FREEHOLD REGIONAL HIGH SCHOOL DISTRICT

OFFICE OF CURRICULUM AND INSTRUCTION

MATHEMATICS DEPARTMENT

ALGEBRA 1 WORKSHOP

Grade Level: 9

Credits: 2.5 - 5

BOARD OF EDUCATION ADOPTION DATE:

AUGUST 31, 2015

FREEHOLD REGIONAL HIGH SCHOOL DISTRICT

Board of Education

Mr. Heshy Moses, President
Mrs. Jennifer Sutera, Vice President
Mr. Vincent Accettola
Mr. William Bruno
Mrs. Elizabeth Canario
Mr. Samuel Carollo
Mrs. Amy Fankhauser
Mrs. Kathie Lavin
Mr. Michael Messinger

Central Administration

Mr. Charles Sampson, Superintendent
Dr. Nicole Hazel, Chief Academic Officer
Dr. Jeffrey Moore, Director of Curriculum and Instruction
Ms. Stephanie Mechmann, Administrative Supervisor of Curriculum & Instruction
Dr. Nicole Santora, Administrative Supervisor of Curriculum & Instruction

Curriculum Writing Committee

Ms. Jacqueline Dunfee
Mr. Brian Golub
Ms. Nicole Ives
Ms. AnnaMarie Popowski
Ms. Katherine Rimakis
Mr. Thomas Sandoval

Supervisors

Ms. Deanna Farinick
Ms. Angelique Gauthier
Mr. Joseph Iacullo
Ms. Annette Kinsley
Ms. Jennifer Okerson
Ms. Denise Scanga

ALGEBRA I WORKSHOP
COURSE PHILOSOPHY
Algebra I Workshop will help students master conceptual understanding and procedural fluency by providing additional time and individual attention in a concurrent support model that will assist students in overcoming deficiencies as they affect performance in Algebra I. Skills reinforcement is essential for success in mathematics. There will also be a focus on complex problem-solving, which enables students to think mathematically, persevere, and apply the techniques and strategies to be independent learners.
COURSE DESCRIPTION
Algebra I Workshop is an elective taught concurrently with Algebra I and will provide assistance with algebraic content, techniques, and strategies needed develop mathematical proficiency and fluency. Students will develop the confidence and appreciation for using mathematics so they can be more successful as they progress in their high school math courses. Emphasis will be placed on written and oral communication of mathematics, as well as the ability to justify mathematical decisions.

COURSE SUMMARY	
COURSE GOALS	
Students will make sense of problems and persevere in solving them by creating algebraic models.	
COURSE ENDURING UNDERSTANDINGS	COURSE ESSENTIAL QUESTIONS
CEU1: There can be different strategies to solve a problem, but some are more effective and efficient than others.	CEQ1a: How do we determine what content, concepts, and skills are useful to solving a specific problem? CEQ1b: What makes your problem-solving strategy effective and efficient?
CEU2: There are mathematical practices that must be mastered in order to effectively solve problems.	CEQ2: How can you model and make sense of problems and persevere in solving them?

UNIT GOALS & PACING		
UNIT TITLE	**UNIT GOALS**	**RECOMMENDED DURATION**
1: The Real Number System	Students will use properties of rational and irrational numbers to reason quantitatively and solve problems.	1-2 weeks
2: Equations and Inequalities	LG1: Students will create and solve equations, inequalities, and systems of linear equations and inequalities that model relationships algebraically, and justify their reasoning. LG2: Students will solve equations, inequalities, and systems of linear equations and inequalities that model relationships graphically, and justify their reasoning.	4-5 weeks
3: Functions	Students will classify, interpret and build a function that models a relationship between two quantities.	5-6 weeks
4: Polynomials and Rational Expressions	Students will perform arithmetic operations on polynomials and make connections between zeros and factors of polynomials.	5-6 weeks
5: Interpreting Algebraic Models	Students will independently construct, represent, and interpret linear, quadratic, and exponential models.	4-5 weeks

ALGEBRA I WORKSHOP
UNIT 1: The Real Number System **SUGGESTED DURATION: 1-2 weeks**

UNIT OVERVIEW

UNIT LEARNING GOALS

Students will use properties of rational and irrational numbers to reason quantitatively and solve problems.

