Audubon Public Schools

Algebra I

Curriculum Guide

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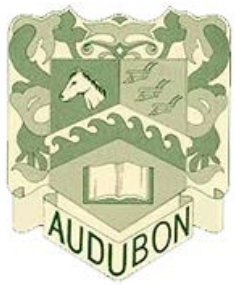

Course Description

Algebra I

Algebra I introduces a new language which is used to develop an understanding of the basic structure of the real number system. One of the principal objectives of this course is to have the pupils understand and appreciate the how and why of arithmetic and mathematics through problem solving techniques. Topics included are sets, negative numbers, equations and inequalities, polynomials, fractions, graphs, the real numbers, and quadratic equations. This course will also help students develop an ever increasing proficiency in the application of mathematics and prepare them for successful experiences in both algebra and geometry and on the State mandated PARCC Algebra 1 exam at the end of this course. Algebra I is a requirement for college bound pupils. Students who successfully complete this course will move on to Geometry.

Overview / Progressions

Overview	Standards for Mathematical Content	Unit Focus	Standards for Mathematical Practice
Unit 1 Linear Equations, Inequalities, and Functions	● N.Q.A.1 ● N.Q.A.2 ● A.SSE.A.1 ● A.CED.A.1 ● A.CED.A.2 ● A.CED.A.4 ● A.REI.A.1 ● A.REI.B.3 ● A.REI.D.10 ● A.REI.D.12 ● F.IF.A.1 ● F.IF.A.2 ● F.IF.B.4 ● F.IF.B.5 ● F.IF.B.6 ● F.IF.C.7 ● F.BF.A.1 ● F.BF.B.4 ● F.LE.B.5 ● S.ID.B.6 ● S.ID.C.7 ● S.ID.C.8 ● S.ID.C.9	● Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters ● Create linear equation and inequalities in one variable and use them to solve problems ● Explain the reasoning behind solving equations ● Use units and quantitative reasoning to solve problems ● Interpret the structure of expressions ● Rearrange formulas to highlight a variable of interest ● Understand how to represent linear relationships on a coordinate plane	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments & critique the reasoning. of others. MP.4 Model with mathematics.

		• Interpret key features of a graph to write and solve linear equations • Understand the concepts of a function and use function notation to represent linear functions • Build a function that models a relationship between two quantities • Analyze functions using different representations • Interpret functions that arise in applications in terms of the context • Represent data on two quantitative variables on a scatter plot and describe how the variables are related • Build inverse functions	MP.5 Use appropriate tools strategically.. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.
Unit 2 Systems of Linear Equations and Inequalities	• A.CED.A.3 • A.REI.C.5 • A.REI.C.6 • A.REI.D.11 • A.REI.D.12	• Solve linear systems of equations algebraically • Solve linear systems of equations using a graph • Use technology to analyze/approximate the	

		solution to a system of linear equations ● Solve a system of linear inequalities graphically ● Create a system of linear equations or inequalities to represent a situation and use it to solve problems	
Unit 3 Quadratic and Polynomial Equations, Expressions, and Functions	● A.SSE.A.2 ● A.SSE.B.3 ● A.APR.A.1 ● A.APR.B.3 ● A.CED.A.1 ● A.REI.B.4 ● A.REI.C.7 ● A.REI.D.11 ● F.IF.B.4 ● F.IF.B.5 ● F.IF.C.7 ● F.IF.C.8 ● F.IF.C.9 ● F.BF.B.3	● Perform arithmetic operations on polynomials ● Understand the relationship between zeros and factors ● Solve quadratic and polynomial equations ● Build a quadratic function that models a relationship between two quantities ● Interpret quadratic functions that arise in application in context ● Construct and compare linear and quadratic models ● Factor quadratic and polynomial expressions (methods include factoring by gcf, grouping, ac rule, completing the square,	

		quadratic formula, and with technology) ● Find the zeros of quadratic and polynomial equations algebraically ● Represent quadratic equations on a coordinate plane ● Interpret key features of quadratic and polynomial equations on a graph ● Use the equation of a quadratic relationships to identify key features like the vertex, minimum or maximum, and opening of the graph ● Identify the effect of a transformation on a quadratic equation	
Unit 4 Exponential Equations and Functions	● A.SSE.A.1 ● A.SSE.B.3 ● F.IF.A.3 ● F.IF.B.4 ● F.IF.B.5 ● F.IF.B.6 ● F.IF.C.7 ● F.IF.C.9	● Utilize exponent rules to simplify exponential expressions ● Perform operations on expressions in scientific notation	

	● F.BF.A.1 ● F.LE.A.1 ● F.LE.A.2 ● F.LE.B.5	● Identify exponential growth and decay in applications in terms of the context ● Interpret key features of exponential functions algebraically and graphically ● Construct and compare linear, quadratic, and exponential models ● Build an exponential function that models a relationship between two quantities ● Analyze successive differences to create a regression equation of best fit for a data set. ● Evaluate exponential, quadratic, and linear regression lines of real-world situations ● Evaluate and create arithmetic and geometric sequences	
Unit 5 Statistical Models	● F.IF.B.4 ● F.IF.B.5 ● S.ID.A.1	● Interpret linear models of categorical and quantitative data	

	● S.ID.A.2 ● S.ID.A.3 ● S.ID.B.5 ● S.ID.B.6	● Summarize, represent, and interpret data on a single count or measurement variable ● Use the Fundamental Counting Principle to determine outcomes ● Calculate the probability of two independent events, dependent events, mutually exclusive and inclusive events ● Calculate probability in real-world events ● Identify various sampling techniques and recognize a biased sample ● Use combinations and permutations to determine probabilities	

Subject: Algebra I	Grade: 9	Unit: 1	1st Marking Period

Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
● A.SSE.A.1. Interpret expressions that represent a quantity in terms of its context. A.SSE.A.1a. Interpret parts of an expression, such as terms, factors, and coefficients	MP.1 Make sense of problems and persevere in solving them. MP 2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.7 Look for and make use of structure.	Concept(s): ● No new concept(s) introduced Students are able to: ● identify different parts of an expression, including terms, factors and constants. ● explain the meaning of parts of an expression in context. Learning Goal 1: Interpret terms, factors, coefficients, and other parts of expressions in terms of a context .
● A.REI.B.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. ● A.REI.A.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.	MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments & critique the reasoning. of others. MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s): ● Literal equations can be rearranged using the properties of equality. Students are able to: ● solve linear equations with coefficients represented by letters in one variable. ● use the properties of equality to justify steps in solving linear equations. ● solve linear inequalities in one variable. ● rearrange linear formulas and literal equations, isolating a specific variable.

Construct a viable argument to justify a solution method. ● A.CED.A.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.		Learning Goal 2: Solve linear equations and inequalities in one variable (including literal equations); justify each step in the process.
● A.CED.A.1. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear functions and quadratic functions, and simple rational and exponential functions. ● A.REI.A.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 a viable argument to justify a solution method.	MP 2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.7 Look for and make use of structure.	Concept(s): ● Equations and inequalities describe relationships. ● Equations can represent real-world and mathematical problems Students are able to: ● identify and describe relationships between quantities in word problems. ● create linear equations in one variable. ● create linear inequalities in one variable. ● use equations and inequalities to solve real world problems. ● explain each step in the solution process Learning Goal 3: Create linear equations and inequalities in one variable and use them in contextual situations to solve problems. Justify each step in the process and the solution.

● N.Q.A.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. ● N.Q.A.2. Define appropriate quantities for the purpose of descriptive modeling	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision.	Concept(s): ● Units are associated with variables in expressions and equations in context. ● Quantities may be used to model attributes of real world situations. ● Measurement tools have an inherent amount of uncertainty in measurement. Students are able to: ● use units to understand real world problems. ● use units to guide the solution of multi-step real world problems (e.g. dimensional analysis). ● choose and interpret units while using formulas to solve problems. ● identify and define appropriate quantities for descriptive modeling. ● choose a level of accuracy when reporting measurement quantities. Learning Goal 4: Solve multi-step problems, using units to guide the solution, interpreting units consistently in formulas and choosing an appropriate level of accuracy on measurement quantities. Develop descriptive models by defining appropriate quantities.
● F.IF.A.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	MP 2 Reason abstractly and quantitatively. MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s): ● F(x) is an element in the range and x is an element in the domain. Students are able to: ● use the definition of a function to determine whether a relationship is a function.

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). ● F.IF.A.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. ● F.BF.A.1. Write a function that describes a relationship between two quantities.		● use function notation once a relation is determined to be a function. ● evaluate functions for given inputs in the domain. ● explain statements involving function notation in the context of the problem. ● write a function from given information. Learning Goal 5: Explain the definition of a function, including the relationship between the domain and range. Use function notation, write functions, evaluate functions and interpret statements in context.
● F.IF.B.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.	MP.1 Make sense of problems and persevere in solving them. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.8 Look for and express regularity in repeated reasoning.	Concept(s): ● Rate of change of non-linear functions varies Students are able to: ● compare key features of two linear functions represented in different ways. ● calculate the rate of change from a table of values or from a function presented symbolically. ● estimate the rate of change from a graph.

		Learning Goal 6: Calculate and interpret the average rate of change of a function presented symbolically or as a table; estimate the rate of change from a graph.
● A.CED.A.2. Create equations in two or more variables to represent relationships between quantities; Graph equations on coordinate axes with labels and scales. ● N.Q.A.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. ● A.REI.D.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). [Focus on linear equations.]	MP 2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.7 Look for and make use of structure.	Concept(s): ● Equations represent quantitative relationships Students are able to: ● create linear equations in two variables, including those from a context. ● select appropriate scales for constructing a graph. ● interpret the origin in graphs. ● graph equations on coordinate axes, including labels and scales. ● identify and describe the solutions in the graph of an equation. Learning Goal 7: Create linear equations in two variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

● F.IF.B.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. *[Focus on linear functions] ● F.LE.B.5. Interpret the parameters in a linear or exponential function in terms of a context. ● F.IF.B.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	MP 2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.6 Attend to precision.	Concept(s): ● Graphs of linear equations and functions obtain key features that can be compared (ie. intercepts, slopes, etc.) ● Terms describing a linear graph such as positive or negative, end behavior, etc. Students are able to: ● given a verbal description of a relationship, sketch linear functions. ● identify intercepts and intervals where the function is positive/negative. ● interpret parameters in context. ● determine the practical domain of a function. Learning Goal 8: Sketch graphs of linear functions expressed symbolically or from a verbal description. Show key features and interpret parameters in context.

integers would be an appropriate domain for the function. ● F.IF.C.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.C.7a Graph linear and quadratic functions and show intercepts, maxima, and minima. *[Focus on linear functions.]		
● A.REI.B.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. ● A.REI.D.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	MP.6 Attend to precision MP.7 Look for and make use of structure.	Concept(s): ● No new concept(s) introduced Students are able to: ● solve linear inequalities. ● graph linear inequalities. ● model real world situations by creating a s linear inequality given a context. ● interpret the solution(s) in context. Learning Goal 9: Solve and graph linear inequalities and explain that the solution in context.

intersection of the corresponding half-plane		
● F.BF.B.4 Find inverse functions. F.BF.B.4a 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. F.BF.B.4c Read values of an inverse function from a graph or table, given that the function has an inverse. ● A.CED.A.2 Create equations in two or more variables to represent relationships between quantities; Graph equations on coordinate axes with labels and scales.	MP.1 Make sense of problems and persevere in solving them. MP.6 Attend to precision. MP.7 Look for and make use of structure.	Concept(s): ● Linear relations and functions have inverse relations and functions. ● Inverse relations are sets obtained by exchanging the x-coordinate with the y-coordinate. ● Inverse functions of linear functions can be found by interchanging the x variable with the y variable. ● Inverses can be represented as relations, tables, graphs, or equations. Students are able to: ● find the inverse of a relation represented in set notation or in a table. ● graph inverse relations. ● find the inverse of a linear function. ● graph inverse linear functions. ● use a linear function and its inverse to represent a real-world situation. ● determine the meaning or significance of a inverse function in context of a problem.

