Blackhawk School District

CURRICULUM

Course Title: Math 6
Grade Level(s): Sixth
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	PA Common Core Standards
Number System	• **Identify and use the properties of association, commutative, identity, and zero.** • **List the factors of numbers through 100.** • **Identify and apply the divisibility rules of 2, 3, 5, 10.** • **Write a number in exponential form.** • **Identify the place value position to the thousandths place.** • **Reduce fractions to lowest terms.** • **Convert mixed numbers to improper fractions.** **Apply and Extend Understanding to Divide Fractions** • Interpret and compute quotients of fractions (including mixed numbers), and solve word problems involving division of fractions by fractions. **Compute and Find Common Factors and Multiples** • Solve problems involving operations (+, –, ×, ÷) with whole numbers, decimals (through thousandths), straight computation, or word problems. • Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. • Apply the distributive property to express a sum of two whole numbers, 1 through 100, with a common factor as a multiple of a sum of two whole numbers with no common factor. **Apply and Extend Understanding of Numbers to Rational Numbers** • Represent quantities in real-world contexts using positive and negative numbers, explaining the meaning of 0 in each situation (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge). • Determine the opposite of a number and recognize that the opposite of the opposite of a number is the number itself (e.g., –(–3) = 3, and that 0 is its own opposite). • Locate and plot integers and other rational numbers on a horizontal or vertical number line; locate and plot pairs of integers and other rational numbers on a coordinate plane. • Write, interpret, and explain statements of order for rational numbers in real-world contexts. • Interpret the absolute value of a rational number as its distance from 0 on the number line and as a magnitude for a positive or negative quantity in a real-world situation. • Solve real-world and mathematical problems by plotting points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.	• M06.A-N.1.1.1 • M06.A-N.2.1.1 • M06.A-N.2.2.1 • M06.A-N.2.2.2 • M06.A-N.3.1.1 • M06.A-N.3.1.2 • M06.A-N.3.1.3 • M06.A-N.3.2.1 • M06.A-N.3.2.2 • M06.A-N.3.2.3

Expressions and Equations	**Apply and Extend Understanding of Math to Numerical and Algebraic Expressions** • Write and evaluate numerical expressions involving whole-number exponents. • Write algebraic expressions from verbal descriptions. • Identify parts of an expression using mathematical terms (e.g., sum, term, product, factor, quotient, coefficient, quantity). • Evaluate expressions at specific values of their variables, including expressions that arise from formulas used in real-world problems. • Apply the properties of operations to generate equivalent expressions. **Interpret and Solve Equations and Inequalities.** • Use substitution to determine whether a given number in a specified set makes an equation or inequality true. • Write algebraic expressions to represent real-world or mathematical problems. • Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q, and x are all non-negative rational numbers. • Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem and/or represent solutions of such inequalities on number lines. **Represent and Analyze Relationships Between Dependent and Independent Variables.** • Write an equation to express the relationship between the dependent and independent variables. • Analyze the relationship between the dependent and independent variables using graphs and tables, and/or relate these to an equation.	• M06.B-E.1.1.1 • M06.B-E.1.1.2 • M06.B-E.1.1.3 • M06.B-E.1.1.4 • M06.B-E.1.1.5 • M06.B-E.2.1.1 • M06.B-E.2.1.2 • M06.B-E.2.1.3 • M06.B-E.2.1.4 • M06-B-E.3.1.1 • M06.B-E.3.1.2
Ratios and Proportional Relationships	**Understand Ratio Concepts and Use Ration Reasoning** • Use ratio language and notation (such as 3 to 4, 3:4, 3/4) to describe a ratio relationship between two quantities. • Find the unit rate a/b associated with a ratio a:b (with $b \neq 0$), and use rate language in the context of a ratio relationship. • Construct tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and/or plot the pairs of values on the coordinate plane. Use tables to compare ratios. • Solve unit rate problems including those involving unit pricing and constant speed. • Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.	• M06.A-R.1.1.1 • M06.A-R.1.1.2 • M06.A-R.1.1.3 • M06.A-R.1.1.4 • M06.A-R.1.1.5

Geometry	• **Identify types of quadrilaterals.** • **Identify 3-D parts (base, edge, face, vertex)** • **Identify 3-d figures (cube, rectangular prism, triangular prism, square prism?)** • **Create a frequency table** **Solve Problems Involving Area, Surface Area, and Volume.** • Determine the area of triangles and special quadrilaterals (i.e., square, rectangle, parallelogram, rhombus, and trapezoid). Formulas will be provided. • Determine the area of irregular or compound polygons. • Determine the volume of right rectangular prisms with fractional edge lengths. *Formulas will be provided.* • Given coordinates for the vertices of a polygon in the plane, use the coordinates to find side lengths and area of the polygon (limited to triangles and special quadrilaterals). *Formulas will be provided.* • Represent three-dimensional figures using nets made up of rectangles and triangles. • Determine the surface area of triangular and rectangular prisms (including cubes). *Formulas will be provided.*	• M06.C-G.1.1.1 • M06.C-G.1.1.2 • M06.C-G.1.1.3 • M06.C-G.1.1.4 • M06.C-G.1.1.5 • M06.C-G.1.1.6
Statistics and Probability	**Demonstrate Understanding of Statistical Variability.** • Display numerical data in plots on a number line, including dot plots, histograms, and box-and whisker plots. • Determine quantitative measures of center (e.g., median, mean, and/or mode) and variability (e.g., range, interquartile range, and/or mean absolute deviation). • Describe any overall pattern and any deviations from the overall pattern with reference to the context in which the data were gathered. • Relate the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.	• M06.D-S.1.1.1 • M06.D-S.1.1.2 • M06.D-S.1.1.3 • M06.D-S.1.1.4

Scope and Sequence

+, -, x ÷ whole numbers

Associative, Commutative, Identity, Zero Property

Factors

Divisibility rules

Exponents

Greatest Common Factor

Distributive Property

Place value

+, -, x ÷ decimals

Word problems (decimals)

Reduce fractions

Convert mixed numbers to improper fractions

Multiply and divide fractions

Divide mixed numbers

Word problems (divide fraction by fraction)

Represent integers

Opposites and opposite of opposites

Locate and plot integers on a number line

Compare integers

Absolute value

Locate and plot integers on a coordinate plane

Writing ratios

Unit rate

Create tables with ratios

Percent of a whole

Write expressions (include exponents)

Translate expressions to number form

Translate expressions to word form (correct terminology)

Substitute values into expressions

Distributive Property (distribute factor, pull-out common factor)

Equivalent expressions

Substitute (is equation/inequality true?)

Write and solve equations (no negative numbers)

Write inequalities

Write inequalities on a number line

Write equations to show a relationship (dependent /independent variables)

Analyze relationships

Area of triangles

Identify types of quadrilaterals (square, rhombus, rectangle, parallelogram, trapezoid)

Area of quadrilaterals

Area of irregular/compound polygons

Identify 3-D parts (base, edge, face, vertex)

Identify 3-d figures (cube, rectangular prism, triangular prism, square prism?)

Volume of rectangular prisms

Represent 3-D figures as a net

Find surface area (triangle and rectangular prisms, cubes)

Measures of central tendency (mean, median, mode)

Display data (number-line, dot plot, frequency table, histogram, box and whisker plot)

Find range, interquartile range, and mean absolute deviation)

Match data to graph