UNIT LEARNING SCALE

4	In addition to score 3 performances, the student can interpret the context of an expression.
3	The student can: • use properties of rational and irrational numbers to perform operations and simplify expressions; • interpret parts of an expression; • write expressions in equivalent forms.
2	The student sometimes needs assistance from a teacher, makes minor mistakes, and/or can do a majority of score 3 performances.
1	With help and/or mistakes, the student can: • explain the difference between rational and irrational numbers; • interpret parts of an expression (e.g., terms, factors, coefficients); • write expressions in equivalent forms.
0	Even with help, the student does not exhibit an understanding of the real number system.

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
EU1: Rational numbers can be compared by rewriting numbers in the same form.	EQ1: Why must we understand that there are different forms of numbers?
EU2: Numerical expressions are powerful tools for representing authentic situations.	EQ2: Which real-world situations can be represented mathematically?

COMMON CORE STANDARDS

*MA.HS.N.RN.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

MA.HS.A.SSE.1 Interpret expressions that represent a quantity in terms of its context (Modeling standard)

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.

*Standards that have a * are topics that are considered "additional content."*

FORMATIVE ASSESSMENTS

Suggestions

- Learning Logs: Students can keep learning logs in which they record what they are learning, the questions they still may have, and progress they have made. Teachers can read student logs and monitor student progress to adjust instruction and meet the student needs.
- Exit Slips: Teachers can monitor both conceptual and procedural understanding through the use of exit slips.
- Peer- and Self-Assessments: Allow students to be involved in criteria and goal setting so that they can evaluate their personal strengths and weaknesses.
- Data-Driven Dynamic Mathematics Software: Students can utilize mathematics software to practice and deepen their skill set. Students are also able to receive immediate, personalized feedback. Teachers have the ability to monitor and track individual student progress.
- Standards Mastery Chart: Each student has a chart of the standards. As students show mastery of a standard, the standard gets checked off on their chart.

SUGGESTED INTERVENTIONS	
Standard	Possible Activities
MA.HS.N.RN.3 MA.HS.A.SSE.1	Create two sets of 10 index cards. Set 1 – each card should have a rational or irrational number written in different forms Set 2 – each card should have an expression that performs operations with rational and irrational numbers First have students sort Set 1 into rational and irrational numbers. After students have mastered the concept, have students simplify expressions on Set 2 and then sort into rational and irrational numbers. Next, students should determine what type of number they get as a solution after performing operations on two rational numbers, two irrational numbers, and one rational/one irrational number.

ALGEBRA I WORKSHOP
UNIT 2: Linear Equations, Inequalities and Systems **SUGGESTED DURATION: 4-5 weeks**

UNIT OVERVIEW	
UNIT LEARNING GOALS	
LG1: Students will create and solve equations, inequalities, and systems of linear equations and inequalities that model relationships algebraically, and justify their reasoning. LG2: Students will solve equations, inequalities, and systems of linear equations and inequalities that model relationships graphically, and justify their reasoning.	
UNIT LEARNING SCALE – LG 1	
4	In addition to score 3 performances, the student can interpret the context of the problem and reflect on whether the answers are reasonable, given the context.
3	The student can: • solve literal equations; • model and solve linear equations; • model and solve linear inequalities; • model and solve absolute value equations and inequalities; • model and solve compound inequalities; • model and solve systems of equations; • model and solve systems and inequalities; • use function notation and evaluate functions; • model and solve problems that arise in everyday situations; • write an equation or inequality in slope-intercept form; • construct a viable argument to justify a solution method.
2	The student sometimes needs assistance from a teacher, makes minor mistakes, and/or can do a majority of score 3 performances.
1	With help and/or mistakes, the student can: • solve linear equations and inequalities; • solve simple literal equations; • solve absolute value equations and inequalities; • write an equation of a line in slope-intercept form.
0	Even with help, the student does not exhibit understanding of linear equations, inequalities, and absolute value equations to model and solve real-world problems.

UNIT LEARNING SCALE – LG 2	
4	In addition to score 3 performances, the student can compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables).
3	The student can: • graph linear equations and show key features of the graph (ie: slope, domain and range); • graph linear inequalities and show key features of the graph (ie: slope, domain and range); • construct a linear function given a graph, description of a relationship, or input-output table; • graph absolute value equations and inequalities; • graph compound inequalities; • graph systems of linear equations; • graph systems of linear inequalities.
2	The student sometimes needs assistance from a teacher, makes minor mistakes, and/or can do a majority of score 3 performances.
1	With help and/or mistakes, the student can: • graph linear equations and show key features of the graph (ie: slope, domain and range); • graph linear inequalities and show key features of the graph (ie: slope, domain and range); • construct a linear function given a graph, description of a relationship, or input-output table; • graph absolute value equations and inequalities; • graph systems of linear equations; • graph systems of linear inequalities.
0	Even with help, the student does not exhibit an understanding of graphing linear equations, absolute value equations, and systems of equations to model a relationship between two quantities.

