Blackhawk School District

CURRICULUM

Course Title: Math 4
Grade Level(s): Fourth
Length of Course: Year
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COURSE DESCRIPTION: Students who achieve these mathematical anchors will be able to communicate mathematically in the real world. The students will demonstrate an understanding of numbers, ways of representing numbers relationships among numbers and number systems. They will learn to apply appropriate techniques, tools and formulas to determine measurements. Students will analyze and understand the characteristics and properties of two- and three- dimensional geometric shapes. Students will also learn to formulate, organize, display, interpret or analyze data and also apply the basic concepts of probability or outcomes.

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.

2. **Reason abstractly and quantitatively.**

   Mathematically proficient students make sense of quantities and their relationships in problem situations. They bringtwo 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.

3. **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.

4. **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.

5. **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.

6. **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.

7. **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 $x^2 + 9x + 14$, 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.

8. **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 $(x – 1)(x +1)$, $(x – 1)(x^3 + x^2 + x +1)$ 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.

Unit Breakdown	Objectives	Common Core Standards	PSSA Standards
Operations and Algebraic Thinking	**Use the four operations with whole numbers to solve problems:** • Interpret a multiplication equation as a comparison. (ex: Interpret 35=5×7 as a statement that 35 is 5 times as many 7 and 7 times as many as 5). • Multiply or divide to solve word problems (ex: by using drawings and equations with a symbol for the unknown number). • Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which a remainder must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. **Gain familiarity with factors and multiples:** • Find all factor pairs for a whole number in the range of 1-100. Recognize that a whole number is a multiple of each of its factors. Determine if a number is prime or composite. **Generate and analyze patterns:** • Generate a number or shape pattern that follows a given rule and be able to explain how to continue the pattern. Identify apparent features of the pattern that were not explicit in the rule (ex: input/output).	• CC.4.OA.1 • CC.4.OA.2 • CC.4.OA.3 • CC.4.OA.4 • CC.4.OA.5	• M4.D.2.1 • M4.A.3.1 • M4.A.1.3 • M4.D.1.1 • M4.D.1.2
Number and Operations in Base Ten	**Generalize place value understanding for multi-digit whole numbers:** • Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right (ex: recognize that 700÷70=10 by applying concepts of place value and division) • Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers using >, =, and < symbols. • Use place value understanding to round multi-digit whole numbers to any place.	• CC.4.NBT.1 • CC.4.NBT.2 • CC.4.NBT.3 • CC.4.NBT.4 • CC.4.NBT.5 • CC.4.NBT.6	• M4.A.1.1 • M4.A.1.2 • M4.A.1.3 • M4.A.3.1 • M4.A.1.2 • M4.A.3.1

	Use place value understanding and properties of operations to perform multi-digit arithmetic: • Fluently add and subtract multi-digit whole numbers. • Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. • Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.		
Number and Operations – Fractions	**Extend understanding of fraction equivalence and ordering:** • Explain why a fraction a/b is equivalent to a fraction (n×a)/(n×b) by using visual fraction models. • Compare two fraction with different numerators and different denominators using >, =, or < and justify the conclusions. **Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers:** • Understand a fraction a/b with a>1 as a sum of fractions 1/b. a. Understand addition and subtraction of fractions. b. Decompose a fraction into a sum of fractions with the same denominator in more than one way as an equation. (ex: 3/8= 1/8 + 1/8 + 1/8 and 3/8 = 1/8 + 2/8). c. Add and subtract mixed numbers with like denominators by replacing the mixed numbers with improper fractions. d. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators. • Apply and extend previous understanding of multiplication to multiply a fraction by a whole number. a. Understand a fraction a/b as a multiple of 1/b (ex: represent 5/4 as 5 × 1/4 b. Understand a multiple of a/b as a multiple of 1/b, and use this understanding to multiply a fraction by a whole number (ex: 3 × (2/5) is equal to 6 × (1/5). c. Solve word problems involving multiplication of a fraction by a whole number.	• CC.4.NF.1 • CC.4.NF.2 • CC.4.NF.3 • CC.4.NF.4 • CC.4.NF.5 • CC.4.NF.6 • CC.4.NF.7	• M4.A.1.2 • M4.A.3.2 • M4.A.1.1 • M4.A.1.2 • M4.A.2.1 • M4.A.3.2

	Understand decimal notation for fractions, and compare decimal fractions: • Express a fraction with denominator of 10 to be equivalent to a fraction with a denominator of 100, and then add the two fractions (ex: express 3/10 as 30/100, and add 3/10 + 4/100 = 34/100) • Use decimal notation for fractions with denominators 10 or 100 (ex: rewrite 0.62 as 62/100 and identify it on a number line). • Compare two decimals to hundredths with the same whole number using the symbols >, =, <. Justify conclusions by using a visual model.		
Measurement and Data	**Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit:** • Know relative sizes of measurement units within one system of units including km, m, cm, kg, g, lb, oz, l, ml, hr, min, sec. Within a single system of measurement express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. (ex: know that 1 ft. is 12 times as long as 1 in. Express the length of a 4 ft. snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1,12), (2,24), (3, 36), … • Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale. • Apply the area and perimeter formulas for rectangles in real world and mathematical problems. **Represent and interpret data:** • Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Solve problems involving addition and subtraction of fractions by using information presented in line plots. **Geometric measurement: understand concepts of angle and measure angles:** • Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement. a. An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the	• CC.4.MD.1 • CC.4.MD.2 • CC.4.MD.3 • CC.4.MD.4 • CC.4.MD.5 • CC.4.MD.6 • CC.4.MD.7	• M4.E.1.1 • M4.E.1.2 • M4.B.1.1 • M4.B.2.1 • M4.E.3.1 • M4.C.3.1

	circular arc between the points where the two rays intersect the circle. An angle that turns through 1/360 of a circle is called a "one-degree angle," and can be used to measure angles. b. An angle that turns through *n* one-degree angles is said to have an angle measure of *n* degrees. • Measure angles in whole-number degrees using a protractor. Sketch angles of a specified measure. • Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems.		
Geometry	**Draw and identify lines and angles, and classify shapes by properties of their lines and angles:** • Draw points, lines, line segments, rays, angles (right, acute, obtuse) and perpendicular and parallel lines. Identify these in two-dimensional figures. • Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles. • Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.	• CC.4.G.1 • CC.4.G.2 • CC.4.G.3	• M4.C.1.2 • M4.C.2.1 • M4.C.1.1