		Learning Goal 10: Explain the relationship between a function and its inverse. Find inverses of a given representation assuming there is an inverse. Use inverse relationships to analyze real-word problems.
● S.ID.B.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. S.ID.B.6a. Fit a function to the data (including the use of technology); 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.B.6c. Fit a linear function for a scatter plot that suggests a linear association. ● S.ID.C.7. Interpret the slope (rate of change) and the intercept (constant term) of a	MP.1 Make sense of problems and persevere in solving them. MP 2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision.	Concept(s): ● Scatter plots represent the relationship between two variables. ● Scatter plots can be used to determine the nature of the association between the variables. ● Linear models may be developed by fitting a linear function to approximately linear data. ● The correlation coefficient represents the strength of a linear association. Students are able to: ● distinguish linear models representing approximately linear data from linear. equations representing “perfectly” linear relationships. ● create a scatter plot and sketch a line of best fit. ● fit a linear function to data using technology. ● solve problems using prediction equations. ● interpret the slope and the intercepts of the linear model in context. ● determine the correlation coefficient for the linear model using technology.

linear model in the context of the data. ● S.ID.C.8. Compute (using technology) and interpret the correlation coefficient of a linear fit. ● S.ID.C.9. Distinguish between correlation and causation.		● determine the direction and strength of the linear association between two variables. Learning Goal 11: Represent data on a scatter plot, describe how the variables are related and use technology to fit a function to data. Learning Goal 12: Interpret the slope, intercept, and correlation coefficient of a data set of a linear model; distinguish between correlation and causation.

Formative Assessments	**Summative Assessments**
● Independent, guided, and group practice/activities ● Teacher observation ● Marzano 9 strategies (think-pair share, graphic organizers, ques and questions, etc.) ● Technology result data (desmos, quizlet, quizizz, kahoot, IXL, etc.)	● Mid-chapter and chapter standard aligned assessments (tests and quizzes) ● MAP Fall
Suggested Primary Resources	**Suggested Supplemental Resources**
● Glencoe Algebra 1 2012 (https://connected.mcgraw-hill.com/connected/login.do) ● TI 84 Graphing Calculator (https://parcctrng.testnav.com/client/index.html#login?username=17MTA1PTOE01010200&password=PCPRACTICE) ● Desmos Graphing Calculator (www.desmos.com)	● Desmos Classroom Activities ● Quizlet, Quizizz, Kahoot, etc. ● Edpuzzle ● IXL Math ● Kuta Software LLC, TeachersPayTeachers, Khan Academy

Cross-Curricular Connections & 21st Century Skills	
● Science, Technology, Engineering, and Mathematics (STEM) Literacy ● Global Awareness ● Creativity and Innovation ● Critical Thinking and Problem Solving ● Communication and Collaboration ● Life and Career Skills	
Essential Questions	**Enduring Understanding**
● How do mathematical models/representations shape our understanding of mathematics? ● What are the similarities and differences in the procedures for solving and expressing the solutions of equations and inequalities? ● What makes a strategy to problem solving effective and efficient in solving linear equations or inequalities in one variable? ● Why are tables, graphs, and equations useful for representing relationships? ● Why are linear functions useful in real-world settings? ● Why would you use multiple representations of linear equations and inequalities?	● Rules of arithmetic and algebra can be used together with notions of equivalence to transform equations and inequalities so solutions can be found. ● Being able to compute fluently means making smart choices about which tools to use and when to use them to accurately solve real-world applications of equations and inequalities. ● Real world situations can be represented symbolically and graphically to influence patterns of prediction or highlight past, present, or future occurrences of linear situations.

NOTE: Italicized areas are for honors level course(s).

Subject: Algebra I	Grade: 9	Unit: 2	1st/ 2nd Marking Period

Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
• A.REI.D.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, polynomial, rational, absolute value, exponential, and logarithmic functions.* [Focus on linear equations.]	MP.1 Make sense of problems and persevere in solving them. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically	Concept(s): • y = f(x), y = g(x) represent a system of equations. • Systems of equations can be solved graphically. Students are able to: • explain the relationship between the x-coordinate of a point of intersection and the solution to the equation f(x) = g(x) for linear equations y = f(x) and y = g(x). • find approximate solutions to the system by making a table of values, graphing, and finding successive approximations. Learning Goal 1: Explain why the solutions of the equation f(x) = g(x) are the x-coordinates of the points where the graphs of the linear equations y=f(x) and y=g(x) intersect. ** function notation is not introduced here

		Learning Goal 2: Find approximate solutions of $f(x) = g(x)$, where $f(x)$ and $g(x)$ are linear functions, by making a table of values, using technology to graph and finding successive approximations.
● A.REI.C.6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. ● A.CED.A.3. Represent constraints by equations or inequalities, and by systems of equations and/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. ● A.REI.C.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	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments & critique the reasoning. of others. MP.4 Model with mathematics.	Concept(s): ● Systems of equations can be solved exactly (algebraically) and approximately (graphically). Students are able to: ● identify and define variables representing essential features for the model. ● model real world situations by creating a system of linear equations. ● solve systems of linear equations using the elimination or substitution method. ● solve systems of linear equations by graphing. ● interpret the solution(s) in context. Learning Goal 3: Solve multistep contextual problems by identifying variables, writing equations, and solving systems of linear equations in two variables algebraically and graphically.

other produces a system with the same solutions.		
● A.REI.D.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. ● A.CED.A.3. Represent constraints by equations or inequalities, and by systems of equations and/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.	MP.1 Make sense of problems and persevere in solving them. MP 2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision.	Concept(s): ● No new concept(s) introduced Students are able to: ● model real world situations by creating a system of linear inequalities given a context. ● interpret the solution(s) in context Learning Goal 4: Graph linear inequalities and systems of linear inequalities in two variables and explain that the solution to the system.

Formative Assessments	Summative Assessments
● Independent, guided, and group practice/activities ● Teacher observation	● Mid-chapter and chapter standard aligned assessments (tests and quizzes)

• Marzano 9 strategies (think-pair share, graphic organizers, ques and questions, etc.) • Technology result data (desmos, quizlet, quizizz, kahoot, IXL, etc.)	• MAP Winter
Suggested Primary Resources	**Suggested Supplemental Resources**
• Glencoe Algebra 1 2012 (https://connected.mcgraw-hill.com/connected/login.do) • TI 84 Graphing Calculator (https://parcctrng.testnav.com/client/index.html#login?username=17MTA1PTOE01010200&password=PCPRACTICE) • Desmos Graphing Calculator (www.desmos.com)	• Desmos Classroom Activities • Quizlet, Quizizz, Kahoot, etc. • Edpuzzle • IXL Math • Kuta Software LLC, TeachersPayTeachers, Khan Academy
Cross-Curricular Connections & 21st Century Skills	
• Science, Technology, Engineering, and Mathematics (STEM) Literacy • Global Awareness • Creativity and Innovation • Critical Thinking and Problem Solving • Communication and Collaboration • Life and Career Skills	
Essential Questions	**Enduring Understanding**
• What does the number of solutions (one, none, or infinite) of a system of linear equations or inequalities represent? • What are the advantages and disadvantages of solving a system of linear equations graphically versus algebraically? • How can systems of equations or inequalities be used to represent situations and solve real world problems?	• There are situations that require two or more equations or inequalities to be satisfied simultaneously. • There are several methods for solving systems of equations (graphing, substitution, and elimination). • Solutions to systems can be interpreted algebraically, geometrically, and in terms of problem contexts. • The number of solutions to a system of equations and/or inequalities can vary from no solution to an infinite number of solutions.

NOTE: Italicized areas are for honors level course(s).

Subject: Algebra I	Grade: 9	Unit: 3	2nd/3rd Marking Period

Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
● A.APR.A.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.A.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 $(x^2 - y^2)(x^2 + y^2)$.	MP.2 Reason abstractly and quantitatively. MP.7 Look for and make use of structure.	Concept(s): ● Polynomials form a system analogous to the integers. ● Polynomials are closed under the operations of addition, subtraction, and multiplication Students are able to: ● add and subtract polynomials. ● multiply polynomials. ● recognize numerical expressions as a difference of squares and rewrite the expression as the product of sums/differences. ● recognize polynomial expressions in one variable as a difference of squares and rewrite the expression as the product of sums/differences. Learning Goal 1: Add, subtract, and multiply polynomials, relating these to arithmetic operations with integers. Factor to produce equivalent forms of quadratic expressions in one variable.

● A.REI.B.4. Solve quadratic equations in one variable. A.REI.B.4b. 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.	MP.1 Make sense of problems and persevere in solving them. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically. MP.7 Look for and make use of structure.	Concept(s): ● Multiple methods for solving quadratic equations. Students are able to: ● solve quadratic equations in one variable by factoring by gcf, grouping, and ac rule. ● solve quadratic equations in one variable by taking square roots. ● strategically select, as appropriate to the initial form of the equation, a method for solving a quadratic equation in one variable. Learning Goal 2: Solve quadratic equations in one variable using a variety of methods including inspection, taking square roots, and factoring. Learning Goal 3: Analyze and strategically identify the appropriate method to identify the zeros of the quadratic function.
● F.IF.C.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.C.7a. Graph linear and	MP.1 Make sense of problems and persevere in solving them. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools	Concept(s): ● No new concept(s) introduced Students are able to: ● graph quadratic functions expressed symbolically.

quadratic functions and show intercepts, maxima, and minima. *[emphasize quadratic functions] ● F.IF.C.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. F.IF.C.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.C.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.	strategically. MP.6 Attend to precision. MP.8 Look for and express regularity in repeated reasoning.	● graph more complicated cases of quadratic functions using technology. ● identify and describe key features of the graphs of quadratic functions. ● given two quadratic functions, each represented in a different way, compare the properties of the functions. Learning Goal 4: Graph quadratic functions by hand in simple cases and with technology in complex cases, showing intercepts, extreme values and symmetry of the graph. Compare properties of two quadratic functions, each represented in a different way.