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
EU1: Change can be expressed mathematically through a variety of representations of a given function.	EQ1a: How can change be represented mathematically? EQ1b: How do you choose the best representation based on the given information?
EU2: Linear relationships are algebraic functions that allow us to organize data and make predictions.	EQ2: How can you use mathematical models to describe change and make predictions?

COMMON CORE STANDARDS

MA.HS.S.ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
MA.HS.A.CED.1 Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear-functions.
MA.HS.A.CED.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
MA.HS.A.CED.3 Represent constraints by equations or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.
MA.HS.A.CED.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law V = IR to highlight resistance R.
MA.HS.A.REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
MA.HS.A.REI.6 Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
MA.HS.A.REI.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).

COMMON CORE STANDARDS
MA.HS.A.REI.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 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, and polynomial-functions. *MA.HS.A.REI.12 Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. *Standards that have a * are topics that are considered "additional content."*

FORMATIVE ASSESSMENTS
Suggestions
• Learning Logs: Students can keep learning logs in which they record what they are learning, the questions they still may have, and progress they have made. Teachers can read student logs and monitor student progress to adjust instruction and meet the student needs. • Exit Slips: Teachers can monitor both conceptual and procedural understanding through the use of exit slips. • Peer- and Self-Assessments: Allow students to be involved in criteria and goal setting so that they can evaluate their personal strengths and weaknesses. • Data-Driven Dynamic Mathematics Software: Students can utilize mathematics software to practice and deepen their skill set. Students are also able to receive immediate, personalized feedback. Teachers have the ability to monitor and track individual student progress. • Standards Mastery Chart: Each student has a chart of the standards. As students show mastery of a standard, the standard gets checked off on their chart.

SUGGESTED INTERVENTIONS	
Standard	Possible Activities
MA.HS.A.REI.3	Students use algebra tiles to manipulate, model, and solve equations.
MA.HS.A.CED.4	In order to teach students how to rearrange formulas, create cards for the variable(s), number(s), equal sign, and operation(s). On the back of each card, write the inverse (use the reciprocal for the inverse of a fraction), and have students move and flip cards to solve for a given variable. Sample equations: $3y + 2x = 5$, $d = rt$, $I = Prt$, $C = 5/9(F – 32)$
MA.HS.A.REI.6 MA.HS.A.REI.12 MA.HS.A.CED.3	Provide students with graphing calculators (traditional graphing calculators, smart phone apps, on-line versions) and have students use the trace and table functions to find the point of intersection of two linear equations. The teacher can have students solve a system of equations algebraically and then use the graphing calculators to check their answers.
MA.HS.A.CED.1 MA.HS.A.CED.2 MA.HS.A.REI.12	Students will create geometric shapes on a coordinate plane. After plotting the vertices of the shapes, they will find the equation of the each side of the shape. Students will then pass their equations on to a partner, who will recreate the shape by graphing the lines. Students can increase complexity by starting at triangles and moving into more complex shapes such as rectangles, squares, hexagons, trapezoids, etc.
MA.HS.S.ID.7 MA.HS.A.REI.10 MA.HS.A.REI.11	Students will look up prices of memberships at local gyms and create equations that represent the amount of money they will spend for monthly versus yearly memberships. Students will compare and contrast memberships to determine which gym is more cost efficient. Students must solve it algebraically and graphically. They must explain which method was most effective and efficient given the scenario.

ALGEBRA I WORKSHOP
UNIT 3: Functions **SUGGESTED DURATION: 5-6 weeks**

UNIT OVERVIEW

UNIT LEARNING GOALS

Students will classify, interpret and build a function that models a relationship between two quantities.

UNIT LEARNING SCALE

4	In addition to score 3 performances, the student can assist a peer in reaching the goal of the unit.
3	The student can: • use function notation and evaluate functions; • graph functions that are written in function notation; • construct linear functions given a set of data; • model and solve problems by analyzing, interpreting and evaluating data that arise in everyday life situations.
2	The student sometimes needs assistance from a teacher, makes minor mistakes, and/or can do a majority of score 3 performances.
1	With help and/or mistakes, the student can: • use function notation and evaluate functions; • graph functions that are written in function notation.
0	Even with help, the student does not exhibit understanding of function notation.

