MISSISSIPPI DEPARTMENT OF EDUCATION

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2016 Mississippi College- and Career-Readiness Standards for Mathematics

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2016 Mississippi College- and Career-Readiness Standards for Mathematics

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Introduction

Mission Statement

The Mississippi Department of Education is dedicated to student success including the improvement of student achievement in mathematics in order to produce citizens who are capable of making complex decisions, solving complex problems, and communicating fluently in a technological society. The *2016 Mississippi College- and Career-Readiness Standards for Mathematics* ("The Standards") provide a consistent, clear understanding of what students are expected to know and be able to do by the end of each grade level and course. The standards are designed to be robust and relevant to the real world, reflecting the knowledge and skills that students need for success in college and careers and to compete in the global economy.

Purpose

In an effort to closely align instruction for students who are progressing toward postsecondary study and the workforce, the *2016 Mississippi College- and Career-Readiness Standards for Mathematics* include grade- and course-specific standards for K-12 mathematics.

The primary purpose of this document is to provide a basis for curriculum development for Grades K-12 mathematics teachers, outlining what students should know and be able to do by the end of each grade level and course. Courses for grades K-12 are based on the *Mississippi College- and Career-Readiness Standards (MS CCRS) for Mathematics*. Mississippi-specific courses that were revised to align with the (*MS CCRS) for Mathematics* include Pre-Calculus (renamed Algebra III) and Calculus.

The Southern Regional Education Board (SREB) Math Ready course is included as a transition to college mathematics courses.

The content of this document is centered on the mathematics domains of **Counting and Cardinality** (Grade K), **Operations and Algebraic Thinking; Numbers and Operations in Base Ten** (Grades K-5); **Numbers and Operations—Fractions** (Grades 3-5); **Measurement and Data** (Grades K-5); **Ratios and Proportional Relationships** (Grades 6-7); **the Number System, Expressions & Equations, Geometry, Statistics & Probability** (Grades 6-8); **Functions** (Grade 8), and the high school conceptual categories of **Number and Quantity**, **Algebra**, **Functions**, **Modeling, Geometry**, and **Statistics & Probability**. Instruction in these domains and conceptual categories should be designed to expose students to experiences, which reflect the value of mathematics, to enhance students' confidence in their ability to do mathematics, and to help students communicate and reason mathematically.

Implementation

The required year for the *2016 Mississippi College- and Career-Readiness Standards for Mathematics* is school year 2016-2017.

Technology

The Mississippi Department of Education (MDE) strongly encourages the use of technology in all mathematics classrooms. Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.

The appropriate use of instructional technology is integrated throughout the *2016 Mississippi College- and Career-Readiness Standards for Mathematics.* Teaching strategies at each grade level and in every secondary course incorporate technology in the form of calculators, software, or on-line internet resources. The graphing calculator is an integral part of mathematics courses beginning with Grade 6.

The MDE believes strongly in the Principles and Standards for School Mathematics Technology Principle of the National Council for Teachers of Mathematics (NCTM):

> "Calculators and computers are reshaping the mathematical landscape, and school mathematics should reflect those changes. Students can learn more mathematics more deeply with the appropriate and responsible use of technology. They can make and test conjectures. They can work at higher levels of generalization or abstraction. In the mathematics classrooms envisioned in *Principles and Standards*, every student has access to technology to facilitate his or her mathematics learning. Technology also offers options for students with special needs. Some students may benefit from the more constrained and engaging task situations possible with computers. Students with physical challenges can become much more engaged in mathematics using special technologies. Technology cannot replace the mathematics teacher, nor can it be used as a replacement for basic understandings and intuitions. The teacher must make prudent decisions about when and how to use technology and should ensure that the technology is enhancing students' mathematical thinking."
> (NCTM, 2013, **http://www.nctm.org**.)

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COMMITTEE MEMBERS (2015)

The Mississippi Department of Education gratefully acknowledges the following individuals who provided feedback in developing the *2016 Mississippi College- and Career-Readiness Standards for Mathematics*.

