**Blackhawk School District**

**CURRICULUM**

**Course Title: Algebra I A**

**Grade Level(s): 8**

**Length of Course: Year**

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**COURSE DESCRIPTION:**

Algebra I A is the beginning course of the two part Algebra sequence. Algebra is a foundational course in the academic mathematics sequence. The intent of this course is to continue to deepen students’ understanding of the real number system and for students to master all of the techniques of algebra at the highest level, including the language of algebra, its properties, and methods of solving equations. Students will also master graphing and solving linear functions. An emphasis will be placed on applications and problem solving. Since this course is part one of a two year Algebra sequence, there will not be a Keystone Exam given at the end of this course.

**Common Core State Standards for Mathematics**

*Research studies of mathematics education have determined that mathematics curriculum must be more focused and coherent. The Common Core State Standards for Mathematics define what students should understand and be able to do in their study of math. The following Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important ‘Processes and proficiencies” with longstanding importance in mathematics education.*

1. **Make sense of problems and persevere in solving them.**

*Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.*

1. **Reason abstractly and quantitatively.**

*Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize – to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents – and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.*

1. **Construct viable arguments and critique the reasoning of others.**

*Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about date, making plausible arguments that take into account the context from which the date arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and – if there is a flaw in an argument – explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.*

1. **Model with mathematics.**

*Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or us a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.*

1. **Use appropriate tools strategically.**

*Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.*

1. **Attend to precision.**

*Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.*

1. **Look for and make use of structure.**

*Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Late, students will see 7 x 8 equals the well-remembered 7 x 5 + 7 x 3, in preparation for learning about the distributive property. In the expression x² + 9x + 14, older students can see the 14 as 2 x 7 and the 9 as 2 +7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see 5 – 3(x – y)² as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.*

1. **Look for and express regularity in repeated reasoning.**

*Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation (y – 2)/(x – 1) = 3. Noticing the regularity in the way terms cancel when expanding (x – 1) (x +1), (x – 1) (x³+ x² + x +1) might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process while attending to the details. They continually evaluate the reasonableness of their intermediate results.*