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
EU1: Representing functions as graphs and equations are alternative (and often equivalent) ways for depicting and analyzing patterns of change.	EQ1: Some methods of graphing are better for a given situation that others. How can you determine the best method for graphing functions?
EU2: Real-world scenarios can be modeled mathematically in order to analyze, interpret and evaluate data.	EQ2: How can you use data to analyze situations in the context of the problem?

COMMON CORE STANDARDS

MA.HS.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 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 is the graph of the equation y = f(x).
MA.HS.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.
MA.HS.F.IF.3 Understand the concept of a function and use function notation~~. 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~~.
MA.HS.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.
MA.HS.F.IF.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.
MA.HS.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.
MA.HS.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.
MA.HS.F.IF.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
MA.HS.F.IF.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). ~~For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.~~

COMMON CORE STANDARDS
MA.HS.F.BF.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. For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model. c. Compose functions. For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time. MA.HS.F.BF.3 Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. MA.HS.F.LE.2 Construct linear functions, ~~including arithmetic sequences~~, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

FORMATIVE ASSESSMENTS
Suggestions
• Learning Logs: Students can keep learning logs in which they record what they are learning, the questions they still may have, and progress they have made. Teachers can read student logs and monitor student progress to adjust instruction and meet the student needs. • Exit Slips: Teachers can monitor both conceptual and procedural understanding through the use of exit slips. • Peer- and Self-Assessments: Allow students to be involved in criteria and goal setting so that they can evaluate their personal strengths and weaknesses. • Data-Driven Dynamic Mathematics Software: Students can utilize mathematics software to practice and deepen their skill set. Students are also able to receive immediate, personalized feedback. Teachers have the ability to monitor and track individual student progress. • Standards Mastery Chart: Each student has a chart of the standards. As students show mastery of a standard, the standard gets checked off on their chart.

SUGGESTED INTERVENTIONS	
Standard	Possible Activities
MA.HS.F.IF.1	Teacher can facilitate a three station activity. At Station 1, present a series of tables, ordered pairs, and mapping diagrams. Students will identify which ones represent functions. At Station 2, present a set of graphs and have students apply the vertical line test and describe the domain and range of each function. Station 3 should have descriptions of real-world situations and students can identify independent and dependent variables and create input/output tables for the situation described.
MA.HS.F.IF.6 MA.HS.F.IF.7 MA.HS.F.IF.2	Provide students with toothpicks and have them construct a series of adjacent boxes. Have students record the number of toothpicks it takes to build each additional box and describe the pattern observed. Students can represent the situation graphically, interpret results, and write an equation in function notation to model the data. Students can use the graphing calculator to confirm their observations. Students should then use their representations to determine the domain and range of the function.
MA.HS.F.LE.2 MA.HS.F.IF.5	Present students with real-world representations of linear data, such as cost of a college education. Students can pair-share observations, describe the rate of change verbally, and then create a written response to explain how properties of linear functions, such as a slope and y-intercept, apply to this given scenario. Students can then use their functions to make predictions about how much college would cost in a given number of years.

SUGGESTED INTERVENTIONS	
Standard	Possible Activities
MA.HS.F.BF.3	Provide students with graphing calculators (traditional graphing calculators, smart phone apps, on-line versions) and students can use the features to investigate the transformation effects of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative). Students can create a chart to categorize the different transformations observed and create rules for each manipulation on the parent function.
MA.HS.F.IF.8 MA.HS.F.IF.4 MA.HS.F.IF.9 MA.HS.F.BF.1	Give students index cards with various properties, features, descriptions, or representations of different functions. Students must match their index card to others that describe the same function; students with the same function form a group. Each group must then write the equation of their function and verify that their equation is correct.

ALGEBRA I WORKSHOP
UNIT 4: Polynomials and Rational Expressions **SUGGESTED DURATION: 5-6 weeks**

UNIT OVERVIEW

UNIT LEARNING GOALS

Students will perform arithmetic operations on polynomials and make connections between zeros and factors of polynomials.

