Algebra 1 Syllabus

School Year: 2017-2018

Certificated Teacher:

Desired Results

Course Title*):* Algebra 1A and 1B

Credit: ____ one semester (.5) __X__ two semesters (1.0)

Prerequisites and/or recommended preparation*:*
Successful completion of 8th Grade Level Math or Pre-Algebra

Estimate of hours per week engaged in learning activities:
5 hours of class work per week per 18 week semester

Instructional Materials:

All learning activity resources and folders are contained within the student online course. Online course is accessed via login and password assigned by student's school (web account) or emailed directly to student upon enrollment, with the login website.
This course requires a MathXL for School account which will be provided by your course instructor.
Optional – Graphing Calculator (Approximately $50-$100). Many online graphing calculators can do what is required of this course and are free.

Course Description:
Algebra will weave together a variety of concepts, procedures and processes in mathematics. Students will develop the ability to explore and solve mathematical problems, think critically, work cooperatively with others and communicate their ideas clearly as they work through these mathematical concepts and algebraic procedures. Topics for this course include a study of linear, quadratic and exponential functions as well as statistics. The Algebra End of Course (EOC) assessment given during the spring in this class is a graduation requirement. Use of the graphing calculator is an integral part of this course.

Enduring Understandings for Course (Performance Objectives):

- Symbols, such as numbers and variables, can be manipulated using different processes and operations to represent real-life quantities and their relationships.
- Equations are dynamic tools for problem solving, communicating and expressing ideas and concepts.
- Functions are used to represent the relationship between unknown quantities.
- Graphs are visual representations of functions/numerical relationships.
- Logical reasoning and Problem Solving enable us to approach a problem, explain reasoning and check answers in order to move from simple ideas to complex ones.

Course Learning Goals (Common Core Standards, National Standards):
Algebra 1 Unit 1: Representing Relationships Mathematically (Linear Relationships and Inequalities)

Target 1A: Communicating Reasoning (SMP 3, 6)

- Construct a viable argument to justify a solution method (A-REI-A1)
- Use units as a way to understand problems and guide the solution of problems (NQ-A1)
- Choose and interpret units consistently in formulas (NQ-A1)
- Interpret the scale and origin in graphs (NQ-A1)
- Interpret solutions as viable or non-viable options in modeling context (A-CED-A3)
- Compare properties of two functions each represented in a different way (F-IF-C9)

Target 1B: Modeling (SMP 4)

- Create linear equations and inequalities in one variable and use them to solve problems (A-CED-A1)
- Determine an explicit expression, a recursive process, or steps for calculation from a context (F-BF-A1a)
- Define appropriate quantities for the purpose of descriptive modeling (NQ-A2)
- Create equations in 2 or more variables to represent relationships (A-CED-A2)
- Represent constraints by equations and inequalities (A-CED A3)

Target 1C: Equation Solving

- Explain each step in solving a simple equation (as following from equality of numbers from the previous step) (A-REI-A1)
- Solve linear equations and inequalities in one variable (A-REI-B3)
- Solve equations and inequalities with coefficients represented by letters (literal equations) (A-REI-B3)

Target 1D: Equations & Graph

- Graph equations and inequalities on coordinate axes with labels and scales (A-CED-A2)
- Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane (A-REI-D10)
- Choose the scale and origin in graphs (NQ-A1)
- Relate the domain of a function to its graph (F-IF-B5)
- Understand the relationship between function notation and ordered pairs using a graph or a table. (A-REI-A11)

Algebra 1 Unit 2: Introduction to Functions/Linear Functions ***Learning Targets***

Target 2A: Reasoning and Modeling (SMP 2, 4)

- For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities (F-IF.B.4)
- Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes (F-IF.B.5)
- Interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph (F.IF.B.6)
- Interpret the parameters in a linear or exponential function in terms of a context (F-LE.B.5)
- Interpret statements that use function notation in terms of a context (F-IF.A.2)