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College- and Career-Readiness Standards for Mathematics Overview

College- and Career-Readiness Standards for Mathematics

For over a decade, research studies of mathematics education in high-performing countries have pointed to the conclusion that the mathematics curriculum in the United States must become substantially more focused and coherent in order to improve mathematics achievement in this country. To deliver on the promise of common standards, the standards must address the problem of a curriculum that is “a mile wide and an inch deep.” These Standards are a substantial answer to that challenge. Aiming for clarity and specificity, these Standards endeavor to follow a design that not only stresses conceptual understanding of key ideas, but also by continually returning to organizing principles such as place value or the laws of arithmetic to structure those ideas.

Understanding Mathematics

These Standards define what students should understand and be able to do in their study of mathematics. Asking a student to understand something means asking a teacher to assess whether the student has understood it. But what does mathematical understanding look like? One hallmark of mathematical understanding is the ability to justify, in a way appropriate to the student’s mathematical maturity, why a particular mathematical statement is true or where a mathematical rule comes from. There is a world of difference between a student who can summon a mnemonic device to expand a product such as $(a + b)(x + y)$ and a student who can explain where the mnemonic comes from. The student who can explain the rule understands the mathematics, and may have a better chance to succeed at a less familiar task such as expanding $(a + b + c)(x + y)$. Mathematical understanding and procedural skill are equally important, and both are assessable using mathematical tasks of sufficient richness.

The Standards set grade-specific expectations but do not define the intervention methods or materials necessary to support students who are well below or well above grade-level expectations. It is also beyond the scope of the Standards to define the full range of supports appropriate for English language learners and for students with special needs. At the same time, all students must have the opportunity to learn and meet the same high standards if they are to access the knowledge and skills necessary for college and/or careers. The Standards should be read as allowing for the widest possible range of students to participate fully from the outset, along with appropriate accommodations to ensure maximum participation of students with special education needs. For example, for students with reading disabilities the use of Braille, screen reader technology, or other assistive devices should be made available. In addition, while writing, these students should have access to a scribe, computer, or speech-to-text technology in their classroom. In a similar vein, speaking and listening should be interpreted broadly to include sign language. No set of grade-specific standards can fully reflect the great variety in abilities, needs, learning rates, and achievement levels of students in any given classroom. However, the Standards do provide clear signposts along the way to the goal of College- and Career-Readiness for all students.

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. <u>Make sense of problems and persevere in solving them</u>.

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. <u>Reason abstractly and quantitatively</u>.

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.

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 data, making plausible arguments that take into account the context from which the data 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 use 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 the 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. Later, students will see 7 × 8 equals the well-remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2 × 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 $(x – 1)(x + 1)$, $(x – 1)(x^2 + x + 1)$, and $(x – 1)(x^3 + x^2 + x + 1)$ 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.

Connecting the Standards for Mathematical Practice to the 2016 Mississippi College- and Career-Readiness Standards for Mathematics

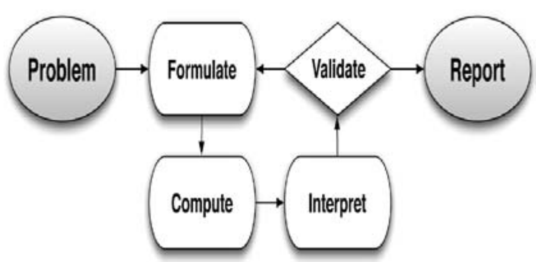
The Standards for Mathematical Practice describe ways in which developing student practitioners of the discipline of mathematics increasingly ought to engage with the subject matter as they grow in mathematical maturity and expertise throughout the elementary, middle and high school years. Designers of curricula, assessments, and professional development should all attend to the need to connect the mathematical practices to the Standards in mathematics instruction.

