functions, and compare and contrast linear and exponential functions, distinguishing between additive and multiplicative change?
3. How can students interpret arithmetic sequences as linear functions and geometric sequences as exponential functions?
4. How can students consider quadratic functions, comparing the key characteristics of quadratic functions to those of linear and exponential functions, and select from among these functions to model phenomena?

Unit (Time)	Standard	Standard Description	Strategies	Content Objectives & Resources
(March – April) **Unit 6: Exponential Functions (continued)** **20 days**	F-LE.2	Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).	Understanding: Comparing exponential and linear functions Explicit vs. recursive formula	O6.8: Write geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. **(2 days)** Geometric Sequences [L] O6.9: Compare geometric and arithmetic sequences (exponential v. linear) from tables, recursive, and explicit rules. O6.10 Compare geometric and arithmetic sequences (exponential v. linear) from situations O6.11 (+) Solve exponential equations using a common base Solving Exponential Equations [L] **Review, Unit 6 Assessment, Test Corrections (3 days)** **Benchmark 3 includes Unit 5 & 6.**
	F-BF.2	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.		
	F-IF.3	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.		

Grade Level/Course Title: MS/HS Algebra I	Quarter 4	Academic Year: 2015-2016

Mathematics Focus for the Course:
For the Model Algebra I course, instructional time should focus on four critical areas: (1) deepen and extend understanding of linear and exponential relationships; (2) contrast linear and exponential relationships with each other and engage in methods for analyzing, solving, and using quadratic functions; (3) extend the laws of exponents to square and cube roots; and (4) apply linear models to data that exhibit a linear trend.

Essential Questions for this Unit:
1. How can students expand their experience with functions to include more specialized functions—absolute value, step, and those that are piecewise-defined?

Unit (Time)	Standard	Standard Description	Strategies	Content Objectives & Resources
(April) **Unit 7: Additional Functions** **13 days**	F-LE.1b	Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.	Understanding: Graphing using transformations Piecewise defined functions as a scaffolding activity Step functions as a type of piecewise functions	O7.1 Graph and identify key features of square root functions (compare with quadratic) (simple vertical or horizontal translation; both directions supplemental) **(2 days)** O7.2 Graph and identify key features of cube root functions (compare with cubic) (simple vertical or horizontal translation; both directions supplemental) **(2 days)** Functions – Family of Cubic Functions [CP] Families of Functions Sort [L] Family of Functions Graphing Worksheet [Worksheet] Graphing Family of Functions [L] O7.3 Graph piecewise functions (2 conditions) **(2 days)** Piecewise & Step Functions [CP] O7.4 Graph piecewise functions (3 conditions) **(2 days)** O7.5 (+) Graph step functions **(2 days)** **Review, Unit 7 Assessment, Test Corrections (3 days)**
	F-LE.1a	Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.		
	F-IF.7b	Graph square root, cube root, & piecewise-defined functions, including step functions & absolute value functions.		
	F-LE.3	Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or as a polynomial function.		

Grade Level/Course Title: MS/HS Algebra I	**Quarter 4**	**Academic Year: 2015-2016**

Mathematics Focus for the Course:
For the Model Algebra I course, instructional time should focus on four critical areas: (1) deepen and extend understanding of linear and exponential relationships; (2) contrast linear and exponential relationships with each other and engage in methods for analyzing, solving, and using quadratic functions; (3) extend the laws of exponents to square and cube roots; and (4) apply linear models to data that exhibit a linear trend.

Essential Questions for this Unit:
1. How can students build upon their prior experiences with data, and explore a more formal means of assessing how a model fits data?
2. How can students use regression techniques to describe approximately linear relationships between quantities?
3. How can students use graphical representations and knowledge of context to make judgments about the appropriateness of linear models and, with linear models, look at residuals to analyze the goodness of fit?

Unit (Time)	Standard	Standard Description	Strategies	Content Objectives & Resources
(May) **Unit 8: Statistics** **18 days**	S-ID.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).	Understanding: Graphical representations of data (scatterplots, histograms, box plots, dot plots) Mean Median Mode Range Distribution Standard deviation Outlier Quartiles	O8.1 Create box plots, histograms, dot plots **(2 days)** O8.2 Interpret the shape of data representatives (box plot, histogram, dot plot) NY engage lesson M2L1 O8.3 Describe and estimate the center of a distribution **(2 days)** NY engage lesson M2L2&3 O8.4 Compare and contrast mean v. median and in which situations each would be a more accurate representative of the data (include discussion on effects of outliers) (2 days) NY engage lesson M2L3&7
	S-ID.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.		
	S-ID.3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).		
	S-ID.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.		

Grade Level/Course Title: MS/HS Algebra I	**Quarter 4**	**Academic Year: 2015-2016**

Mathematics Focus for the Course:
For the Model Algebra I course, instructional time should focus on four critical areas: (1) deepen and extend understanding of linear and exponential relationships; (2) contrast linear and exponential relationships with each other and engage in methods for analyzing, solving, and using quadratic functions; (3) extend the laws of exponents to square and cube roots; and (4) apply linear models to data that exhibit a linear trend.

Essential Questions for this Unit:
1. How can students build upon their prior experiences with data, and explore a more formal means of assessing how a model fits data?
2. How can students use regression techniques to describe approximately linear relationships between quantities?
3. How can students use graphical representations and knowledge of context to make judgments about the appropriateness of linear models and, with linear models, look at residuals to analyze the goodness of fit?

Unit (Time)	Standard	Standard Description	Strategies	Content Objectives & Resources
(May) **Unit 8: Statistics (continued)** **18 days**	S-ID.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.	Understanding: Graphical representations of data (scatterplots, histograms, box plots, dot plots) Correlation Correlation coefficient Line of best fit Regression model	O8.5 Create and interpret a two-way frequency table from categorical data **(3 days)** NY engage lesson M2L9,10 & 11 O8.6 Create and describe trends in scatterplots with quantitative data NY engage lesson M2L12 O8.7 Use linear regression model on graphing calculators to find the line of best fit **(2 days)** NY engage lesson M2L13&14 O8.8 Use graphing calculators to compute the correlation coefficient and interpret the significance of that coefficient for a data set **(2 days)** NY engage lesson M2L19 Correlation and Line of Best Fit [L] **Review, Unit 8 Assessment, Test Corrections (3 days)**
	S-ID.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.		
	S-ID.6a	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, quadratic, and exponential models.*		
	S-ID.6b	Informally assess the fit of a function by plotting and analyzing residuals.		
	S-ID.6c	Fit a linear function for a scatter plot that suggests a linear association.		
	S-ID.8	Compute (using technology) and interpret the correlation coefficient of a linear fit.		
	S-ID.9	Distinguish between correlation and causation.		