● F.IF.B.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.B.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	MP.4 Model with mathematics. MP.6 Attend to precision.	Concept(s): ● No new concept(s) introduced Students are able to: ● interpret maximum/minimum and intercepts of quadratic functions from graphs and tables in the context of the problem. ● sketch graphs of quadratic functions given a verbal description of the relationship between the quantities. ● identify intercepts and intervals where function is increasing/decreasing ● determine the practical domain of a function. Learning Goal 5: Interpret key features of quadratic functions from graphs and tables. Given a verbal description of the relationship, sketch the graph of a quadratic function, showing key features and relating the domain of the function to its graph.

● F.BF.B.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.	MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically. MP.7 Look for and make use of structure.	Concept(s): ● Characteristics of even and odd functions in graphs and algebraic expressions ● Vertical and horizontal shifts Students are able to: ● perform transformations on graphs of linear and quadratic functions. ● 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). ● identify the effect on the graph of combinations of transformations. ● given the graph, find the value of k. ● illustrate an explanation of the effects on linear and quadratic graphs using technology. ● recognize even and odd functions from their graphs and from algebraic expressions for them. Learning Goal 6: Identify the effects of transformations and combinations of transformations [f(x) + k, k f(x), f(kx), and f(x + k)] on a function; find the value of k given the graph.
● A.REI.B.4. Solve quadratic equations in one variable.	MP.1 Make sense of problems and persevere in solving them.	Concept(s): ● Multiple methods for solving quadratic equations.

A.REI.B.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. A.REI.B.4b. 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.* ● A.CED.A.1. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear functions and quadratic functions, and simple rational and exponential functions	MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure.	● Transforming a quadratic equation into the form $(x - p)^2 = q$ yields an equation having the same solutions. Students are able to: ● use the method of completing the square to transform a quadratic equation in x into an equation of the form $(x - p)^2 = q$. ● derive the quadratic formula from $(x - p)^2 = q$. ● solve quadratic equations in one variable by completing the square. ● solve quadratic equations in one variable using the quadratic formula. ● strategically select, as appropriate to the initial form of the equation, a method for solving a quadratic equation in one variable. ● *write complex solutions of the quadratic formula in a ± bi form.* ● create quadratic equations in one variable. ● use quadratic equations to solve real world problems ● analyze the quadratic formula, recognizing the conditions leading to complex solutions (discriminant). Learning Goal 7: Derive the quadratic formula by completing the square and recognize when there are no real solutions. Learning Goal 8: Solve quadratic equations in one variable using a variety of methods (including inspection, taking square roots, factoring, completing the square, and the quadratic formula) and *write complex solutions in a ± bi form.graph.*

		Learning Goal 9: Create quadratic equations in one variable and use them to solve problems.
● A.SSE.B.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. A.SSE.B.3a. Factor a quadratic expression to reveal the zeros of the function it defines. A.SSE.B.3b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines	MP.1 Make sense of problems and persevere in solving them. MP.4 Model with mathematics. MP.7 Look for and make use of structure.	Concept(s): ● Alternate, equivalent forms of a quadratic expression may reveal specific attributes of the function that it defines. Students are able to: ● factor a quadratic expression for the purpose of revealing the zeros of a function. ● complete the square for the purpose of revealing the maximum or minimum of a function. Learning Goal 10: Use factoring and completing the square to produce equivalent forms of quadratic expressions in one variable that highlight particular properties such as the zeros or the maximum or minimum value of the function.
● *A.REI.D.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*	*MP.1 Make sense of problems and persevere in solving them.* *MP.5 Use appropriate tools strategically.*	*Concept(s):* ● *No new concept(s) introduced* *Students are able to:* ● *approximate the solution(x) to a system of equations comprised of a linear and a quadratic function by using technology to graph the functions, by making a table of values and/or by finding successive approximations.*

*approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.**		*Learning Goal 11: Find approximate solutions of f(x) = g(x), where f(x) is a linear function and g(x) is a quadratic function by making a table of values, using technology to graph and finding successive approximations.*
● *A.APR.B.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. *[Algebra 1: limit to quadratic and cubic functions in which linear and quadratic factors are available]*	*MP.7 Look for and make use of structure.*	*Concept(s):* ● *General shape(s) and end behavior of cubic functions* *Students are able to:* ● *find the zeros of a polynomial (quadratic and cubic).* ● *test domain intervals to determine where f(x) is greater than or less than zero.* ● *use zeros of a function to sketch a graph.* *Learning Goal 12: Identify zeros of cubic functions when suitable factorizations are available and use the zeros to construct a rough graph of the function. (*cubic functions are presented as the product of a linear and a quadratic factor)*

Formative Assessments	Summative Assessments
● Independent, guided, and group practice/activities ● Teacher observation	● Mid-chapter and chapter standard aligned assessments (tests and quizzes)

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- Marzano 9 strategies (think-pair share, graphic organizers, ques and questions, etc.)
- Technology result data (desmos, quizlet, quizizz, kahoot, IXL, etc.)

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- MAP Winter/ Spring

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<tr><th>Suggested Primary Resources</th><th>Suggested Supplemental Resources</th></tr>
<tr><td>

- Glencoe Algebra 1 2012 (https://connected.mcgraw-hill.com/connected/login.do)
- TI 84 Graphing Calculator (https://parcctrng.testnav.com/client/index.html#login?username=17MTA1PTOE01010200&password=PCPRACTICE)
- Desmos Graphing Calculator (www.desmos.com)

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- Desmos Classroom Activities
- Quizlet, Quizizz, Kahoot, etc.
- Edpuzzle
- IXL Math
- Kuta Software LLC, TeachersPayTeachers, Khan Academy

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<tr><th colspan="2">Cross-Curricular Connections & 21st Century Skills</th></tr>
<tr><td colspan="2">

- Science, Technology, Engineering, and Mathematics (STEM) Literacy
- Global Awareness
- Creativity and Innovation
- Critical Thinking and Problem Solving
- Communication and Collaboration
- Life and Career Skills

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<tr><th>Essential Questions</th><th>Enduring Understanding</th></tr>
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- How are quadratic functions used to model, analyze and interpret mathematical relationships?
- Why is it advantageous to know a variety of ways to solve and graph quadratic functions?

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- Utilize critical thinking strategies and acquired skills to determine the appropriate method to identify or interpret solution(s) or characteristics of a quadratic function.
- Comprehend that solution(s) may exist beyond the realm of the real number system.

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NOTE: Italicized areas are for honors level course(s).

Subject: Algebra I	Grade: 9	Unit: 4	3rd Marking Period

Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
● A.SSE.B.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. A.SSE.B.3c. 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%. *[Algebra 1: limit to exponential expressions with integer exponents]	MP.1 Make sense of problems and persevere in solving them. MP 2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.7 Look for and make use of structure	Concept(s): ● Solve equations involving rational exponents by the use of exponent properties ● Use technology to solve harder exponential equations Students are able to: ● use the properties of exponents to simplify or expand exponential expressions, recognizing these are equivalent forms. ● use the properties of exponents to create equivalent forms of expressions to determine the solution of exponential equations ● utilize technology to determine the solutions of complex exponential equations (equations without common bases) Learning Goal 1: Use properties of exponents to produce equivalent forms of exponential expressions in one variable. Learning Goal 2: Use properties of exponents to produce equivalent expressions to solve an exponential equations, utilize technology for exponential equations without common bases.

● F.IF.B.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. *[Focus on exponential functions] ● F.LE.A.1. Distinguish between situations that can be modeled with linear functions and with exponential functions. F.LE.A.1a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. F.LE.A.1b. Recognize situations in which one	MP 2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.4 Model with mathematics. MP.6 Attend to precision.	Concept(s): ● Linear functions grow by equal differences over equal intervals. ● Exponential functions grow by equal factors over equal intervals. Students are able to: ● identify and describe situations in which one quantity changes at a constant rate. ● identify and describe situations in which a quantity grows or decays by a constant percent. ● show that linear functions grow by equal differences over equal intervals. ● show that exponential functions grow by equal factors over equal intervals ● given a verbal description of a relationship, sketch linear and exponential functions. ● identify intercepts and intervals where the function is positive/negative. ● interpret parameters in context. ● determine the practical domain of a function. Learning Goal 3: Distinguish between and explain situations modeled with linear functions and with exponential functions. Learning Goal 4: Sketch graphs of linear and exponential functions expressed symbolically or from a verbal description. Show key features and interpret parameters in

quantity changes at a constant rate per unit interval relative to another. F.LE.A.1c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another ● F.LE.B.5. Interpret the parameters in a linear or exponential function in terms of a context. ● F.IF.B.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		context.
● F.LE.A.2. Construct linear and exponential functions - including arithmetic and geometric sequences - given a	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and	Concept(s): ● Sequences are functions, sometimes defined and represented recursively.

graph, a description of a relationship, or two input-output pairs (include reading these from a table). *[Algebra 1 limitation: exponential expressions with integer exponents] ● F.IF.A.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 $n \geq 1$.	quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure.	● Sequences are functions whose domain is a subset of integers. Students are able to: ● create arithmetic and geometric sequences from verbal descriptions. ● create arithmetic sequences from linear functions. ● create geometric sequences from exponential functions. ● identify recursively defined sequences as functions. ● create linear, exponential, and quadratic regression functions given − a graph; − a description of a relationship; − a table of values Learning Goal 5: Write linear and exponential functions given a graph, table of values, or written description; construct arithmetic and geometric sequences.
● F.BF.A.1. Write a function that describes a relationship between two quantities. 1a. Determine an explicit expression, a recursive process, or steps for calculation from a context. ● A.SSE.A.1. Interpret expressions that represent a quantity in terms of its context A.SSE.A.1a: Interpret parts of an expression, such as	MP 2 Reason abstractly and quantitatively. MP.4 Model with mathematics	Concept(s): ● Creating linear, exponential, and quadratic equations/functions through the regression feature of a graphing calculator (technology) Students are able to: ● given a data set, analyze successive differences, write an explicit regression function of best fit for linear, exponential, or quadratic models ● interpret parts of linear, exponential, and quadratic functions in context

terms, factors, and coefficients. A.SSE.A.1b: Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r)n as the product of P and a factor not depending on P. *[Algebra 1 limitation: exponential expressions with integer exponents]		• use technology to evaluate or predict outcomes of real-world problems Learning Goal 6: Create a regression function of best fit (linear, exponential, or quadratic) by analyzing successive differences and use the regression function to solve or predict outcomes of real-world problems.
• *F.IF.C.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. *[Limit to linear and exponential]* • *F.IF.B.6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval.*	*MP.1 Make sense of problems and persevere in solving them.* *MP.3 Construct viable arguments and critique the reasoning of others.* *MP.5 Use appropriate tools strategically.* *MP.6 Attend to precision.* *MP.8 Look for and express regularity in repeated reasoning.*	*Concept(s):* • *Rate of change of non-linear functions varies.* *Students are able to:* • *compare key features of two linear functions represented in different ways.* • *compare key features of two exponential functions represented in different ways.* • *calculate the rate of change from a table of values or from a function presented symbolically.* • *estimate the rate of change from a graph.* *Learning Goal 7: Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).*