The Standards are a balanced combination of procedure and understanding. Expectations that begin with the word “understand” are often especially good opportunities to connect the practices to the content. Students who lack understanding of a topic may rely on procedures too heavily. Without a flexible base from which to work, they may be less likely to consider analogous problems, represent problems coherently, justify conclusions, apply the mathematics to practical situations, use technology mindfully to work with the mathematics, explain the mathematics accurately to other students, step back for an overview, or deviate from a known procedure to find a shortcut. In short, a lack of understanding effectively prevents a student from engaging in the mathematical practices.

In this respect, those content standards which set an expectation of understanding are potential “points of intersection” between the Standards for Mathematical Content and the Standards for Mathematical Practice. These points of intersection are intended to be weighted toward central and generative concepts in the school mathematics curriculum that most merit the time, resources, innovative energies, and focus necessary to qualitatively improve the curriculum, instruction, assessment, professional development, and student achievement in mathematics.

Modeling (High School Courses only)

Modeling standards are noted throughout the high school courses with an asterisk (*). *Modeling* links classroom mathematics and statistics to everyday life, work, and decision-making. *Modeling* is the process of choosing and using appropriate mathematics and statistics to analyze empirical situations, to understand them better, and to improve decisions. Quantities and their relationships in physical, economic, public policy, social, and everyday situations can be modeled using mathematical and statistical methods. When making mathematical models, technology is valuable for varying assumptions, exploring consequences, and comparing predictions with data.



Making mathematical models is a Standard for Mathematical Practice, and specific *Modeling* standards appear throughout the high school standards. The basic modeling cycle above involves (1) identifying variables in the situation and selecting those that represent essential features, (2) formulating a model by creating and selecting geometric, graphical, tabular, algebraic, or statistical representations that describe relationships between the variables, (3) analyzing and performing operations on these relationships to draw conclusions, (4) interpreting the results of the mathematics in terms of the original situation, (5) validating the conclusions by comparing them with the situation, and then either improving the model or, if it is acceptable, (6) reporting on the conclusions and the reasoning behind them. Choices, assumptions, and approximations are present throughout this cycle.

College- and Career-Readiness Standards for Mathematics Scaffolding Document

2016 Mississippi College- and Career-Readiness Standards Scaffolding Document

Purpose

The primary purpose of the 2016 Mississippi College- and Career-Readiness Standards Scaffolding Document is to provide teachers with a deeper understanding of the Standards as they plan for classroom instruction. Based on the 2016 Mississippi College- and Career-Readiness Standards for Mathematics, this document provides a close analysis of the requirements for student mastery. Because of the rigor and depth of the Standards, scaffolding instruction to meet the needs of all learners is essential to individual success. The Scaffolding Document will aid teachers' understanding of how to teach the Standards through a natural progression of student mastery. The Scaffolding Document is located at **http://www.mde.k12.ms.us/ESE/ccr.**

Organization of the 2016 Mississippi College- and Career-Standards Scaffolding Document

The 2016 Mississippi College- and Career-Readiness Standards Scaffolding Document is divided by grade level. Within each grade level, the Scaffolding Document is separated into the mathematical domains **Counting and Cardinality** (Grade K), **Operations and Algebraic Thinking** (Grades K-5); **Numbers and Operations in Base Ten** (Grades K-5); **Numbers and Operations—Fractions** (Grades 3-5); **Measurement and Data** (Grades K-5); **Ratios and Proportional Relationships** (Grades 6-7); **the Number System, Expressions & Equations, Geometry, Statistics & Probability** (Grades 6-8); **Functions** (Grade 8), and the high school conceptual categories of **Number and Quantity**, **Algebra**, **Functions, Geometry**, and **Statistics & Probability**.