UNIT LEARNING SCALE

4	In addition to score 3 performances, the student can interpret solutions in the context of the expression and problem.
3	The student can: • classify polynomials and find their degree; • simplify polynomial expressions; • multiply polynomial expressions; • factor polynomial expressions using the GCF, $x^2 + bx + c$, $ax^2 + bx + c$, difference of two squares, and perfect square trinomials; • choose the most efficient method to simplify a polynomial expression and justify their choice mathematically.
2	The student sometimes needs assistance from a teacher, makes minor mistakes, and/or can do a majority of score 3 performances.
1	With help and/or mistakes, the student can: • classify polynomials and find their degree; • simplify polynomial expressions; • multiply polynomial expressions with a coefficient of 1; • factor polynomial expressions using the GCF, $x^2 + bx + c$, $ax^2 + bx + c$, difference of two squares, and perfect square trinomials.
0	Even with help, the student does not exhibit understanding of how to identify different types of polynomials and determine the appropriate method for simplifying a polynomial expression.

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
EU1: There are a variety of methods to transform and simplify polynomials using addition, subtraction, multiplication, and factoring.	EQ1: Why is it necessary to transform or simplify polynomial expressions in mathematics?
EU2: There are efficient methods for solving quadratic equations.	EQ2: Which method is most efficient for solving a quadratic equation and why?

COMMON CORE STANDARDS

MA.HS.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.

MA.HS.A.APR.3 Identify zeroes of polynomials when suitable factorizations are available, and use the zeroes to construct a rough graph of the function defined by the polynomial.

MA.HS.A.SSE.2 Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 – y^4$ as $(x^2)^2 – (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 – y^2)(x^2 + y^2)$.

MA.HS.A.SSE.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 zeroes of the function it defines.

MA.HS.A.REI.4 Solve quadratic equations in one variable.

d. 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.

FORMATIVE ASSESSMENTS
Suggestions
• Learning Logs: Students can keep learning logs in which they record what they are learning, the questions they still may have, and progress they have made. Teachers can read student logs and monitor student progress to adjust instruction and meet the student needs. • Exit Slips: Teachers can monitor both conceptual and procedural understanding through the use of exit slips. • Peer- and Self-Assessments: Allow students to be involved in criteria and goal setting so that they can evaluate their personal strengths and weaknesses. • Data-Driven Dynamic Mathematics Software: Students can utilize mathematics software to practice and deepen their skill set. Students are also able to receive immediate, personalized feedback. Teachers have the ability to monitor and track individual student progress. • Standards Mastery Chart: Each student has a chart of the standards. As students show mastery of a standard, the standard gets checked off on their chart.

SUGGESTED INTERVENTIONS	
Standard	Possible Activities
MA.HS.A.SSE.3a MA.HS.A.REI.4	Provide algebra tiles to allow students to model quadratic expressions and arrange tiles to represent factoring by finding length and width of a rectangle.
MA.HS.A.APR.3	Provide sorting activity with two sets of cards. Set 1 should contain quadratic equations and Set 2 should contain graphs of quadratic functions. First have students sort both sets into equations that have one real solution, two real solutions, or no real solutions. Then have students match equations from Set 1 to the graphs from Set 2. Students should discuss justifications for their selections.
MA.HS.A.APR.1	Use algebra tiles to model operations of addition, subtraction, and multiplication of polynomials.
MA.HS.A.SSE.2	Each student will factor a quadratic expression. Students will write the factored form of the expression on an index card and exchange with another student. Students will now multiply the expression back together to confirm factorization was performed correctly. If the factorization and the quadratic equation do not match up, students should work together to find and correct the error in the process.

ALGEBRA I WORKSHOP
UNIT 5: Interpreting Algebraic Models **SUGGESTED DURATION: 4-5 weeks**

UNIT OVERVIEW

UNIT LEARNING GOALS

Students will independently construct, represent, and interpret linear, quadratic, and exponential models.

UNIT LEARNING SCALE

4	In addition to score 3 performances, the student can make sense of quantities and their relationships in the context of the problem.
3	The student can: • interpret and write exponential growth and decay functions; • evaluate and graph exponential functions; • solve exponential equations algebraically and graphically; • construct exponential functions given a graph, description or table; • apply the mathematics they know to solve the problems that arise in everyday life.
2	The student sometimes needs assistance from a teacher, makes minor mistakes, and/or can do a majority of score 3 performances.
1	With help and/or mistakes the student can: • interpret exponential growth and decay functions; • evaluate exponential functions.
0	Even with help, the student does not exhibit an understanding of distinguishing between linear and exponential functions given an equation, situation, or graph.