Estimate the rate of change from a graph.		
● *F.IF.C.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.C.7a. Graph linear and quadratic functions and show intercepts, maxima, and minima.* *F.IF.C.7b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions*	*MP.1 Make sense of problems and persevere in solving them.* *MP.5 Use appropriate tools strategically.* *MP.6 Attend to precision*	*Concept(s):* ● *Piecewise-defined functions may contain discontinuities.* ● *Absolute value functions are piecewise functions.* *Students are able to:* ● *graph linear, square root, cube root, and piecewise-defined functions.* ● *graph more complicated cases of functions using technology.* ● *identify and describe key features of the graphs of square root, cube root, and piecewise-defined functions .* *Learning Goal 8: Graph linear, square root, cube root, and piecewise-defined functions (including step and absolute value functions) expressed symbolically. Graph by hand in simple cases and using technology in more complex cases, showing key features of the graph.*

Formative Assessments	Summative Assessments
● Independent, guided, and group practice/activities ● Teacher observation ● Marzano 9 strategies (think-pair share, graphic organizers, ques and questions, etc.) ● Technology result data (desmos, quizlet, quizizz, kahoot, IXL, etc.)	● Mid-chapter and chapter standard aligned assessments (tests and quizzes) ● MAP Spring ● PARCC

Suggested Primary Resources	Suggested Supplemental Resources
● Glencoe Algebra 1 2012 (https://connected.mcgraw-hill.com/connected/login.do) ● TI 84 Graphing Calculator (https://parcctrng.testnav.com/client/index.html#login?username=17MTA1PTOE01010200&password=PCPRACTICE) ● Desmos Graphing Calculator (www.desmos.com)	● Desmos Classroom Activities ● Quizlet, Quizizz, Kahoot, etc. ● Edpuzzle ● IXL Math ● Kuta Software LLC, TeachersPayTeachers, Khan Academy
Cross-Curricular Connections & 21st Century Skills	
● Science, Technology, Engineering, and Mathematics (STEM) Literacy ● Global Awareness ● Creativity and Innovation ● Critical Thinking and Problem Solving ● Communication and Collaboration ● Life and Career Skills	
Essential Questions	**Enduring Understanding**
● How can exponential functions be used to model real-world problems and solutions? ● How do multiplicative patterns model the physical world?	● Exponential models carefully define the percent rate of change in real-world applications. ● In a geometric sequence, the ratio of any term to its preceding term is a constant value. ● Exponential functions are important because they can be used to describe real-world situation involving population growth, decay of radioactive materials (half-life), compound interest.

NOTE: Italicized areas are for honors level course(s).

Subject: Algebra I	Grade: 9	Unit: 5	4th Marking Period

Content Standards	Suggested Standards for Mathematical Practice	Critical Knowledge & Skills
● S.ID.A.1. Represent data with plots on the real number line (dot plots, histograms, and box plots).	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision	Concept(s): ● No new concept(s) introduced Students are able to: ● represent data with dot plots on the real number line. ● represent data with histograms on the real number line. ● represent data with box plots on the real number line. Learning Goal 1: Represent data with plots (dot plots, histograms, and box plots) on the real number line.
● S.ID.A.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.A.3. Interpret differences in shape, center, and spread in	MP.1 Make sense of problems and persevere in solving them. MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools	Concept(s): ● Appropriate use of a statistic depends on the shape of the data distribution. ● Standard deviation Students are able to:

the context of the data sets, accounting for possible effects of extreme data points (outliers).	strategically. MP.6 Attend to precision.	● represent two or more data sets with plots and use appropriate statistics to compare their center and spread. ● interpret differences in shape, center, and spread in context. ● explain possible effects of extreme data points (outliers) when summarizing data and interpreting shape, center and spread. Learning Goal 2: Compare center and spread of two or more data sets, interpreting differences in shape, center, and spread in the context of the data, taking into account the effects of outliers.
● S.ID.B.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.	MP.1 Make sense of problems and persevere in solving them. MP.5 Use appropriate tools strategically. MP.7 Look for and make use of structure.	Concept(s): ● Categorical variables represent types of data which may be divided into groups. Students are able to: ● construct two-way frequency tables for categorical data. ● interpret joint, marginal and conditional relative frequencies in context. ● explain possible associations between categorical data in two-way tables. ● identify and describe trends in the data. Learning Goal 3: Summarize and interpret categorical data for two categories in two-way frequency tables; explain possible associations and trends in the data.

● S.ID.B.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. S.ID.B.6a. Fit a function to the data (including the use of technology); 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.B.6b. Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology	MP.1 Make sense of problems and persevere in solving them. MP 2 Reason abstractly and quantitatively. MP.4 Model with mathematics. MP.5 Use appropriate tools strategically. MP.6 Attend to precision.	Concept(s): ● No new concept(s) introduced Students are able to: ● fit a function to data using technology. ● solve problems using functions fitted to data (prediction equations). ● interpret the intercepts of models in context. ● plot residuals of linear and non-linear functions. ● analyze residuals in order to informally evaluate the fit of linear and non-linear functions. Learning Goal 4: Fit functions to data using technology, plot residuals and informally assess the fit of linear and non-linear functions by analyzing residuals.
● F.IF.B.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:	MP.4 Model with mathematics. MP.6 Attend to precision.	Concept(s): ● No new concept(s) introduced Students are able to: ● interpret maximum/minimum and intercepts of functions from graphs and tables in the context of the problem.

intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. ● F.IF.B.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.		● sketch graphs of functions given a verbal description of the relationship between the quantities. ● identify intercepts and intervals where function is increasing/decreasing. ● determine the practical domain of a function . Learning Goal 5: Interpret key features of functions from graphs and tables. Given a verbal description of the relationship, sketch the graph of a function, showing key features and relating the domain of the function to its graph.

Formative Assessments	Summative Assessments
● Independent, guided, and group practice/activities ● Teacher observation ● Marzano 9 strategies (think-pair share, graphic organizers, ques and questions, etc.) ● Technology result data (desmos, quizlet, quizizz, kahoot, IXL, etc.)	● Mid-chapter and chapter standard aligned assessments (tests and quizzes)
Suggested Primary Resources	**Suggested Supplemental Resources**

• Glencoe Algebra 1 2012 (https://connected.mcgraw-hill.com/connected/login.do) • TI 84 Graphing Calculator (https://parcctrng.testnav.com/client/index.html#login?username=17MTA1PTOE01010200&password=PCPRACTICE) • Desmos Graphing Calculator (www.desmos.com)	• Desmos Classroom Activities • Quizlet, Quizizz, Kahoot, etc. • Edpuzzle • IXL Math • Kuta Software LLC, TeachersPayTeachers, Khan Academy
Cross-Curricular Connections & 21st Century Skills	
• Science, Technology, Engineering, and Mathematics (STEM) Literacy • Global Awareness • Creativity and Innovation • Critical Thinking and Problem Solving • Communication and Collaboration • Life and Career Skills	
Essential Questions	**Enduring Understanding**
• Why is data collected and analyzed? • How do sampling methods affect the evaluation of survey results? • How do different displays help you interpret data? • How does understanding probability help you make decisions? • Why is it important for you to understand how data is organized and presented in real-world situations?	• The way that data is collected, organized and displayed influences interpretation. • The probability of an event's occurrence can be predicted with varying degrees of confidence.

NOTE: Italicized areas are for honors level course(s).

Appendix A

Audubon Public Schools
Engaging Students ~ Fostering Achievement ~ Cultivating 21st Century Global Skills
Written By: Ron Latham, Kim Weikel, Nicole Szymanski, Patti Myers-Griffith
Course Title: Algebra I
Unit Name: Linear Equations & Functions
Grade Level: 8-10
Approved: August 20, 2014
Approved June 2017

Content Statements and Rationale:	**NJSLS:**
In this unit, students will review the use of functional relationships and begin to comprehend the concept of a mathematical function.	N.RN.3 N.Q.1-3 A.SSE.1-3 A.CED.1-3 A.REI.10 F.IF.1-5,9 F.BF.1
Overarching Essential Questions: How can we represent relationships among quantities using tables, graphs, verbal descriptions, and inequalities? How can problems be modeled using algebraic symbols? How can algebraic symbols be manipulated? How can we find specific function values and solve equations in problem situations? How can we interpret and make critical predictions from functional relationships? How can we connect equation notation with function notation?	**Overarching Enduring Understandings:** This unit provides an opportunity for students to reinforce their understanding of the various representations of a functional relationship. The unit reviews the distinction between independent and dependent variables in a functional relationship and connects those to the domain and range of a function.

Unit Essential Questions:	**Unit Enduring Understandings:**
How do you use the order of operations? How are verbal and algebraic models and formulas used to represent real life situations? How can a problem be translated into an equation? How can you apply the rules of multiplication and division? How can variables be used to solve problems dealing with consecutive integers? How is the distributive property used in an algebraic equation or expression? What are number operations and algebraic expressions? How do you represent a relation? How do you solve equations? What is function notation? What are relations and functions and how are they related to graphs? In what ways can the skill of solving equations be applied to solve real world problems? How can the result of an equation be checked? How can an equation be solved when there is a variable on both sides? What are the steps to solving an equation that involves one or more transformations?	Algebra techniques can be used to set up equations, translate words into symbols, and translate problems into equations. A variable can be used to represent an unknown value, and a sequence of steps can be used to solve for an unknown. A relation can be represented as a set of ordered pairs (x,y), as an equation, a table, a mapping, or a graph. A function is a relationship between input and output, where each input value has exactly one output.
Benchmarks: End of Lesson Assessments- ConnectED (Online Textbook) Ch 1 Practice Assessment- Pg 67 in textbook Ch 1 Standardized Test Practice- Pg 70-71 in textbook	**Unit Student Learning Overview:** Students will be able to use the necessary algebraic skills required to simplify algebraic expressions and inequalities in problem situations. Students will also be able to use the properties and attributes of functions, and apply functions to problem situations.