Each standard is then broken down into three categories: Prerequisite Knowledge, Conceptual Understanding, and Evidence of Knowledge. The Prerequisite Knowledge column lists the skills that students should have mastered in previous grades in order to work towards mastery of the grade-specific standard. In other words, this column details what a student needs to *KNOW* before mastering the grade-specific standard. The Conceptual Understanding column explains the deeper understanding of concepts—not actions or skills—that are required for mastery of the grade specific standard. In other words, this column explains what a student needs to *UNDERSTAND* before mastering the grade-specific standard. The last column, Evidence of Knowledge, explains what student mastery looks like, including what work a student produces to exhibit mastery of the grade-specific standard. In other words, this column describes what a student needs to *DO* to show mastery of the grade-specific standard.

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College- and Career-Readiness Standards for Mathematics (Grades K-5)

Fluency/Fluently Defined

Throughout the *2016 Mississippi College- and Career-Readiness Standards for Mathematics* Grades K-5 standards, the words fluency and fluently will appear in bold, italicized, and underlined font (for example: ***<u>fluently</u>***). With respect to student performance <u>and</u> effective in-class instruction, the expectations for mathematical fluency are explained below:

Fluency is not meant to come at the expense of understanding, but is an outcome of a progression of learning and sufficient thoughtful practice. It is important to provide the conceptual building blocks that develop understanding in tandem with skill along the way to fluency; the roots of this conceptual understanding often extend one or more grades earlier in the standards than the grade when fluency is finally expected.

Wherever the word *fluently* appears in a MS CCR content standard, the word means quickly and accurately. It is important to understand that this is not explicitly tied to assessment purposes, but means more or less the same as when someone is said to be fluent in a foreign language. To be fluent is to flow: Fluent isn’t halting, stumbling, or reversing oneself.

A key aspect of fluency in this sense is that it is not something that happens all at once in a single grade but requires attention to student understanding along the way. It is important to ensure that sufficient practice and extra support are provided at each grade to allow all students to meet the standards that call explicitly for fluency.

Grade 8

For Math Grade 8, a one-credit course, instruction should focus on 3 critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; and (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem. Each critical area is described below.

(1) Students use linear equations and systems of linear equations to represent, analyze, and solve a variety of problems. Students recognize equations for proportions ($y/x = m$ or $y = mx$) as special linear equations ($y = mx + b$), understanding that the constant of proportionality (m) is the slope, and the graphs are lines through the origin. They understand that the slope (m) of a line is a constant rate of change, so that if the input or x-coordinate changes by an amount A, the output or y-coordinate changes by the amount $m \cdot A$. Students also use a linear equation to describe the association between two quantities in bivariate data (such as arm span vs. height for students in a classroom). At this grade, fitting the model, and assessing its fit to the data are done informally. Interpreting the model in the context of the data requires students to express a relationship between the two quantities in question and to interpret components of the relationship (such as slope and y-intercept) in terms of the situation.

Students strategically choose and efficiently implement procedures to solve linear equations in one variable, understanding that when they use the properties of equality and the concept of logical equivalence, they maintain the solutions of the original equation. Students solve systems of two linear equations in two variables and relate the systems to pairs of lines in the plane; these intersect, are parallel, or are the same line. Students use linear equations, systems of linear equations, linear functions, and their understanding of slope of a line to analyze situations and solve problems.

(2) Students grasp the concept of a function as a rule that assigns to each input exactly one output. They understand that functions describe situations where one quantity determines another. They can translate among representations and partial representations of functions (noting that tabular and graphical representations may be partial representations), and they describe how aspects of the function are reflected in the different representations.

(3) Students use ideas about distance and angles, how they behave under translations, rotations, reflections, and dilations, and ideas about congruence and similarity to describe and analyze two-dimensional figures and to solve problems. Students show that the sum of the angles in a triangle is the angle formed by a straight line, and that various configurations of lines give rise to similar triangles because of the angles created when a transversal cuts parallel lines. Students understand the statement of the Pythagorean Theorem and its converse, and can explain why the Pythagorean Theorem holds, for example, by decomposing a square

Grade 8 (continued)

in two different ways. They apply the Pythagorean Theorem to find distances between points on the coordinate plane, to find lengths, and to analyze polygons. Students complete their work on volume by solving problems involving cones, cylinders, and spheres.