Target 2B: Functions and Notation

- Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers (F-IF.A.3)
- 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 (F-IF.A.1)
- Identify the effect on the graph of replacing $f(x)$ by $f(x)+k$, $kf(x)$, $f(kx)$, and $f(x+k)$ for specific values of k (both positive and negative); find the value of k given the graphs (F-BF.B.3)
- Use function notation and evaluate functions for inputs in their domains (F-IF.A.2)
- Sketch graphs showing key features (intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity) given a verbal description of the relationship (F-IF.B.4)

Target 2C: Linear Functions

- Construct linear functions, including arithmetic sequences, given a graph, a description of a relationship, or two input - output pairs (include reading these from a table) (F-LE.A.2)
- Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data (S-ID.C.7)
- Recognize situations in which one quantity changes at a constant rate per unit interval relative to another (F-LE.A.1b)
- Calculate and interpret the average rate of change of a function (presented symbolically or as a table) and estimate the rate of change from a graph (F-IF.B.6)
- Graph linear functions and show intercepts (F-IF.C.7a)
- Prove that linear functions grow by equal differences over equal intervals (F-LE.A.1a)

Algebra 1 Unit 3: Statistical Models ***Learning Targets***

Target 3A: Modeling To Make Arguments (SMP 3, 4, 6)

- Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range) of two or more different data sets. (S-ID.A.2)
- Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear models. (S-ID.B.6.a)
- Distinguish between correlation and causation. (S-ID.C.9)
- Recognize possible associations and trends in bivariate categorical data. (S-ID.B.5)
- 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.1)
- Define appropriate quantities for the purpose of descriptive modeling. (N-Q.A.2)
- Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (N-Q.A.3)

Target 3B: Univariate Data

- Represent data with plots on the real number line (dot plots, histograms, and box plots) (S-ID.A.1)
- Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers) (S-ID.A.3)

Target 3C: Bivariate Data

- Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. (S-ID.B.6)
- Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. (S-ID.C.7)
- Fit a linear function for a scatter plot that suggests a linear association. (S-ID.B.6.c)
- Compute (using technology) and interpret the correlation coefficient of a linear fit. (S-ID.C.8)
- 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). (S-ID.B.5)

Algebra 1 Unit 4: Systems of Equations ***Learning Targets***

Target 4A: Reason Abstractly and Quantitatively (SMP 2)

- Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of other produces a system with the same solutions. (A-REI.C.5)
- 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 g(x) are linear. (REI.11)

Target 4B: Modeling (SMP 4)

- Represent constraints by (equations and inequalities) and by systems of equation and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods. (A-CED.A.3)
- Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales(A-CED.A2)

Target 4C: Solve Systems of Equations and Inequalities Algebraically

- Solve systems of linear equation exactly, focusing on pairs of linear equations in two variables. (A-REI.C.6)

Target 4D: Solve Systems of Equations and Inequalities Graphically

- Graph (the solutions to a linear inequality in two variables as a half plane (excluding the boundary in the case of 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-REI.D.12)
- Solve systems of linear equation approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. (A-REI.C.6)

Algebra 1 Unit 5: Non-Linear Relationships ***Targets***

Target 5A: Modeling with Mathematics (SMP4)

- Create Equations in two or more variable to represent relationships between two or more quantities. **(A-CED.A.2)**

Target 5B: Understanding Non-Linear Functions (Square Root, Cube Root, Step, Absolute Value, Piecewise)

- Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. **(F-IF.A.2)**
- Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★
    - b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. **(F-IF.C.7.b)**
- 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 to 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. ★ **(A-REI.D.11)**

Target 5C: Understanding Rational Exponents

- Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define* $5^{1/3}$ *to be the cube root of 5 because we want* $(5^{1/3})^3 = 5^{(1/3)3}$ *to hold, so* $(5^{1/3})^3$ *must equal 5.* **(N-RN.A.1)**
- Rewrite expressions involving radicals and rational exponents using the properties of exponents. **(N-RN.A.2)**

Note: Properties of exponents is a middle school standard; however, we understand that students may need a review of these properties for mastery of the above standards.