Key Terms (Essential Vocabulary):
constant - number
consecutive integers - whole numbers that are all in a row
equation - contains numbers and/or variables and Must contain an Equal sign
inequality - contains numbers and/or variables and uses four inequality symbols
integer - positive or negative whole number
numerical expression - numbers separated by mathematical operations
order of operations - order that must be followed when there is more than 1 mathematical operation present; PEMDAS - Parenthesis, Exponents, Multiplication/Division, Addition/Subtraction
variable - letter or symbol that stands for a number
algebraic expression -variable or number or both separated by mathematical operations

term – number or variable or product or quotient of numbers and variables

power – x to the n
coefficient – numerical factor of a term
solution – replacement value for an equation
identity – an equation that is true for every value of the variable
relation – set of ordered pairs
domain – first set of numbers in ordered pairs of a relation
range – second set of numbers in ordered pairs of a relation
independent variable – value of the variable that determines the output in a relation
dependent variable – variable with a value that is dependent on the value of the independent variable
function – set of points where each input value has only one output value
intercept – point where a graph intersects an axis
line symmetry – each half of a graph one either side of the line matches exactly
end behavior – describes the values of a function at the positive and negative extremes in the domain
formula – rule for the relationship between two quantities
equivalent equations – equations that have the same solution
solve an equation – to find the value of the variable that makes the equation true
ratio – comparison of two numbers using division
proportion - two fractions set equal to each other
unit rate – rate telling how many of one item is being compared to one of another

scale model – proportional model of something too large or too small to use the actual size
percent of change – ratio of change of an amount compared to the original and expressed as a percent
literal equation – equation involving several variables
dimensional analysis – carrying units throughout a computation
weighted average – multiplying the data value by its weight and then find the average
percent - something out of 100

Resources:
Glencoe Algebra 1 2012; Scientific Calculator/ Graphing Calculator, kuta.com, brightstorm.com, khanacademy.com

Suggested Activities for Inclusion in Lesson Planning
Interdisciplinary Connections are identified with and I, followed by the related content area(s):
Draw a series of pictures then have a partner write a variable expression to represent the pictures.
Write your own consecutive integer problem and pass to a partner to solve.
Translate words into symbols.
Discuss list of vocabulary words and their connection to operations and symbols; have students match word phrases with correct symbols.
Have students write phrases and pass to a partner to write symbols.
Play variable expression game – students get a card with a word phrase on one side and variable symbols on the other. A student reads their word phrase out loud and the student in the room with the matching variable phrase stands up and reads their variable phrase then reads the next word phrase for another student.
Translate problems into equations.
Have students write word problems and pass to a partner to write equations.
Set up and solve word problems.
Have students write word problems and pass to a partner to write equations and solve.
Use absolute value.
Use tables and graphs to organize data.
Have students choose a word problem and then create a poster or a power point presentation showing each of the steps used to solve the problem including organizing data with charts and graphs
Find the reciprocal of a number.
Include reciprocals in the variable expression game.

<table>
<tr><td colspan="2">Apply the distributive property to simplify an expression.
Write your own consecutive integer problem and pass to a partner to solve.
Set up word problems with consecutive integers as well as consecutive odd and even integers.
Apply the distributive property to find the area and perimeter of figures with sides of variable lengths.

Decide whether a given value is a solution of an equation.
Have students write an equation and give it to a partner with 3 possible solutions; have partner show work to decide if the possible solutions work.
Justify each step in the solution of an equation.
Generalize solutions of equations to solve literal equations involving physical, geometric, and scientific formulas.
Use rates, ratios and percents to model and solve real-life problems.
Solve linear equations.</td></tr>
<tr><td>Modifications for Special Education Students, ELLs and Gifted Students:

Special Needs – Students with IEPs will be placed in classes with additional instructional support, and the material will be delivered in a co-teaching model. Students with 504s will receive the support those documents dictate.

ELL – Language support, as needed. Utilization of experience and information, as applicable. Opportunities for students to write or communicate in their native language, as availability of translation allows. Depending on the level of acquisition, opportunities to write instead of speaking; and opportunities to practice speaking.</td><td>Suggested Timeline:
Variables & Expressions, Order of Operations, Properties of Numbers, Distributive Property: 1 week

Equations, Relations, Functions, Interpreting Graphs of Functions: 1-2 weeks</td></tr>
</table>

Gifted Learners – Deeper investigations of content; lead roles during collaborative group assignments. **Mainstream Learners –** Formative assessments to gauge understanding and learning; participation in lesson examples.	

Audubon Public Schools
Engaging Students ~ Fostering Achievement ~ Cultivating 21st Century Global Skills
Written By: Ron Latham, Kim Weikel, Nicole Szymanski, Patti Myers-Griffith
Course Title: Algebra I Unit Name: Linear Functions Grade Level: 8-10

Content Statements and Rationale: In this unit, students will review the connection between the constant rate of change of a linear function, slope of the line that is the linear function's graph, and the point-slope form for the equation of a line. The unit also introduces students to the idea that graphs of linear functions can be thought of as transformations on the graphs of other linear functions.	**NJSLS:** F.IF.6-7 F.BF.3 F.LE.1-2,5 S.ID.7
Overarching Essential Questions: How does the concept of slope relate to rate of change?	**Overarching Enduring Understandings:** The unit focuses on the constant rate of change of a linear function. Students continue to demonstrate a

How can we interpret the meaning of slope in situations using data, symbolic representations, or graphs? How can we relate direct variation to linear functions to solve problems involving proportional change?	deeper understanding of functions by writing linear functions to model relationships between two quantities, and compare properties of linear functions.
Unit Essential Questions: How can we determine whether an equation is a linear equation? How can we analyze a graph of a linear function to determine domain, range, and end behavior? How do we use the *x* and *y* intercepts to graph a linear equation? How do you find the slope of a line? How does slope relate to the rate of change? How can we identify the rate of change of a table or graph? How do we find the constant of variation of an equation? What is direct variation? How can we determine whether a sequence is an arithmetic sequence? How do you find the next few terms of an arithmetic sequence? How do you write an equation for a proportional relationship? Non-proportional?	**Unit Enduring Understandings:** An equation is linear if the Properties of Equality can be applied to rewrite it in standard form. Rate of change is a ratio that describes how one quantity changes with respect to a change in another quantity. The slope of a line is the ratio of the vertical change in the line to the horizontal change in the line. If the ratio of two variables is a constant, then direct variation is the way of expressing the relationship between the two variables. Any term of an arithmetic sequence can be found by adding the common difference to the preceding term.
Benchmarks: End of Lesson Assessments- ConnectED (Online Textbook) Ch 3 Practice Assessment- Pg 207 in textbook	**Unit Student Learning Overview:** Students will be able to identify mathematical domains and ranges, and determine values for given situations, both continuous and discrete.

Ch 3 Standardized Test Practice- Pg 210-211 in textbook	Students will also be able to use functions to model and make predictions involving direct variation.

Key Terms (Essential Vocabulary):

domain – first set of numbers in ordered pairs of a relation
range – second set of numbers in ordered pairs of a relation
end behavior – describes the values of a function at the positive and negative extremes in the domain
rational number - can be written as a fraction
inverse variation – represented by the equation: $y = k/x$
linear equation - two variable equation whose graph is a straight line
parallel lines - have same slope; are everywhere equidistant and never intersect
slope - rise over run; steepness of a line
solution of a system of equations - x and y value that makes all equations in the system true
system of linear equations - two or more linear equations
standard form – $Ax + By = C$
constant – a number
x-intercept – point at which a graph of an equation crosses the x-axis
y-intercept – point at which a graph of an equation crosses the y-axis
linear function – function for which the graph is a line
parent function – simplest linear function
family of graphs – group of graphs with one or more similar characteristics
root – solution of an equation
rate of change – ratio which describes how much one quantity changes with respect to another quantity
direct variation – relationship where as one quantity increases, the other also increases involving a constant rate of change
constant of variation – the k in $y = kx$; constant rate of change in a direct variation relationship
arithmetic sequence – set of numbers where the difference between successive terms is constant
slope-intercept form – $y = mx + b$ where m is slope and b is y-intercept
linear extrapolation – use linear equation to make predictions about data beyond given values
point-slope form – $y – y1 = m(x – x1)$ where (x1, y1) is a point on the line and m is the slope
parallel lines – lines in the same plane that do not intersect
perpendicular lines – lines that intersect at right angles

scatterplot – graph of ordered pairs that shows relationship between two variables
line of fit – trend line
line of best fit – more precise line of fit
linear interpolation – use a linear equation to predict values inside the range of data
linear regression – algorithm that finds line of best fit
correlation coefficient – number that tells how closely an equation models the data
median fit line – found by using the means of all of the coordinates of the data points
inverse relation – set of ordered pairs found by exchanging the x & y coordinates of each ordered pair in a relation
inverse function – can generate ordered pairs of the inverse relation
inequality – open sentence containing $<$, $>$, $\leq$ or $\geq$
set-builder notation – $\{ x | x > 20 \}$
compound inequality – two inequalities with "and" or with "or" create a compound inequality
intersection – where the graph of two inequalities overlap
union – graph of two inequalities with "or"
boundary – divides plane into two half-planes
half-plane – created by a boundary line
closed plane – half plane and the boundary line are solutions
open half-plane – half plane but NOT the boundary line are solutions
system of equations – two or more equations
consistent – when a system of equations has at least one solution
independent – when a system of equations has exactly one solution
dependent – when a system of equations has an infinite number of solutions
inconsistent – when a system of equations has no solution
substitution – one method for solving systems of equations
elimination – one method for solving systems of equations
system of inequalities – 2 or more inequalities

Resources:
Glencoe Algebra 1 2012; Scientific Calculator, Graphing Calculator, kuta.com, brightstorm.com, khanacademy.com

Suggested Activities for Inclusion in Lesson Planning
Interdisciplinary Connections are identified with and I, followed by the related content area(s):
Analyze the key features of linear graphs.
Estimate solutions to an equation by graphing.
Change the viewing window so that a complete graph of a linear function can be displayed.
Investigate the steepness of a line using concrete models.
Use rate of change to solve problems.
Write and graph direct variation equations.
Relate arithmetic sequences to linear functions.
Investigate inductive and deductive reasoning.
Write equations for proportional and non-proportional relationships.
Simplify algebraic fractions and rational expressions.
Multiply algebraic fractions and rational expressions.
Divide algebraic fractions and rational expressions.
Write mixed expressions as fractions in simplest form.
Divide polynomials.
Create or find examples of rational and irrational numbers.
Evaluate radical expressions.
Use radical expressions to solve quadratic equations.
Solve radical equations.
Perform operations on radical expressions.
Solve rational equations.
Perform operations on rational expressions.

Modifications for Special Education Students, ELLs and Gifted Students:	**Suggested Timeline:**
Special Needs – Students with IEPs will be placed in classes with additional instructional support, and the material will be delivered in a co-teaching model. Students with 504s will receive the support those documents dictate.	Graphing Linear Equations, Solving Linear Equations by Graphing, Rate of Change & Slope: **3 weeks** Direction Variation, Arithmetic Sequences as Linear Functions, and Proportional and Non-Proportional Relationships: **2 weeks**

ELL – Language support, as needed. Utilization of experience and information, as applicable. Opportunities for students to write or communicate in their native language, as availability of translation allows. Depending on the level of acquisition, opportunities to write instead of speaking; and opportunities to practice speaking. **Gifted Learners –** Deeper investigations of content; lead roles during collaborative group assignments. **Mainstream Learners –** Formative assessments to gauge understanding and learning; participation in lesson examples.	