The content of this document is centered on the mathematics domains of **Counting and Cardinality** (Grade K), **Operations and Algebraic Thinking; Numbers and Operations in Base Ten** (Grades K-5); **Numbers and Operations—Fractions** (Grades 3-5); **Measurement and Data** (Grades K-5); **Ratios and Proportional Relationships** (Grades 6-7); **the Number System, Expressions & Equations, Geometry, Statistics & Probability** (Grades 6-8); **Functions** (Grade 8), and the high school conceptual categories of **Number and Quantity**, **Algebra**, **Functions**, **Modeling, Geometry**, and **Statistics & Probability**. Instruction in these domains and conceptual categories should be designed to expose students to experiences, which reflect the value of mathematics, to enhance students' confidence in their ability to do mathematics, and to help students communicate and reason mathematically.

Grade 8

The Number System (NS)	
Know that there are numbers that are not rational, and approximate them by rational numbers	
8.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.
8.NS.2	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). *For example, by truncating the decimal expansion of* $\sqrt{2}$*, show that* $\sqrt{2}$ *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 (EE)	
Work with radicals and integer exponents	
8.EE.1	Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example,* $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.
8.EE.2	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 small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.
8.EE.3	Use numbers expressed in the form of a single digit times an integer power of 10 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.*
8.EE.4	Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use 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.
Understand the connections between proportional relationships, lines, and linear equations	
8.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.*
8.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.

Grade 8

Analyze and solve linear equations and pairs of simultaneous linear equations	
8.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 and inequalities with rational number coefficients, including those whose solutions require expanding expressions using the distributive property and collecting like terms.
8.EE.8	Analyze and solve pairs of simultaneous 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 (F)	
Define, evaluate, and compare functions	
8.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. [1]
8.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.*
8.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	
8.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.

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8.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 (G)	
Understand congruence and similarity using physical models, transparencies, or geometry software	
8.G.1	Verify experimentally the properties of rotations, reflections, and translations a. Lines are taken to lines, and line segments to line segments of the same length. b. Angles are taken to angles of the same measure. c. Parallel lines are taken to parallel lines.
8.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.
8.G.3	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
8.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.
8.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 sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.*
Understand and apply the Pythagorean Theorem	
8.G.6	Explain a proof of the Pythagorean Theorem and its converse.
8.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.
8.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	
8.G.9	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
Statistics and Probability (SP)	
Investigate patterns of association in bivariate data	
8.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.

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8.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.
8.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.*
8.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. 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 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?*

[1] Function notation is not required in Grade 8.

Additional Resource

2016 Mississippi College- and Career-Standards Scaffolding Document

The primary purpose of the *2016 Mississippi College- and Career-Readiness Standards Scaffolding Document* is to provide teachers with a deeper understanding of the Standards as they plan for classroom instruction. Based on the 2016 Mississippi College- and Career-Readiness Standards for Mathematics, this document provides a close analysis of the requirements for student mastery. Because of the rigor and depth of the Standards, scaffolding instruction to meet the needs of all learners is essential to individual success. The Scaffolding Document will aid teachers' understanding of how to teach the Standards through a natural progression of student mastery. The Scaffolding Document can be found at **http://www.mde.k12.ms.us/ESE/ccr**.

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.

Acceleration in Middle School

There are some students who are able to move through the mathematics quickly. These students may choose to take high school mathematics beginning in eighth grade or earlier so they can take college-level mathematics in high school. Students who are capable of moving more quickly deserve thoughtful attention, both to ensure that they are challenged and that they are mastering the full range of mathematical content and skills—without omitting critical concepts and topics. Care must be taken to ensure that students master and fully understand all important topics in the mathematics curriculum, and that the continuity of the mathematics learning progression is not disrupted. In particular, the Standards for Mathematical Practice ought to continue to be emphasized in these cases.