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| **Unit Breakdown** | **Objectives** | **Common Core Standards** | **PSSA Standards: 8th grade and Algebra 1** |
| **Connections to Algebra** | * Write and evaluate expressions, equations, and inequalities. * Apply the order of operations. * Use a problem-solving plan to solve real-world problems. * Represent functions as rules and as tables. * Graph functions given a rule or table of values. | CC.2.2.8.B.1 | * M08.B-F.1.1.1 * M08.B-F.1.1.2 * A1.1.1.3 |
| **Properties of Real Numbers** | * Classify real numbers. * Compare and order integers and rational numbers. * Perform basic operations. * Find and simplify square roots. * Apply properties to evaluate and simplify expressions. * Use the distributive property to write equivalent expressions. * Determine whether a number is rational or irrational. For rational numbers, show that the decimal expansion terminates or repeats (limit repeating decimals to thousandths). * Convert a terminating or repeating decimal into a rational number (limit repeating decimals to thousandths). * Estimate the value of irrational numbers without a calculator (limit whole number radicand to less than 144). Example: √5 is between 2 and 3 but closer to 2. * Use rational approximations of irrational numbers to compare and order irrational numbers. * Locate/identify rational and irrational numbers at their approximate locations on a number line. | * CC.2.1.8.E.1 * CC.2.1.8.E.4 | * M08.A-N.1.1.1 * M.08.A-N.1.1.2 * M08.A-N.1.1.3 * M08.A-N.1.1.4 * M08.A-N.1.1.5 * A1.1.1.1 * A1.1.1.1.2 |
| **Statistics and Probability** | * Calculate probabilities and odds of simple events. * Calculate probabilities of compound events, identifying whether events are mutually exclusive or overlapping, or whether they are dependent or independent. * Compare measures of central tendency and measures of dispersion. * Analyze and display data. | * CC.2.4.HS.B.5 * CC.2.4.HS.B.3 * CC.2.4.HS.B.4 * CC.2.4.HS.B.7 | * A1.2.3.2 * A1.2.3.1 * A1.2.3.3 |
| **Solving Linear Equations** | * Solve formula and literal equations for a given variable. * Rewriting equations into different forms. * Write and identify linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form x = a, a = a, or a = b results (where a and b are different numbers). * Solve linear equations that have rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms. * Solving equations with absolute values, cubes and square roots. * Apply formulas for the volumes of cones, cylinders, and spheres to solve real-world and mathematical problems. Formulas will be provided. * Apply the converse of the Pythagorean Theorem to show a triangle is a right triangle. * Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. (Figures provided for problems in three dimensions will be consistent with Eligible Content in grade 8 and below.) * Apply the Pythagorean Theorem to find the distance between two points in a coordinate system. * Use square root and cube root symbols to represent solutions to equations of the form *x*2 = *p* and *x*3 = *p*, where *p* is a positive rational number. Evaluate square roots of perfect squares (up to and including 122) and cube roots of perfect cubes (up to and including 53) without a calculator. | * CC.2.2.8.B.1 * CC.2.2.8.B.3 * CC.2.2.8.C.2 * CC.2.3.8.A.1 * CC.2.3.8.A.3 | * M08.B-E.3.1.1 * M08.B-E.3.1.2 * M08.C-G.3.1.1 * M08.C-G.2.1.1 * M08.C-G.2.1.2 * M08.C-G.2.1.3 * M08.B-E.1.1.2 * A1.1.2.1 * G.2.3.1 * G.2.3.1 |
| **Graphing & Writing Linear Equations & Functions** | * Plot points in a coordinate plane. * Use tables, *x*- and *y*-intercepts, and the slope and *y*-intercept to graph linear equations and functions. * Interpret slope as a rate of change in real-world situations and explore how changing the slope and *y*-intercept changes the graph. * Use slope to identify parallel lines. * Rewrite equations in function form. * Write and graph direct variation equations and use them to solve real-world problems. * Compare families of graphs. * Determine whether a relation is a function. * Compare properties of two functions each represented in a different way (i.e., algebraically, graphically, numerically in tables, or by verbal descriptions). Interpret the equation y = mx + b as defining a linear function whose graph is a straight line; give examples of functions that are not linear. * Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (*x*, *y*) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models and in terms of its graph or a table of values. * 2 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch or determine a graph that exhibits the qualitative features of a function that has been described verbally. * Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways * Use similar right triangles to show and explain why the slope *m* is the same between any two distinct points on a non-vertical line in the coordinate plane. | * CC.2.2.8.B2 * CC.2.2.8.C.1 * CC.2.2.8.C.2 | * M08.B-F.1.1.1 * M08.B-F.1.1.2 * M08.B-F.1.1.3 * M08.B-F.2.1.1 * M08.B-F.2.1. * M08.B-E.2.1.1 * M08.B-E.2.1.2 * A1.2.1.2 * A1.1.2.1 * A1.2.1.1 * A1.2.2.1 |
| **Writing Equations** | * Write equations of lines in slope-intercept form given: the slope and *y* -intercept; the slope and a point; or two points. * Write and graph equations using the slope and a point, using a graph of the line, or using real-world data. * Write equations of lines in standard form, and use these equations to solve real-world problems. * Write and find equations of lines parallel or perpendicular to a given line. * Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative correlation, linear association, and nonlinear association. * Derive the equation *y* = *mx* for a line through the origin and the equation *y* = *mx* + *b* for a line intercepting the vertical axis at *b*. * For scatter plots that suggest a linear association, identify a line of best fit by judging the closeness of the data points to the line. * Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. * Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible associations between the two variables. | * CC.2.2.8.B.2 * CC.2.2.8.C.1 * CC.2.2.8.C.2 * CC.2.4.8.B.1 * CC.2.4.8.B.2 * CC.2.4.HS.B.2 | * M08.D-S.1.1.1 * M08.D-S.1.1.2 * M08.D-S.1.1.3 * M08.D-S.1.2.1 * M08.B-E.2.1.3 * A1.1.2.1 * A1.2.1.1 * A1.2.2.1 * A1.2.2.2 * A2.2.3.1 |
| **Systems of Equations** | * Use graphing, substitution, and elimination to solve systems of linear equations. * When solving by the elimination method, either add or subtract, or multiply first and then add or subtract. * Identify linear systems as having one solution, no solution, or infinitely many solutions. * Interpret solutions to a system of two linear equations in two variables as points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. * Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. Solve real-world and mathematical problems leading to two linear equations in two variables. | * CC.2.2.8.B.3 | * M08.B-E.3.1.3 * M08.B-E.3.1.4 * M08.B-E.3.1.5 * A1.1.2.2 |
| **Transformations** | * Identify and apply properties of rotations, reflections, and translations. Example: Angle measures are preserved in rotations, reflections, and translations. * Given two congruent figures, describe a sequence of transformations that exhibits the congruence between them. * Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures, using coordinates. * Given two similar two-dimensional figures, describe a sequence of transformations that exhibits the similarity between them. | * CC.2.3.8.A.2 | * M08.C-G.1.1.1 * M08.C-G.1.1.2 * M08.C-G.1.1.3 * M08.C-G.1.1.4 |
| **Exponents & Exponential Functions** | * Apply one or more properties of integer exponents to generate equivalent numerical expressions without a calculator (with final answers expressed in exponential form with positive exponents). * Estimate very large or very small quantities by using numbers expressed in the form of a single digit times an integer power of 10, and express how many times larger or smaller one number is than another. * Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Express answers in scientific notation and choose units of appropriate size for measurements of very large or very small quantities. Interpret scientific notation that has been generated by technology | * CC.2.2.8.B.1 | * M08.B-E.1.1.1 * M08.B-E.1.1.2 * M08.B-E.1.1.3 * M08.B-E.1.1.4 |