Audubon Public Schools
Engaging Students ~ Fostering Achievement ~ Cultivating 21st Century Global Skills
Written By: Ron Latham, Kim Weikel, Nicole Szymanski, Patti Myers-Griffith
Course Title: Algebra I Unit Name: Linear Equations & Inequalities Grade Level: 8-10

Content Statements and Rationale: In this unit, students will understand the connection between equations and functions, and explore how different representations of a function lead to techniques to solve linear equations. This unit will also provide students with the ability to create and graph equations in two variables.	**NJSLS:** A.CED.1, 3-4 A.REI.1, 3, 11-12
Overarching Essential Questions: How many solutions does a linear equation with 2 variables have? How do you graph the solutions of a linear equation in 2 variables? What is a system of linear equations and how do you solve it? What does it mean when the system does not have a single solution? What is slope and how is it related to solutions of a system of linear equations? How do you solve and graph a linear inequality with one or two variables? How do you solve and graph compound inequalities and inequalities containing absolute value?	**Overarching Enduring Understandings:** This unit focuses on single linear equations and inequalities. Students are able to use tables, graphs, concrete models, and algebraic operations to understand relationships of the equations and inequalities.
Unit Essential Questions: What is the slope of the line? What are x & y intercepts and how do you find them? What is slope-intercept form?	**Unit Enduring Understandings:** Linear Equations in two variables have infinitely many solutions, which can be graphed on the coordinate plane.

What is point-slope form? How can you write an equation in slope-intercept form, given two coordinate pairs? How can you write an equation in slope-intercept form given a coordinate pair and an equation? How do you use an equation written in standard slope-intercept form to graph the equation? How can you recognize parallel or perpendicular lines without graphing them? How do you solve and graph linear inequalities with one or two variables? How do you solve and graph inequalities involving absolute value?	Slope-intercept form ($y = mx + b$) can be used to graph equations, given a slope and y-intercept. Linear equations can have zero, one, or two solutions. Linear inequalities have many solutions; these need to be shown on a graph Absolute value inequalities create combined inequalities
Benchmarks: End of Lesson Assessments- ConnectED (Online Textbook) Ch 4 Practice Assessment- Pg 277 in textbook Ch 4 Standardized Test Practice- Pg 280-281 in textbook Ch 5 Practice Assessment- Pg 327 Ch 5 Standardized Test Practice- Pg 330-331 in textbook	**Unit Student Learning Overview:** Students will be able to use functions to model and make predictions, use algebraic methods to solve equations and inequalities, and use the necessary algebraic skills required to solve equations and inequalities in problem situations.
Key Terms (Essential Vocabulary): linear equation - two variable equation whose graph is a straight line slope - rise over run; steepness of a line standard form – Ax + By = C constant – a number x-intercept – point at which a graph of an equation crosses the x-axis y-intercept – point at which a graph of an equation crosses the y-axis linear function – function for which the graph is a line	

parent function – simplest linear function
family of graphs – group of graphs with one or more similar characteristics
root – solution of an equation
rate of change – ratio which describes how much one quantity changes with respect to another quantity
direct variation – relationship where as one quantity increases, the other also increases involving a constant rate of change
constant of variation – the k in y = kx; constant rate of change in a direct variation relationship
arithmetic sequence – set of numbers where the difference between successive terms is constant
slope-intercept form – y = mx + b where m is slope and b is y-intercept
linear extrapolation – use linear equation to make predictions about data beyond given values
point-slope form – $y - y1 = m(x - x1)$ where (x1, y1) is a point on the line and m is the slope
parallel lines – lines in the same plane that do not intersect
perpendicular lines – lines that intersect at right angles
scatterplot – graph of ordered pairs that shows relationship between two variables
line of fit – trend line
line of best fit – more precise line of fit
linear interpolation – use a linear equation to predict values inside the range of data
linear regression – algorithm that finds line of best fit
correlation coefficient – number that tells how closely an equation models the data
median fit line – found by using the means of all of the coordinates of the data points
inverse relation – set of ordered pairs found by exchanging the x & y coordinates of each ordered pair in a relation
inverse function – can generate ordered pairs of the inverse relation
inequality – open sentence containing $<$, $>$, $\leq$ or $\geq$
set-builder notation – $\{ x| x > 20 \}$
compound inequality – two inequalities with "and" or with "or" create a compound inequality
intersection – where the graph of two inequalities overlap
union – graph of two inequalities with "or"
boundary – divides plane into two half-planes
half-plane – created by a boundary line
closed plane – half plane and the boundary line are solutions
open half-plane – half plane but NOT the boundary line are solutions

Resources:
Glencoe Algebra 1 2012; Scientific Calculator, Graphing Calculator,kuta.com, brightstorm.com, khanacademy.com

Suggested Activities for Inclusion in Lesson Planning
Interdisciplinary Connections are identified with and I, followed by the related content area(s):
Use the graphing calculator to graph a linear equation, then manipulate the slope to observe the change in graph.
Have students create and describe real-world applications of slope.
Use a tape measure to measure foot sizes of students. Collect data, create a table, make a scatter plot and draw a line best fit for the data. Then write an equation for the line of fit.
Have students create and describe real-world applications of inverse functions.
Draw an inverse of a relation to determine whether the inverse is a function, without using a calculator.
Use algebra tiles to model solving inequalities.
Use a calculator to model graphing inequalities; manipulate the windows, change the inequality, and have the students describe their observations.

Modifications for Special Education Students, ELLs and Gifted Students:

Special Needs – Students with IEPs will be placed in classes with additional instructional support, and the material will be delivered in a co-teaching model. Students with 504s will receive the support those documents dictate.

ELL – Language support, as needed. Utilization of experience and information, as applicable. Opportunities for students to write or communicate in their native language, as availability of translation allows. Depending on the level of acquisition, opportunities to write

Suggested Timeline:
Graphing and Writing Equations in Slope-Intercept Form and Point-Slope Form: **2 weeks**

Parallel/Perpendicular Lines: **1 week**

Scatter Plots, Lines of Fit, Regression, Inverse Linear Functions: **1 week**

Solving Inequalities, Multi-Step Inequalities: **1 week**

Solving Compound Inequalities, Absolute Value Inequalities: **1 week**

instead of speaking; and opportunities to practice speaking. **Gifted Learners –** Deeper investigations of content; lead roles during collaborative group assignments. **Mainstream Learners –** Formative assessments to gauge understanding and learning; participation in lesson examples.	Graphing: **1 week**

Audubon Public Schools
Engaging Students ~ Fostering Achievement ~ Cultivating 21st Century Global Skills
Written By: Ron Latham, Kim Weikel, Nicole Szymanski, Patti Myers-Griffith

Course Title: Algebra I **Unit Name: Systems of Linear Equations & Inequalities** **Grade Level: 8-10**

Content Statements and Rationale: In this unit, students will continue the study of systems of linear equations that began in their previous mathematics course. This unit will also provide students with the ability to create and and solve systems of linear inequalities.	**NJSLS:** A.CED.3 A.REI.5-6, 12
Overarching Essential Questions: How many solutions does a linear equation with 2 variables have?	**Overarching Enduring Understandings:** This unit focuses on analyzing situations and formulates systems of linear equations in two unknowns to solve problems. This unit also

What is a system of linear equations and how do you solve it? What does it mean when the system does not have a single solution? How do you solve and graph a linear inequality with one or two variables? What is a system of linear inequalities and how do you solve and graph it?	involves solving systems of equations and inequalities using graphs and algebraic models.
Unit Essential Questions: What does it mean if two lines intersect? How does the substitution method for solving systems of equations provide solutions to the system? What is the elimination method for solving systems of equations? What method would be most appropriate to solve the system of equations? Is the solution to a system of equations reasonable? Does the system have one, no or infinitely many solutions? How can you recognize parallel or perpendicular lines without graphing them? How do you solve and graph linear inequalities with one or two variables? How do you solve a system of inequalities with two variables?	**Unit Enduring Understandings:** Linear Equations in two variables have infinitely many solutions, which can be graphed on the coordinate plane. Systems of linear equations can be solved by substitution, elimination, and other methods. Linear equations can have zero, one, or two solutions. Linear inequalities have many solutions; these need to be shown on a graph
Benchmarks: End of Lesson Assessments- ConnectED (Online Textbook) Ch 6 Practice Assessment- Pg 383 in textbook Ch 6 Standardized Test Practice- Pg 386-387 in textbook	**Unit Student Learning Overview:** Students will be able to analyze and formula systems of equations in two or more unknowns, or inequalities in two unknowns to solve problems. Students will also be able to interpret and determine the reasonableness of solutions to

	systems of equations or inequalities for given contexts.

Key Terms (Essential Vocabulary):

linear equation - two variable equation whose graph is a straight line
parallel lines - have same slope; are everywhere equidistant and never intersect
slope - rise over run; steepness of a line
solution of a system of equations - x and y value that makes all equations in the system true
system of linear equations - two or more linear equations
x-intercept – point at which a graph of an equation crosses the x-axis
y-intercept – point at which a graph of an equation crosses the y-axis
linear function – function for which the graph is a line
family of graphs – group of graphs with one or more similar characteristics
slope-intercept form – $y = mx + b$ where m is slope and b is y-intercept
linear extrapolation – use linear equation to make predictions about data beyond given values
parallel lines – lines in the same plane that do not intersect
perpendicular lines – lines that intersect at right angles
inequality – open sentence containing $<$, $>$, $\leq$ or $\geq$
intersection – where the graph of two inequalities overlap
union – graph of two inequalities with "or"
boundary – divides plane into two half-planes
half-plane – created by a boundary line
closed plane – half plane and the boundary line are solutions
open half-plane – half plane but NOT the boundary line are solutions
system of equations – two or more equations
consistent – when a system of equations has at least one solution
independent – when a system of equations has exactly one solution
dependent – when a system of equations has an infinite number of solutions
inconsistent – when a system of equations has no solution
substitution – one method for solving systems of equations
elimination – one method for solving systems of equations
system of inequalities – 2 or more inequalities

Resources: Glencoe Algebra 1 2012; Scientific Calculator, Graphing Calculator, kuta.com, brightstorm.com, khanacademy.com
Suggested Activities for Inclusion in Lesson Planning **Interdisciplinary Connections are identified with and I, followed by the related content area(s):** Write a word problem involving a system of linear equations for a partner to solve. Graph multiple equations on extra large graph paper and discuss results. Explain how the graphical intersection of 2 lines relates to the algebraic solution of all systems. Use substitution, elimination and graphing to solve a system of equations. Decide which method is the most appropriate for a given problem. Conclude whether a system has one, no or many solutions. Find slope given 2 points and write a linear equation using slope and points.