To prepare students for high school mathematics in eighth grade, the MDE has developed a well-crafted sequence of **compacted courses**. The term "compacted" means to compress content, which requires a faster pace to complete, as opposed to skipping content. These compacted courses are designed for districts offering the Traditional Pathway (Algebra I – Geometry – Algebra II) high school sequence, and the other for districts using an Integrated Pathway sequence (Integrated Math I – Integrated Math II – Integrated Math III) which is commonly found internationally. A snapshot of the content standards in each Pathway is available on pages 135-136. Both Pathways are based on the idea that content should compact 3 years of content into 2 years, at most. As a result, Grades 7, 8, and 9 were compacted into Grades 7 and 8 (a 3:2 compaction). Whereas, some 8th grade content is addressed in the 7th grade courses, and high school content is addressed in 8th grade.

The Compacted Traditional sequence compacts MS CCRS Grade 7, MS CCRS Grade 8, and high school MS CCRS Algebra I into two years. Upon successful completion of this Pathway, students will be ready for MS CCRS Geometry or MS CCRS Algebra II in high school. The Compacted Integrated sequence compacts MS CCRS Grade 7, MS CCRS Grade 8, and-MS CCRS Integrated Mathematics I into two years. At the end of 8th grade, these students will be ready for MS CCRS Integrated Mathematics II in high school. While the MS CCRS Grades K-7 effectively prepare students for algebra I in 8th grade, some standards from 8th grade have been placed in the Compacted Mathematics Grade 7 course to make the Compacted Mathematics Grade 8 courses more manageable- regardless of the Pathway chosen.

1. **Compacted courses should include the same Mississippi College- and Career-Readiness Standards as the non-compacted courses.**

   It is recommended to compact three years of material into two years, rather than compacting two years into one. The rationale is that mathematical concepts are likely to be omitted when trying to squeeze two years of material into one. This is to be avoided, as the standards have been carefully developed to define clear learning progressions through the major mathematical domains. Moreover, the compacted courses should not sacrifice attention to the Mathematical Practices Standard.

Acceleration in Middle School (continued)

2. **Decisions to accelerate students into the Mississippi College- and Career-Readiness Standards for high school mathematics before ninth grade should not be rushed.**
   Placing students into tracks too early should be avoided at all costs. It is not recommended to compact the standards before grade seven. In this document, compaction begins in seventh grade for both the traditional and integrated (international) pathways.

3. **Decisions to accelerate students into high school mathematics before ninth grade should be based on solid evidence of student learning.**
   Research has shown discrepancies in the placement of students into "advanced" classes by race/ethnicity and socioeconomic background. While such decisions to accelerate are almost always a joint decision between the school and the family, serious efforts must be made to consider solid evidence of student learning in order to avoid unwittingly disadvantaging the opportunities of particular groups of students.

4. **A menu of challenging options should be available for students after their third year of mathematics—and all students should be strongly encouraged to take mathematics in all years of high school.**
   Traditionally, students taking high school mathematics in the eighth grade are expected to take a Pre-Calculus or Algebra III course in their junior years and then Calculus in their senior years. This is a good and worthy goal, but it should not be the only option for students. An array of challenging options will keep mathematics relevant for students, and give them a new set of tools for their futures in college and career.

Secondary Sequence Options

Students will progress according to grade level through the sixth grade. Beginning in the seventh grade, students are given course sequence options based on academic progress, teacher recommendation, and parental consent. Below are **suggested** secondary course sequence options:

Suggested Secondary Course Sequence Options for Mathematics

Grade Level	OPTION 1	OPTION 2	OPTION 3
7	Grade 7	Compacted Grade 7	Compacted Grade 7
8	Grade 8	Compacted Grade 8 (with Algebra I) **or** Compacted Grade 8 (with Integrated Math I)	Compacted Grade 8 (with Algebra I) **or** Compacted Grade 8 (with Integrated Math I)
9	Algebra I **or** Integrated Math I	Geometry **or** Integrated Math II	Algebra II **or** Integrated Math II
10	Geometry **or** Integrated Math II	Algebra II **or** Integrated Math III	Geometry **or** Integrated Math III
11	Algebra II **or** Integrated Math III	Algebra III, Advanced Mathematics Plus, Calculus, AP Calculus, AP Statistics, Dual Credit/Dual Enrollment or SREB Math Ready Course	Algebra III, Advanced Mathematics Plus, Calculus, AP Calculus, AP Statistics, Dual Credit/Dual Enrollment or SREB Math Ready Course
12	Algebra III, Advanced Mathematics Plus, Calculus, AP Calculus, AP Statistics, Dual Credit/Dual Enrollment or SREB Math Ready Course	Algebra III, Advanced Mathematics Plus, Calculus, AP Calculus, AP Statistics, Dual Credit/Dual Enrollment or SREB Math Ready Course	Algebra III, Advanced Mathematics Plus, Calculus, AP Calculus, AP Statistics, Dual Credit/Dual Enrollment or SREB Math Ready Course

Compacted Mathematics Grade 8 (with Algebra I)

In Compacted Mathematics Grade 8 (with Algebra I), a one-credit course, instruction should focus on three critical areas from Grade 8: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; and (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem. Each critical area is described below.

(1) Students use linear equations and systems of linear equations to represent, analyze, and solve a variety of problems. Students recognize equations for proportions ($y/x = m$ or $y = mx$) as special linear equations ($y = mx + b$), understanding that the constant of proportionality (m) is the slope, and the graphs are lines through the origin. They understand that the slope (m) of a line is a constant rate of change, so that if the input or x-coordinate changes by an amount A, the output or y-coordinate changes by the amount $m \cdot A$. Students also use a linear equation to describe the association between two quantities in bivariate data (such as arm span vs. height for students in a classroom). At this grade, fitting the model, and assessing its fit to the data are done informally. Interpreting the model in the context of the data requires students to express a relationship between the two quantities in question and to interpret components of the relationship (such as slope and y-intercept) in terms of the situation.

Students strategically choose and efficiently implement procedures to solve linear equations in one variable, understanding that when they use the properties of equality and the concept of logical equivalence, they maintain the solutions of the original equation. Students solve systems of two linear equations in two variables and relate the systems to pairs of lines in the plane; these intersect, are parallel, or are the same line. Students use linear equations, systems of linear equations, linear functions, and their understanding of slope of a line to analyze situations and solve problems.

(2) Students grasp the concept of a function as a rule that assigns to each input exactly one output. They understand that functions describe situations where one quantity determines another. They can translate among representations and partial representations of functions (noting that tabular and graphical representations may be partial representations), and they describe how aspects of the function are reflected in the different representations.

(3) Students use ideas about distance and angles, how they behave under translations, rotations, reflections, and dilations, and ideas about congruence and similarity to describe and analyze two-dimensional figures and to solve problems. Students show that the sum of the angles in a triangle is the angle formed by a straight line, and that various configurations of lines give rise to similar triangles

Compacted Mathematics Grade 8 (with Algebra I) (continued)

because of the angles created when a transversal cuts parallel lines. Students understand the statement of the Pythagorean Theorem and its converse, and can explain why the Pythagorean Theorem holds, for example, by decomposing a square in two different ways. They apply the Pythagorean Theorem to find distances between points on the coordinate plane, to find lengths, and to analyze polygons. Students complete their work on volume by solving problems involving cones, cylinders, and spheres.

In Algebra I, the fundamental purpose of this course is to formalize and extend the mathematics that students learned in the middle grades. Because it is built on the middle grades standards, this is a more ambitious version of Algebra I than has generally been offered. Instruction should focus on five critical areas: (1) analyze and explain the process of solving equations and inequalities: (2) learn function notation and develop the concepts of domain and range; (3) use regression techniques; (4) create quadratic and exponential expressions; and (5) select from among these functions to model phenomena. Each critical area is described below.