Algebra 1 Unit 6: Exponential Functions ***Learning Targets***

Target 6A: Modeling with Exponential Growth and Decay

- Construct and compare linear, quadratic, and exponential models and solve problems. Distinguish between situations that can be modeled with linear functions and with exponential functions. Prove that exponential functions grow by equal factors over equal intervals. **(F-LE.A.1.a)**
- Interpret expressions for functions in terms of the situation they model. Interpret the parameters in a exponential function in terms of a context. **(F-LE.B.5)**
- Interpret parts of an expression, such as terms, factors, and coefficients. **(A-SSE.A.1.a)**
- For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities. **(F-IF.B.4)**
- Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. **(F-LE.A.1.c)**

Target 6B: Geometric Sequences and Exponential Equations

- Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context **(F-IF.A.2)**
- Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). **(F-IF.C.9)**
- Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context. **(F-BF.A.1.a)**
- Construct exponential expressions, including geometric sequences, given a graph, a description of a relationship, or two input-output pairs (including reading these from a table). **(F-LE.2)**

Target 6D: Graphs of Exponential Functions

- For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities **(F-IF.B.4)**
- Relate the domain of a function to its graph, and, when applicable, to the quantitative relationship it describes. **(F-IF.B.5)**
- 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.* **(F-BF.B.3)**
- Graph exponential functions, showing intercepts and end behavior. **(F-IF.C.7.e)**
- 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.* **(F-IF.C.9)**

Algebra 1 Unit 7: Polynomials and Quadratic Functions ***Learning Targets***

Target 7A: Modeling (SMP 4)

- 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-APR.A.1)
- Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. (F-IF.A.2)
- For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior. (F-IF.B.4)
- 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. (F-IF.B.5)
- Determine an explicit expression, a recursive process, or steps for calculation from a context. (F-BF.A.1.a)
- Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. (S-ID.B.6)

Target 7B: Look for and Make Use of Structure (SMP 7)

- Interpret parts of an expression, such as terms, factors, and coefficients. (A-SSE.A.1.a)
- Interpret complicated expressions by viewing one or more of their parts as a single entity. (A-SSE.A.1.b)
- 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 $(x^2 - y^2)(x^2 + y^2)$. (A-SSE.A.2)
- Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. (A-SSE.B.3.a)

- Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. (A-SSE.B.3.b)
- 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-APR.A.1)
- 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.4.a)
- Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. (F-IF-C.8.a)

Evidence of Assessment

Performance Tasks:

• The students will work through a web based math program (MathXL) to master the unit targets based on CCSS-M.
• Once the work is complete in MathXL, the students will assess their knowledge on unit quizzes and end of unit assessment.

Other Evidence (self-assessments, observations, work samples, quizzes, tests and so on):

• Quizzes/Assessments in MathXL
• Unit assessments based on CCSS-M

Types of Learning Activities

Indicate from the table below all applicable learning strategies that may be used in the course.

Direct Instruction	Indirect Instruction	Experiential Learning	Independent Study	Interactive Instruction
____Structured Overview ____Mini presentation ____Drill & Practice ____Demonstrations _X___Other (List) -Pronto Discussions -Virtual Classroom -Online Videos	____Problem-based ___Case Studies ____Inquiry ____Reflective Practice ____Project ____Paper ____Concept Mapping ____Other (List)	____ Virt. Field Trip ____Experiments __X__Simulations ____Games ____Field Observ. ___Role-playing ____Model Bldg. ____Surveys ____Other (List)	____Essays __X_Self-paced computer ____Journals ____Learning Logs ____Reports ____Directed Study ____Research Projects __X__Other (List) -Target based practice -Interactive Web Based Practice	__X__Discussion ____Debates ___Role Playing ____Panels ____Peer Partner Learning ____Project team ____Laboratory Groups ____Think, Pair, Share ____Cooperative Learning ____Tutorial Groups ____Interviewing ____Conferencing ____Other (List)

Other:

Learning Activities

These learning activities are aligned with the successful completion of the course learning goals and progress towards these learning activities will be reported monthly on a progress report.