Modifications for Special Education Students, ELLs and Gifted Students:	**Suggested Timeline:**
Special Needs – Students with IEPs will be placed in classes with additional instructional support, and the material will be delivered in a co-teaching model. Students with 504s will receive the support those documents dictate. **ELL –** Language support, as needed. Utilization of experience and information, as applicable. Opportunities for students to write or communicate in their native language, as availability of translation allows. Depending on the level of acquisition, opportunities to write instead of speaking; and opportunities to practice speaking.	Graphing Method, Substitution Method, and Elimination Method for solving systems of equations: **2 weeks** Applying Systems of Equations: **1 week** Systems of Inequalities: **1 week**

Gifted Learners – Deeper investigations of content; lead roles during collaborative group assignments. **Mainstream Learners –** Formative assessments to gauge understanding and learning; participation in lesson examples.	

Audubon Public Schools
Engaging Students ~ Fostering Achievement ~ Cultivating 21st Century Global Skills
Written By: Ron Latham, Kim Weikel, Nicole Szymanski, Patti Myers-Griffith
Course Title: Algebra I Unit Name: Exponential Functions & Equations Grade Level: 8-10

Content Statements and Rationale: In this unit, students will explore different situations that can be modeled with exponential functions and equations.	**NJSLS:** A.SSE.3 F.IF.7 F.LE.1,2,3 S.ID.6
Overarching Essential Questions: What are the laws of exponents and how do you use them to simplify expressions? How do you graph and analyze an exponential function? How do you analyze data and represent situations involving exponential growth and decay? How do you relate geometric sequences to exponential functions?	**Overarching Enduring Understandings:** The unit continues to reinforce the work with creating and representing equations and connects with the structure of exponential expressions. The unit also deepens students' understanding of functions and their notation.

Unit Essential Questions:	**Unit Enduring Understandings:**
How do you simplify a monomial function? How do you simplify an expression with negative exponents? What is scientific notation and how is it used? How do you graph exponential functions? How are exponential functions used in real life? How can the GCF for a set of monomials and integers be found? How can an exponential expression be simplified? How can the properties of exponents be extended to rational exponents? How are the laws of exponents applied in solving real-world problems? How can you use the recursive formula to list the terms in a sequence?	An exponential function can simplified using the laws of exponents. The Power Property of Equality and properties of exponents can be used to solve exponential equations. By graphing exponential functions, we can identify data that is displayed by exponential behavior.
Benchmarks: End of Lesson Assessments- ConnectED (Online Textbook) Ch 7 Practice Assessment- Pg 455 in textbook Ch 7 Standardized Test Practice- Pg 458-459 in textbook	**Unit Student Learning Overview:** Students will be able to understand mathematical models as they compare exponential to linear functions. The students will also be able to write exponential functions to model relationships between two quantities, and compare the properties of exponential functions.
Key Terms (Essential Vocabulary): Binomial - polynomial with exactly two terms Monomial - variable or number or both separated only by multiplication Polynomial - one or more monomials separated by addition or subtraction Constant – number Degree of a monomial –sum of exponents of all its variables Degree of a polynomial – greatest degree of any term in the polynomial	

Standard form of a polynomial – written with terms in order of degree from greatest to least
Leading coefficient – coefficient of first term in a polynomial
Zero product property – if the product of 2 factors equals zero, then at least one of those factors has to equal zero.
Square root property – to solve x^2 = n, take the square root of both sides
Term - a piece of a polynomial
Trinomial - polynomial with exactly three terms
base - big number next to an exponent - it is the number being multiplied
exponent - little number next to a regular number - means repeated multiplication
power - base and exponent together form a power
zero exponent – non-zero number raised to the zero power; it always equals 1
negative exponent – non-zero real number raised to a negative power;
order of magnitude – number rounded to the nearest power of 10
rational exponent – positive real number (y) raised to the (a/b) power where a and b are > 1; it equals b root (y) to the a power
cube root – if a^3 = b then a is the cube root of b
nth root – if a^n = b then a is the nth root of b
exponential equation – variables occur as exponents
scientific notation – number in the form a x 10^n where a is between 1 and 10 and n is an integer
exponential function – function of the form y = ab^x, where a does not equal 0 and b > 0 and b does not equal 1
exponential growth – function of the form y = ab^x, where a > 0 and b > 1
exponential decay – function of the form y = ab^x, where a > 0 and 0 < b < 1
compound interest – interest earned or paid on both the initial investment and previously earned interest
geometric sequence – sequence where first term is not 0 and each subsequent term is found by multiplying previous terms by constant r (common ratio)
common ratio – constant used to find next term(s) in a geometric sequence
recursive formula – allows you to find the nth term of a sequence by performing operations to 1 or more of the preceding terms

Resources:

Glencoe Algebra 1 2012; Scientific Calculator, Graphing Calculator, kuta.com, brightstorm.com, khanacademy.com

Suggested Activities for Inclusion in Lesson Planning
Interdisciplinary Connections are identified with and I, followed by the related content area(s):
Formulate solutions to real-world exponential problems.
Apply the rules of exponents and distributive property to multiply polynomials.
Simplify expressions with exponents.
Add and subtract polynomials.
Draw a series of pictures to represent addition or subtraction problems then have a partner write the variable expression and then solve the problem.
Graph exponential equations on Big paper with a partner; discuss results as a class to make connections with graphs and solutions.
Graph a set of three similar exponential equations on a calculator and describe the graphs. Make connections to the exponential functions in relations to the graphs.

Modifications for Special Education Students, ELLs and Gifted Students:

Special Needs – Students with IEPs will be placed in classes with additional instructional support, and the material will be delivered in a co-teaching model. Students with 504s will receive the support those documents dictate.

ELL – Language support, as needed. Utilization of experience and information, as applicable. Opportunities for students to write or communicate in their native language, as availability of translation allows. Depending on the level of acquisition, opportunities to write instead of speaking; and opportunities to practice speaking.

Suggested Timeline:
Properties of Exponents and Rational Exponents: **1 week**

Scientific Notation, Exponential Functions, Graphing: **1 week**

Growth/Decay, Geometric Sequences as Exponential Functions, and Recursive Formulas: **1-2 weeks**

Gifted Learners – Deeper investigations of content; lead roles during collaborative group assignments. **Mainstream Learners –** Formative assessments to gauge understanding and learning; participation in lesson examples.	

Audubon Public Schools
Engaging Students ~ Fostering Achievement ~ Cultivating 21st Century Global Skills
Written By: Ron Latham, Kim Weikel, Nicole Szymanski, Patti Myers-Griffith
Course Title: Algebra I Unit Name: Polynomials Expressions and Functions Grade Level: 8-10

Content Statements and Rationale: In this unit, students will learn how to perform arithmetic operations on quadratic and cubic polynomials using concrete models and analytic techniques. They will also learn how to factor quadratic trinomials and cubic polynomials.	**NJSLS:** A.SSE.1-3 A.APR.1,3
Overarching Essential Questions: What are polynomials and how do you factor them? What is a greatest common factor and how do you find it? How do you perform operations on polynomials? How do you solve a polynomial equation?	**Overarching Enduring Understandings:** The unit focuses on factoring polynomials as it is necessary in problem solving situations. Factoring is essential to solving quadratic equations. Working with polynomials is an essential algebra skill.
Unit Essential Questions: How do you perform operations on polynomials? How can general quadratic trinomials be factored? How can factoring help us to solve equations?	**Unit Enduring Understandings:** When adding and subtracting polynomials, you can only combine like terms.

How can factoring quadratic equations solve problems? What is prime factorization? What does GCF mean? How can equations involving the addition and subtraction of polynomials be simplified and solved? How do you graph quadratic functions? How do you solve quadratic equations? How do you graph exponential functions? How can the GCF for a set of monomials and integers be found? What is the quadratic formula and how is it used to solve quadratic equations?	When multiplying polynomials, you will use the FOIL method and simplify. A quadratic function can be factored by breaking it down into two binomials in parentheses, or by removing the greatest common factor. To solve quadratic equations, you will factor the quadratic and set the equation equal to zero.
Benchmarks: End of Lesson Assessments- ConnectED (Online Textbook) Ch 8 Practice Assessment- Pg 535 in textbook Ch 8 Standardized Test Practice- Pg 538-539 in textbook	**Unit Student Learning Overview:** Students will be able to use factoring to simplify expressions and transform and solve equations. Students will also be able to analyze situations involving quadratic functions and formulate quadratic equations to solve problems.
Key Terms (Essential Vocabulary): Binomial - polynomial with exactly two terms Factor - process by which a polynomial is broken down into a product of smaller polynomials GCF - greatest common factor which is the largest term that can be divided out of all parts of a polynomial Monomial - variable or number or both separated only by multiplication Polynomial - one or more monomials separated by addition or subtraction Constant – number Degree of a monomial –sum of exponents of all its variables Degree of a polynomial – greatest degree of any term in the polynomial Standard form of a polynomial – written with terms in order of degree from greatest to least Leading coefficient – coefficient of first term in a polynomial FOIL method – method for multiplying two binomials (First, Outside, Inside, Last)	

Quadratic expression – expression in one variable with degree of 2
Factoring – reversing the FOIL process and writing a polynomial as the product of two or more factors
Zero product property – if the product of 2 factors equals zero, then at least one of those factors has to equal zero.
Quadratic equation – $ax^2 + bx + c = 0$, where a does not equal 0
Prime polynomial – polynomial that can not be factored
Square root property – to solve $x^2 = n$, take the square root of both sides
Term - a piece of a polynomial
Trinomial - polynomial with exactly three terms
root (y) to the a power
cube root – if $a^3 = b$ then a is the cube root of b
nth root – if $a^n = b$ then a is the nth root of b
quadratic function – non-linear functions $f(x) = ax^2 + bx + c$, where a does not equal 0
parabola – shape of the graph of a quadratic function
axis of symmetry – central line that cuts a parabola in half
vertex – point where a parabola changes direction
minimum – lowest point on a graph
maximum – highest point on a graph
discriminant – expression under the radical in the quadratic equation: $b^2 – 4ac$; this determines the number of solutions
double root – when two roots are the same
transformation – changes the position or size of a figure
quadratic formula – used to solve quadratic equations without factoring; $x = -b \pm \sqrt{b^2 – 4ac}/2a$

Resources:
Glencoe Algebra 1 2012; Scientific Calculator, Graphing Calculator, kuta.com, brightstorm.com, khanacademy.com

Suggested Activities for Inclusion in Lesson Planning
Interdisciplinary Connections are identified with and I, followed by the related content area(s):
Solving quadratic equations involving area and perimeter.
Solve quadratic expressions.
Apply the a/c rule.
Formulate solutions to real world quadratic problems.
Factor polynomials completely.
Use GCF and prime factorization.
Solve open-ended questions dealing with factoring and quadratics.
Factor trinomials.
Factor using the difference of two squares.
Factor perfect square trinomials.
Manipulate standard formulas (area, Perimeter, distance etc) to be solved for different variables. See how this can make solving word problems easier.
Apply operations with polynomials to find area and perimeter.
Apply the rules of exponents and distributive property to multiply polynomials.
Add and subtract polynomials.
Draw a series of pictures to represent addition or subtraction problems then have a partner write the variable expression and then solve the problem.
Multiply a polynomial by a monomial.
Multiply polynomials.
Solve uniform motion problems.
Have students write their own D = RT problem and pass to a partner to solve.
Transform formulas.
Recognizing problems that do not have solutions.

