COBB TEACHING AND LEARNING STANDARDS

8th Grade Math

COBB COUNTY SCHOOL DISTRICT

ONE TEAM
ONE GOAL
STUDENT SUCCESS

8th Grade Mathematics Teaching & Learning Framework

Quarter 1		Quarter 2		Quarter 3		Quarter 4	
Unit 1 5 weeks	**Unit 2** 5 weeks	**Unit 3** 5 weeks	**Unit 4** 3 weeks	**Unit 5** 5 weeks	**Unit 6** 5 weeks	**Unit 7** 4 weeks	**Unit 8** 4 weeks
Transformations, Congruence and Similarity	**Exponents**	**Geometric Applications of Exponents**	**Functions**	**Linear Functions**	**Linear Models & Tables**	**Solving Systems of Equations**	**Review and Extend**
MGSE8.G.1 (experiment with transformations) **MGSE8.G.2** (Congruence) **MGSE8.G.3** (Transformations on the coordinate plane) **MGSE8.G.4** (Similarity) **MGSE8.G.5** (Investigating angles)	**MGSE8.EE.1** (Integer exponents) **MGSE8.EE.2** (Square & cube roots & equations) **MGSE8.EE.3** (Estimate with scientific notation) **MGSE8.EE.4** (Compute with scientific notation) **MGSE8.EE.7** (Solve linear equations) **MGSE8.EE.7a** (Multi-step equations) **MGSE8.EE.7b** (Linear equations with rationals) **MGSE8.NS.1** (Irrational numbers) **MGSE8.NS.2** (Rational approximations)	**MGSE8.G.6** (Pythagorean Theorem & it's converse) **MGSE8.G.7** (Apply the Pythagorean Theorem) **MGSE8.G.8** (Pythagorean Theorem & distance) **MGSE8.G.9** (Volume formulas) **MGSE8.EE.2** (Square & cube roots & equations)	**MGSE8.F.1** (Understanding functions) **MGSE8.F.2** (Comparing functions)	**MGSE8.EE.5** (Graph proportional relationships-slope) **MGSE8.EE.6** (Similar triangles to derive y=mx & y=mx+b) **MGSE8.F.3** (Linear & non-linear functions)	**MGSE8.F.4** (Construct a function) **MGSE8.F.5** (Analyze & sketch functional relationships) **MGSE8.SP.1** (Scatterplots) **MGSE8.SP.2** (Best fit line) **MGSE8.SP.3** (Interpreting bivariate data) **MGSE8.SP.4** (2-way tables)	**MGSE8.EE.8** (Analyze & solve linear systems) **MGSE8.EE.8a** (Solutions to systems) **MGSE8.EE.8b** (Solve systems algebraically and graphically) **MGSE8.EE.8c** (Systems in context)	**Review:** **All standards by differentiating for student needs** **Extend:** **MGSE9-12.A.CED.3** (Constraints by equations & inequalities including systems) **MGSE9-12.A.CED.4** (Rearrange formulas to solve) **MGSE9-12.A.REI.3** (Solve equations & inequalities with letters as coefficients)

These units were written to build upon concepts from prior units, so later units contain tasks that depend upon the concepts addressed in earlier units.
All units will include the Mathematical Practices and indicate skills to maintain.

NOTE: Mathematical standards are interwoven and should be addressed throughout the year in as many different units and tasks as possible in order to stress the natural connections that exist among mathematical topics.
Grades 6-8 Key: NS = The Number System, RP = Ratios and Proportional Relationships, EE = Expressions and Equations, G = Geometry, SP = Statistics and Probability.

Standards for Mathematical Practice

The 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. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council's report *Adding It Up*: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy).

1. Make sense of problems and persevere in solving them.
In grade 8, students solve real world problems through the application of algebraic and geometric concepts. Students seek the meaning of a problem and look for efficient ways to represent and solve it. They may check their thinking by asking themselves, "What is the most efficient way to solve the problem?", "Does this make sense?", and "Can I solve the problem in a different way?"

2. Reason abstractly and quantitatively.
In grade 8, students represent a wide variety of real world contexts through the use of real numbers and variables in mathematical expressions, equations, and inequalities. They examine patterns in data and assess the degree of linearity of functions. Students contextualize to understand the meaning of the number or variable as related to the problem and decontextualize to manipulate symbolic representations by applying properties of operations.

3. Construct viable arguments and critique the reasoning of others.
In grade 8, students construct arguments using verbal or written explanations accompanied by expressions, equations, inequalities, models, and graphs, tables, and other data displays (i.e. box plots, dot plots, histograms, etc.). They further refine their mathematical communication skills through mathematical discussions in which they critically evaluate their own thinking and the thinking of other students. They pose questions like "How did you get that?", "Why is that true?" "Does that always work?" They explain their thinking to others and respond to others' thinking.