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
EU1: Properties of exponents make it easier to simplify expressions.	EQ1: How can a single quantity be represented by many different expressions?
EU2: Real-world situations involving linear, quadratic and exponential relationships can be solved using multiple representations.	EQ2a: Why is it necessary to model a real-world situation using mathematics? EQ2b: How do we determine the best way to model a mathematical relationship?

COMMON CORE STANDARDS

MA.HS.A.SSE.3e Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

d. Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15t can be rewritten as (1.151/12)12t ≈ 1 01212t to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.

MA.HS.S.ID.1 Represent data with plots on the real number line (dot plots, histograms, and box plots).

MA.HS.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.

MA.HS.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).

MA.HS.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.

MA.HS.S.ID.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.

c. Fit a linear function for a scatter plot that suggests a linear association.

MA.HS.S.ID.8 interpret the correlation coefficient of a linear fit.

MA.HS.S.ID.9 Distinguish between correlation and causation.

COMMON CORE STANDARDS
MA.HS.N.Q.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. MA.HS.N.Q.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. MA.HS.F.LE.1 Distinguish between situations that can be modeled with linear functions and with exponential function. 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. MA.HS.F.LE.2 Construct linear and exponential functions, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). MA.HS.F.LE.5 Interpret the parameters in a linear or exponential function in terms of a context.

FORMATIVE ASSESSMENTS
Suggestions
• Learning Logs: Students can keep learning logs in which they record what they are learning, the questions they still may have, and progress they have made. Teachers can read student logs and monitor student progress to adjust instruction and meet the student needs. • Exit Slips: Teachers can monitor both conceptual and procedural understanding through the use of exit slips. • Peer- and Self-Assessments: Allow students to be involved in criteria and goal setting so that they can evaluate their personal strengths and weaknesses. • Data-Driven Dynamic Mathematics Software: Students can utilize mathematics software to practice and deepen their skill set. Students are also able to receive immediate, personalized feedback. Teachers have the ability to monitor and track individual student progress. • Standards Mastery Chart: Each student has a chart of the standards. As students show mastery of a standard, the standard gets checked off on their chart.

SUGGESTED INTERVENTIONS	
Standard	Possible Activities
MA.HS.F.LE.5 MA.HS.F.LE.3 MA.HS.F.LE.2	Students can complete an exponential growth and decay activity using coins to represent cancerous cell growth. Place two coins in a cup; this is trial 0. Dump out the coins. For every coin with the heads up, add another coin to the population. Repeat the process until you have 15 – 20 trials. Use the data to create a scatterplot and interpret the results.
MA.HS.S.ID.9	Provide students with cards that have descriptions of real life scenarios, such as car value over time or a comic book value appreciation over time. Students will sort cards by causation, correlation, or both. Students must be able to justify their reasoning. Students can then take the correlation descriptions and divide them into sub-categories of positive or negative correlation.
MA.HS.S.ID.6 MA.HS.S.ID.8 MA.HS.S.ID.3 MA.HS.N.Q.3	Students will take a survey of height and arm span of each person in the class. Students will then create a scatterplot of the information and analyze the graph to determine the line of best fit, correlation coefficient, and any outliers that may occur. Class should discuss using different measurements to determine what the best scale is for showing their results.
MA.HS.S.ID.1 MA.HS.S.ID.2	Students can create survey questions (e.g., how many hours spent participating in school activities) and poll other students for responses. Students can analyze data by finding measures of central tendency and draw conclusions.

SUGGESTED INTERVENTIONS	
Standard	Possible Activities
MA.HS.F.LE.1	Present students with the following scenario: you add the same amount to a piggy bank everyday vs. depositing money into an interest earning account. In small groups, have students discuss the scenario and write mathematical models to represent the situations. Have students compare and contrast the similarities and differences between the models. Discuss observations as a class. Connect discussion to the concepts of discrete vs. continuous data and arithmetic sequences.
MA.HS.A.SSE.3e MA.HS.F.LE.5	Present students with a variety of descriptive relationships (e.g, the height of a bouncing ball reaches 80% of its previous height with each bounce). Students can work in pairs to identify the pattern of change as linear, exponential, or neither in each situation and explain how they found the pattern of change. As a class discuss observations.
MA.HS.N.Q.1	Teacher can provide students with a set of real-world data, such as depreciation values of cars, and have them graph the data using various scales. Students can compare and contrast the visuals formed by using different scales and explain why graph representation can be misleading.