Modifications for Special Education Students, ELLs and Gifted Students:	**Suggested Timeline:**
Special Needs – Students with IEPs will be placed in classes with additional instructional support, and the material will be delivered in a co-teaching	Arithmetic operations with Monomials and Polynomials: **1-2 weeks** Special Products and Using the Distributive Property: **1 week**

model. Students with 504s will receive the support those documents dictate. **ELL –** Language support, as needed. Utilization of experience and information, as applicable. Opportunities for students to write or communicate in their native language, as availability of translation allows. Depending on the level of acquisition, opportunities to write instead of speaking; and opportunities to practice speaking. **Gifted Learners –** Deeper investigations of content; lead roles during collaborative group assignments. **Mainstream Learners –** Formative assessments to gauge understanding and learning; participation in lesson examples.	Solving Trinomials using factoring methods: **1-2 weeks** Differences of Squares and Perfect Squares: **1-2 weeks**

Audubon Public Schools
Engaging Students ~ Fostering Achievement ~ Cultivating 21st Century Global Skills
Written By: Ron Latham, Kim Weikel, Nicole Szymanski, Patti Myers-Griffith
Course Title: Algebra I Unit Name: Quadratic Functions and Equations Grade Level: 8-10

Content Statements and Rationale:	**NJSLS:**
In this unit, students will learn how to solve quadratic equations by graphing, factoring, and completing the square, and understand how the	N.RN.3 A.REI.4 A.SSE.3

solution methods are connected to the roots of the equations, *x* intercepts of a graph, and zeros of a function. They will also focus on building quadratic functions that model real-world situations.	F.IF.4, 7-8 S.ID.6
Overarching Essential Questions: How do you identify and graph the general forms of quadratic parent functions? How do you solve quadratic equations using concrete models, tables, graphs, and algebraic methods? How do you identify and graph special functions?	**Overarching Enduring Understandings:** The unit focuses on quadratic equations in one variable that arise from quadratic functions. Factoring is essential to solving quadratic equations. Working with quadratic functions and equations are essential algebra skills.
Unit Essential Questions: How do you use the standard form of a quadratic function to identify if the graph opens up or down? What is the vertex of a quadratic function? What is the axis of symmetry of a quadratic function? How do you find the vertex and axis of symmetry of a graph quadratic function? How do you determine the solutions of a quadratic function, given the graph of the function? What are the types of transformations of a quadratic function? How do you determine the transformations? How do you solve quadratic equations by completing the square? How do you solve quadratic equations using the quadratic formula?	**Unit Enduring Understandings:** A quadratic function can be graphed by identifying the vertex, axis of symmetry, and whether the parabola opens upward or downward. The solutions to a quadratic equation are called roots. Translations, vertical stretches/shrinks, and reflections are types of transformations of quadratic functions. You can use complete the square and the quadratic formula as methods for solving quadratic equations: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Benchmarks:	**Unit Student Learning Overview:**
End of Lesson Assessments- ConnectED (Online Textbook) Ch 9 Practice Assessment- Pg 611 in textbook Ch 9 Standardized Test Practice- Pg 614-615 in textbook	Students will be able relate representations of quadratic functions, such as algebraic, graphical, and verbal descriptions. Students will also be able to determine a quadratic function from its roots or a graph.

Key Terms (Essential Vocabulary):

Leading coefficient – coefficient of first term in a polynomial
Quadratic expression – expression in one variable with degree of 2
Factoring – reversing the FOIL process and writing a polynomial as the product of two or more factors
Zero product property – if the product of 2 factors equals zero, then at least one of those factors has to equal zero.
Quadratic equation – ax^2 + bx + c = 0, where a does not equal 0
Trinomial - polynomial with exactly three terms
quadratic function – non-linear functions f(x) = ax^2 + bx + c, where a does not equal 0
parabola – shape of the graph of a quadratic function
axis of symmetry – central line that cuts a parabola in half
vertex – point where a parabola changes direction
minimum – lowest point on a graph
maximum – highest point on a graph
discriminant – expression under the radical in the quadratic equation: b^2 – 4ac; this determines the number of solutions
double root – when two roots are the same
transformation – changes the position or size of a figure (translation, vertical stretches/shrinks, reflections)
completing the square – method for solving, by taking the square root of each side of a quadratic equation

quadratic formula – used to solve quadratic equations without factoring; $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Resources: Glencoe Algebra 1 2012; Scientific Calculator, Graphing Calculator, kuta.com, brightstorm.com, khanacademy.com
Suggested Activities for Inclusion in Lesson Planning **Interdisciplinary Connections are identified with and I, followed by the related content area(s):** Solve quadratic equations by graphing. Graph quadratic equations on Big paper with a partner; discuss results as a class to make connections with graphs and solutions. Solve quadratic equations using quadratic formula. Have students graph a quadratic function and another student analyze the graph. Have students create quadratic functions and another student graph the function. Use graphing calculators to analyze quadratic function characteristics. Create a table of data, which would be plotted to create a quadratic function. Have students make inferences of the outcome.

Modifications for Special Education Students, ELLs and Gifted Students:	**Suggested Timeline:**
Special Needs – Students with IEPs will be placed in classes with additional instructional support, and the material will be delivered in a co-teaching model. Students with 504s will receive the support those documents dictate. **ELL –** Language support, as needed. Utilization of experience and information, as applicable. Opportunities for students to write or communicate in their native language, as availability of translation allows. Depending on the level of acquisition, opportunities to write	Graphing Quadratic Functions and Solving Quadratic Equations by Graphing: **1 week** Transformations: **1 week** Solving Quadratic Equations by Completing the Square and the Quadratic Formula: **1 week**

instead of speaking; and opportunities to practice speaking. **Gifted Learners –** Deeper investigations of content; lead roles during collaborative group assignments. **Mainstream Learners –** Formative assessments to gauge understanding and learning; participation in lesson examples.	

Audubon Public Schools
Engaging Students ~ Fostering Achievement ~ Cultivating 21st Century Global Skills
Written By: Ron Latham, Kim Weikel, Nicole Szymanski, Patti Myers-Griffith
Course Title: Algebra I Unit Name: Statistical Models Grade Level: 8-10

Content Statements and Rationale: In this unit, students will interpret linear models of categorical and quantitative data. They will also summarize, represent, and interpret data on a single count or measurement variable.	**NJSLS :** S.ID.1-3 S.ID.5-9
Overarching Essential Questions: How can we identify various sampling techniques and recognize a biased sample? How do we use the Fundamental Counting Principle/ to determine count outcomes?	**Overarching Enduring Understandings:** The unit focuses on count outcomes using the Fundamental Counting Principle. The unit also focuses on the use of combinations and permutations to determine probabilities.

What is the probability of two independent events? Dependent events? Two mutually exclusive or inclusive events? How is probability used in real-world situations?	
Unit Essential Questions: What is the total number of possible outcomes? What is the probability of an event? What is the difference between dependent and independent events? What is distribution of data? How many license plates can be formed under certain restrictions? What is the difference between a combination and a permutation and how do you find them? How can you decide if a sample is biased or unbiased? How can a histogram show the distribution of data? How do you find the mean, median, mode, range and standard deviation of a group of data? What is the difference between simple and compound events?	**Unit Enduring Understandings:** Using probability can determine how many outcomes in given situations, and figure out the chances of an event occurring. Distribution of data shows the frequency of each possible data value. We use random variables to compute probability, and use probability distributions to solve real-world problems.
Benchmarks: End of Lesson Assessments- ConnectED (Online Textbook) Ch 12 Practice Assessment- Pg 817 in textbook Ch 12 Standardized Test Practice- Pg 820-821 in textbook	**Unit Student Learning Overview:** Students will be able to use probability concepts to make informed decisions in real-life situations.
Key Terms (Essential Vocabulary): Population – all the members of a group of interest Sample – small group or subset sometimes used to represent a population Bias – error that results in misinterpretation of data Observational study – members of a group are measured or observed without being affected by the study	

Experiment – sample split into 2 groups and effect of experimental group is compared to the control group
Statistic – measure that describes a characteristic of a sample
Parameter – measure that describes a characteristic of a population
Standard deviation – calculation that shows how the data deviate from the mean
Distribution – shows the observed or theoretical frequency of each possible data value
Symmetric distribution – data is distributed evenly
Theoretical probability – ratio of number of favorable outcomes compared to total number of possible outcomes
Experimental probability – determined from results of an experiment
Simulation – model used to take the place of a complicated experiment
Permutation – arrangement where order is important
Combination – arrangement where order is NOT important
Compound event – made up of 2 or more simple events
Independent event – outcome of one event does NOT affect the outcome of another event
Dependent event – outcome of one event Does affect the outcome of another event
Mutually exclusive – events that can NOT occur at the same time
Random variable – variable with a value that is the numerical outcome of a random event
Probability distribution – probability of every possible value of the random variable
Expected value – E(x) weighted average of the variable

Resources:
Glencoe Algebra 1 2012; Scientific Calculator, Graphing Calculator, kuta.com, brightstorm.com, khanacademy.com

Suggested Activities for Inclusion in Lesson Planning
Interdisciplinary Connections are identified with and I, followed by the related content area(s):
Perform experiments with coins and spinners.
Determine simple probability.
Determine compound probability.
Perform experiments with names or marbles in a bag without replacement.
Determine combinations and permutations.
Possible outcomes and sample space of events.
Use the counting principle to determine outcomes.

<table>
<tr><td colspan="2">Estimate probability and make predictions.
Play and analyze probability based games.
Play both addition game and multiplication game with a partner and 1 game die; determine whether the games are “fair” or what can be changed to make the games “fair.”
Open ended practice with probability related problems.
Perform the handshake problem.
In small groups or as a class, determine how many total handshakes take place if everyone shakes hands with everyone else one time; Discuss results and connect it to the formula for combinations.</td></tr>
<tr><td>Modifications for Special Education Students, ELLs and Gifted Students:

Special Needs – Students with IEPs will be placed in classes with additional instructional support, and the material will be delivered in a co-teaching model. Students with 504s will receive the support those documents dictate.

ELL – Language support, as needed. Utilization of experience and information, as applicable. Opportunities for students to write or communicate in their native language, as availability of translation allows. Depending on the level of acquisition, opportunities to write instead of speaking; and opportunities to practice speaking.

Gifted Learners – Deeper investigations of content; lead roles during collaborative group assignments.</td><td>Suggested Timeline:
Samples, Statistics & Parameters, and Distributions of Data: 1 week

Comparing Sets of Data, Simulations, Permutations and Combinations: 1 week

Probability of Compound Events, and Probability Distribution: 1 week</td></tr>
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Mainstream Learners – Formative assessments to gauge understanding and learning; participation in lesson examples.	