DISTRICT OF COLUMBIA
PUBLIC SCHOOLS

SY14-15 Algebra I Math Scope and Sequence

Year-at-a-Glance

Instructional Window 1
- Unit 1.1: Functions

Instructional Window 2
- Unit 2.1: Solving, Graphing and Creating Linear Equations

Instructional Window 3
- Unit 3.1: Solving, Graphing and Creating Linear Inequalities
- Unit 3.2: Systems of Linear Equations and Inequalities

Instructional Window 4
- Unit 4.1: Quadratics

Instructional Window
- Unit 5.1: Exponential Functions and Review
- Unit 5.2: Interpreting Categorical and Quantitative Data

Fluency and/or Culminating Standards

- **A/G** Students become fluent in solving characteristic problems involving the analytic geometry of lines, such as writing down the equation of a line given a point and a slope.
- **A-APR.1** Fluency in adding, subtracting, and multiplying polynomials supports students throughout their work in algebra, as well as in their symbolic work with functions.
- **A-SSE.1b** Fluency in transforming expressions and chunking (seeing parts of an expression as a single object) is essential in factoring and other mindful algebraic calculations.

STANDARDS FOR MATHEMATICAL PRACTICE:
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Algebra I Overview

THE REAL NUMBER SYSTEM (N-RN)
- ○ Use properties of rational and irrational numbers

QUANTITIES (N-Q)
- □ Reason quantitatively and use units to solve problems

SEEING STRUCTURE IN EXPRESSIONS (A-SSE)
- ■ Interpret the structure of expressions
- □ Write expression in equivalent forms to solve problems

ARITHMETIC WITH POLYNOMIALS AND RATIONAL EXPRESSIONS (A-APR)
- ■ Perform arithmetic operations on polynomials
- □ Understand the relationship between zeros and factors of polynomials

CREATING EQUATIONS (A-CED)
- ■ Create equations that describe numbers or relationships

REASONING WITH EQUATIONS AND INEQUALITIES (A-REI)
- ■ Understand solving equations as a process of reasoning and explain the reasoning
- ■ Solve equations and inequalities in one variable
- ○ Solve systems of equations
- ■ Represent and solve equations and inequalities graphically

INTERPRETING FUNCTIONS (F-IF)
- ■ Understand the concept of a function and use function notation
- ■ Interpret functions that arise in applications in terms of the context
- □ Analyze functions using different representations

BUILDING FUNCTIONS (F-BF)
- □ Build a function that models a relationship between two quantities
- ○ Build new functions from existing functions

LINEAR, QUADRATIC, AND EXPONENTIAL MODELS (F-LE)
- □ Construct and compare linear, quadratic and exponential models and solve problems
- □ Interpret expressions for functions in terms of the situation they model

INTERPRETING CATEGORICAL AND QUANTITATIVE DATA (S-ID)
- □ Summarize, represent and interpret data on two categorical and quantitative variables

KEY: ■ Major Clusters | □ Supporting Clusters | ○ Additional Clusters

First Instructional Window	Instructional Units	Common Core State Standards for Mathematical Content
August 25 – October 9 **Suggested Unit Assessment Window: September 29 – October 7**	**1.1 Functions**	**Understand the concept of a function and use function notation (Major Cluster Standards)** **F.IF.1** Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f*(*x*) denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation y = f(x). **F.IF.2** Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. **F.IF.3** Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n + 1) = f(n) + f(n -1) for n ≥ 1.* **Interpret functions that arise in applications in terms of the context (Major Cluster Standards)** **F.IF.4** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries and end behavior.* ★ **F.IF.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.* ★ **F.IF.6** Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. ★ **Build a function that models a relationship between two quantities** **F.BF.1** Write a function that describes a relationship between two quantities. ★ **A.** Determine an explicit expression, a recursive process, or steps for calculation from a context. **Build new functions from existing functions** **F.BF.3** Identify the effect on the graph of replacing *f*(*x*) by *f*(*x*) + *k*, *k f*(*x*), *f*(*kx*), and *f*(*x* + *k*) for specific values of *k* (both positive and negative); find the value of *k* given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*

		Reason quantitatively and use units to solve problems **N.Q.1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. **N.Q.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
Second Instructional Window	**Instructional Units**	**Standards**
October 14 – December 12 **Suggested Unit Assessment Window: November 19 – December 2**	**2.1 Solving, graphing, and creating linear equations**	**Interpret the structure of expressions (Major Cluster Standards)** **A.SSE.1** Interpret expressions that represent a quantity in terms of its context. ★ **A.** Interpret parts of an expression, such as terms, factors, and coefficients. **B.** Interpret complicated expressions by viewing one or more of their parts as a single entity. For example, interpret P(1+r)n as the product of P and a factor not depending on P. **Understand solving equations as a process of reasoning and explain the reasoning (Major Cluster Standards)** **A.REI.1** Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. **Solve equations in one variable (Major Cluster Standards)** **A.REI.3** Solve linear equations in one variable, including equations with coefficients represented by letters. **Create equations that describe numbers or relationships (Major Cluster Standards)** **A.CED.1** Create equations in one variable and use them to solve problems. *Include equations arising from linear functions. (Equations only in this window, no inequalities!)* **A.CED.2** Graph equations on coordinate axes with labels and scales **A.CED.4** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law V =IR to highlight resistance R. **Analyze functions using different representations** **F.IF.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. ★ **A.** Graph linear and show intercepts, maxima, and minima. **Construct and compare linear, quadratic, and exponential models and solve problems**