4. Model with mathematics.
In grade 8, students model problem situations symbolically, graphically, tabularly, and contextually. Students form expressions, equations, or inequalities from real world contexts and connect symbolic and graphical representations. Students solve systems of linear equations and compare properties of functions provided in different forms. Students use scatterplots to represent data and describe associations between variables. Students need many opportunities to connect and explain the connections between the different representations. They should be able to use all of these representations as appropriate to a problem context.

Standards for Mathematical Practice continued

5. Use appropriate tools strategically.
Students consider available tools (including estimation and technology) when solving a mathematical problem and decide when certain tools might be helpful. For instance, students in grade 8 may translate a set of data given in tabular form to a graphical representation to compare it to another data set. Students might draw pictures, use applets, or write equations to show the relationships between the angles created by a transversal.

6. Attend to precision.
In grade 8, students continue to refine their mathematical communication skills by using clear and precise language in their discussions with others and in their own reasoning. Students use appropriate terminology when referring to the number system, functions, geometric figures, and data displays.

7. Look for and make use of structure.
Students routinely seek patterns or structures to model and solve problems. In grade 8, students apply properties to generate equivalent expressions and solve equations. Students examine patterns in tables and graphs to generate equations and describe relationships. Additionally, students experimentally verify the effects of transformations and describe them in terms of congruence and similarity.

8. Look for and express regularity in repeated reasoning.
In grade 8, students use repeated reasoning to understand algorithms and make generalizations about patterns. Students use iterative processes to determine more precise rational approximations for irrational numbers. During multiple opportunities to solve and model problems, they notice that the slope of a line and rate of change are the same value. Students flexibly make connections between covariance, rates, and representations showing the relationships between quantities.

The Number System (8.NS)

Know that there are numbers that are not rational, and approximate them by rational numbers.

MGSE8.NS.1 Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.

MGSE8.NS.2 Use rational approximation of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line, and estimate the value of expressions (e.g., estimate π^2*to the nearest tenth). For example, by truncating the decimal expansion of √2 (square root of 2), show that √2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.*

Expressions and Equations (8.EE)

Work with radicals and integer exponents.

MGSE8.EE.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{(-5)} = 3^{(-3)} = 1/(3^3) = 1/27$.

MGSE8.EE.2 Use square root and cube root symbols to represent solutions to equations. Recognize that $x^2 = p$ (where p is a positive rational number and lxl < 25) has 2 solutions and $x^3 = p$ (where p is a negative or positive rational number and lxl < 10) has one solution. Evaluate square roots of perfect squares < 625 and cube roots of perfect cubes > -1000 and < 1000.

MGSE8.EE.3 Use numbers expressed in scientific notation to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as 3×10^8 and the population of the world as 7×10^9, and determine that the world population is more than 20 times larger.*

MGSE8.EE.4 Add, subtract, multiply and divide numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Understand scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g. use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology (e.g. calculators).

Understand the connections between proportional relationships, lines, and linear equations.

MGSE8.EE.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*

MGSE8.EE.6 Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; 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.

Analyze and solve linear equations and pairs of simultaneous linear equations.

MGSE8.EE.7 Solve linear equations in one variable.

a. Give examples of 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).

b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

MGSE8.EE.8 Analyze and solve pairs of simultaneous linear equations (systems of linear equations).

a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.

b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. *For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.*

c. Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.*

Functions (8.F)

Define, evaluate, and compare functions.

MGSE8.F.1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.

MGSE8.F.2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.*

MGSE8.F.3. 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. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points $(1,1)$, $(2,4)$ and $(3,9)$, which are not on a straight line.*

Use functions to model relationships between quantities

MGSE8.F.4. 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.

MGSE8.F.5. 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 a graph that exhibits the qualitative features of a function that has been described verbally.

Geometry (8.G)

Understand congruence and similarity using physical models, transparencies, or geometry software.

MGSE8.G.1 Verify experimentally the congruence properties of rotations, reflections, and translations: lines are taken to lines and line segments to line segments of the same length; angles are taken to angles of the same measure; parallel lines are taken to parallel lines.

MGSE8.G.2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

MGSE8.G.3 Describe the effect of dilations, translations, rotations and reflections on two-dimensional figures using coordinates.

MGSE8.G.4 Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

MGSE8.G.5. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the three angles appear to form a line, and give an argument in terms of transversals why this is so.*

Understand and apply the Pythagorean Theorem.

MGSE8.G.6. Explain a proof of the Pythagorean Theorem and its converse.

MGSE8.G.7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

MGSE8.G.8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.

MGSE8.G.9 Apply the formulas for the volume of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Statistics and Probability (8.SP)

Investigate patterns of association in bivariate data.

MGSE8.SP.1. 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 association, linear association, and nonlinear association.

MGSE8.SP.2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

MGSE8.SP.3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*

MGSE8.SP.4 Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table.

- **a.** Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects.
- **b.** Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?*