1st Semester Algebra I Learning Activities

Unit 1 Linear Relationships and Inequalities

In this unit, students solidify their previous work with functional relationships as they begin to formalize the concept of a mathematical function.

Students have written and solved linear equations and inequalities in their previous mathematics courses. The work of this unit should be on bringing students to mastery of this area of their mathematical study.

This unit leverages the connection between equations and functions and explores how different representations of a function lead to techniques to solve linear equations, including tables, graphs, concrete models, algebraic operations, and "undoing" (reasoning backwards).

This unit provides opportunities for students to continue to practice their ability to create and graph equations in two variables.

Unit 2 Linear Functions

This unit solidifies students' understanding of linear functions. It reviews the connection between the constant rate of change of a linear function, the slope of the line that is the linear function's graph, and the slope-intercept form for the equation of a line, $y = mx + b$ before introducing the x-intercept, the standard form for the equation of a line, and the point-slope form for the equation of a line.

This 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, setting the stage for the broader study of transformations of functions that continues in this and subsequent mathematics courses.

This unit continues to reinforce the work with creating and representing equations with connecting the structure of expressions to contexts.

This unit also deepens students' understanding of functions and their notation**.** Students will investigate key features, domains, and ranges of linear functions; write linear functions to model relationships between two quantities and compare properties of linear functions.

Unit 3 Statistical Models

This unit reviews the univariate data representations students studied previously and then introduces statistical models for bivariate categorical and quantitative data. Students have already addressed in previous units many of the standards in this unit, and they should now be able to apply their understandings from that previous work in the new work with the statistics standards in this unit. This unit provides opportunities to reinforce students' work from the previous unit with representing linear functions symbolically and graphically.

2nd Semester Algebra I Learning Activities

Unit 4 Systems of Linear Equations and Inequalities

In this unit students continue the study of systems of linear equations that they began in Grade 8. This unit should solidify their understanding of that prior work, and extend that understanding to creating and solving systems of linear inequalities. This unit provides opportunities for students to continue creating and graphing equations in two variables. They also extend their understanding of estimating solutions to equations graphically to estimating solutions of systems of equations.

Unit 5 Relationships that are Non Linear

In this unit students explore examples of nonlinear functions that exhibit some linear characteristics as they work with absolute value and step functions. Students also connect rational exponents to roots, and investigate square root and cube root functions as other special instances of nonlinear functions. This unit again provides opportunities for students to create and graph equations in two or more variables and use and interpret function notation.

Unit 6 Exponential Functions and Equations

This unit explores different situations that can be modeled with exponential functions and equations. Students use tables and graphs to contrast the repeated multiplication of exponential patterns with the repeated addition of linear patterns. This unit continues to reinforce the work with creating and representing equations with connecting the structure of expressions to contexts. This unit also deepens students' understanding of functions and their notation**.** Students will investigate key features, domains, and ranges of exponential functions; write exponential functions to model relationships between two quantities; use technology to explore simple transformations of exponential; and compare properties of exponential functions.

Unit 7 Quadratics

In this unit students learn how to multiply, add, and subtract quadratic and cubic polynomials using concrete models and analytic techniques. They also learn how to factor quadratic trinomials and cubic polynomials using concrete models and analytic techniques. The second part of this unit builds on students' previous exposure to quadratic functions, focusing on how to build quadratic functions that model real-world situations. Students learn how to use the method of completing the square to transform quadratic function rules to understand the behavior of the function.