		F.LE.2 Construct linear functions, including arithmetic sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). **Interpret expressions for functions in terms of the situation they model** **F.LE.5** Interpret the parameters in a linear function in terms of a context.
Third Instructional Window	**Instructional Units**	**Standards**
December 15 – February 12 **Suggested Unit Assessment Window: February 2 – February 10**	**3.1 Solving, graphing, and creating linear inequalities**	**Create equations that describe numbers or relationships (Major Cluster Standards)** **A.CED.1** Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear functions.* **Solve inequalities in one variable (Major Cluster Standards)** **A.REI.3** Solve linear inequalities in one variable, including equations with coefficients represented by letters. **Represent and solve equations and inequalities graphically (Major Cluster Standards)** **A.REI.12** Graph the solutions to a linear inequality in two variables as a half plane (excluding the boundary in the case of a strict inequality). **Reason quantitatively and use units to solve problems** **N.Q.2** Define appropriate quantities for the purpose of descriptive modeling.
	3.2 Systems of linear equations & inequalities	**Solve systems of equations** **A.REI.5** Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. **A.REI.6** Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. **Represent and solve equations and inequalities graphically (Major Cluster Standards)** **A.REI.12** Graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. **Create equations that describe numbers or relationships (Major Cluster Standards)**

		A.CED.3 Represent constraints 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.*
Fourth Instructional Window	**Instructional Units**	**Standards**
February 17 - April 10 **Suggested Unit Assessment Window (Optional) March 30 – April 2**	**4.1 Quadratics**	**Interpret the structure of expressions (Major Cluster Standards)** **A.SSE.2** Use the structure of a quadratic expression to identify ways to rewrite it. **Write expressions in equivalent forms to solve problems** **A.SSE.3** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. ★ **A.** Factor a quadratic expression to reveal the zeros of the function it defines. **Perform arithmetic operations on polynomials** **A.APR.1** Add, subtract, and multiply quadratic polynomials. **Understand the relationship between zeros and factors of polynomials** **A.APR.3** Identify zeroes of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function described by the polynomial. (Quadratics only!) **Create equations that describe numbers or relationships (Major Cluster Standards)** **A.CED.1** Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from quadratic functions.* **Solve equations and inequalities in one variable (Major Cluster Standards)** **A.REI.4** Solve quadratic equations in one variable. **A.** Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x-p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. **B.** Solve quadratic equations by inspection (e.g., for $x^2 = 49$) and factoring. **Analyze functions using different representations** **F.IF.8** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. **A.** Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

Fifth Instructional Window	Instructional Units	Standards
April 20 – June 17 **Suggested Unit Assessment Window: May 4 – June 12**	**5.1 Exponential functions & review**	**Use properties of rational and irrational numbers** **N.RN.3** Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational. **Write expressions in equivalent forms to solve problems** **A.SSE.3** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. **C.** Use the properties of exponents to transform expressions for exponential functions. *For example the expression* 1.15^t *can be rewritten as* $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ *to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.* **Create equations that describe numbers or relationships (Major Cluster Standards)** **A.CED.1** Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from exponential functions.* **Represent and solve equations and inequalities graphically (Major Cluster Standards)** **A.REI.10** Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). **A.REI.11** Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values. Include cases where $f(x)$ and/or $g(x)$ are linear, quadratic, rational, absolute value, and exponential functions. ★ **Analyze functions using different representations** **F.IF.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.* **Construct and compare linear, quadratic, and exponential models and solve problems** **F.LE.1** Distinguish between situations that can be modeled with linear functions and with exponential functions. **B.** Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. **C.** Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

		F.LE.2 Construct exponential functions, including geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). **F.LE.3** Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly. **Interpret expressions for functions in terms of the situation they model** **F.LE.5** Interpret the parameters in an exponential function in terms of a context.
	5.2 Interpreting Categorical and Quantitative Data	**Summarize, represent, and interpret data on a single count or measurement variable** **S.ID.1** Represent data with plots on the real number line (dot plots, histograms, and box plots). **S.ID.2** Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more data sets **Summarize, represent, and interpret data on two categorical and quantitative variables** **S.ID.5.** Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

★ Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by the star symbol (★)