(1) By the end of eighth grade, students have learned to solve linear equations in one variable and have applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables. Now, students analyze and explain the process of solving an equation. Students develop fluency writing, interpreting, and translating between various forms of linear equations and inequalities, and using them to solve problems. They master the solution of linear equations and apply related solution techniques and the laws of exponents to the creation and solution of simple exponential equations.

(2) In earlier grades, students define, evaluate, and compare functions, and use them to model relationships between quantities. In this unit, students will learn function notation and develop the concepts of domain and range. They explore many examples of functions, including sequences; they interpret functions given graphically, numerically, symbolically, and verbally, translate between representations, and understand the limitations of various representations. Students build on and informally extend their understanding of integer exponents to consider exponential functions. They compare and contrast linear and exponential functions, distinguishing between additive and multiplicative change. Students explore systems of equations and inequalities, and they find and interpret their solutions. They interpret arithmetic sequences as linear functions and geometric sequences as exponential functions.

Compacted Mathematics Grade 8 (with Algebra I) (Continued)

(3) This area builds upon prior students' prior experiences with data, providing students with more formal means of assessing how a model fits data. Students use regression techniques to describe approximately linear relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit.

(4) In this area, students build on their knowledge from unit 2, where they extended the laws of exponents to rational exponents. Students apply this new understanding of number and strengthen their ability to see structure in and create quadratic and exponential expressions. They create and solve equations, inequalities, and systems of equations involving quadratic expressions.

(5) In this area, students consider quadratic functions, comparing the key characteristics of quadratic functions to those of linear and exponential functions. They select from among these functions to model phenomena. Students learn to anticipate the graph of a quadratic function by interpreting various forms of quadratic expressions. In particular, they identify the real solutions of a quadratic equation as the zeros of a related quadratic function. Students expand their experience with functions to include more specialized functions—absolute value, step, and those that are piecewise-defined.

The content of this document is centered on the mathematics domains of **Counting and Cardinality** (Grade K), **Operations and Algebraic Thinking; Numbers and Operations in Base Ten** (Grades K-5); **Numbers and Operations—Fractions** (Grades 3-5); **Measurement and Data** (Grades K-5); **Ratios and Proportional Relationships** (Grades 6-7); **the Number System, Expressions & Equations, Geometry, Statistics & Probability** (Grades 6-8); **Functions** (Grade 8), and the high school conceptual categories of **Number and Quantity**, **Algebra**, **Functions**, **Modeling, Geometry**, and **Statistics & Probability**. Instruction in these domains and conceptual categories should be designed to expose students to experiences, which reflect the value of mathematics, to enhance students' confidence in their ability to do mathematics, and to help students communicate and reason mathematically.

Compacted Mathematics Grade 8 (with Algebra I)

Number and Quantity

The Real Number System (N-RN)

Use properties of rational and irrational numbers

N-RN.3	Explain why: • the sum or product of two rational numbers is rational; • the sum of a rational number and an irrational number is irrational; and • the product of a nonzero rational number and an irrational number is irrational.

Quantities (N-Q)*

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.2	Define appropriate quantities for the purpose of descriptive modeling.* [Refer to *Quantities* section of the High School *Number and Quantity* Conceptual Category in the previous pages of this document.]
N-Q.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.*

Algebra

Expressions and Expressions (EE)

Analyze and solve linear equations and pairs of simultaneous linear equations

8.EE.8	Analyze and solve pairs of simultaneous 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.*

Seeing Structure in Expressions (A-SSE)

Interpret the structure of expressions

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.*

Compacted Mathematics Grade 8 (with Algebra I)

A-SSE.2	Use the structure of an expression to identify ways to rewrite it. *For example, see* $x^4 - y^4$ *as* $(x^2)^2 - (y^2)^2$*, thus recognizing it as a difference of squares that can be factored as* $(x^2 - y^2)(x^2 + y^2)$.
	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. b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. 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%.*
	Arithmetic with Polynomials and Rational Expressions (A-APR)
	Perform arithmetic operations on polynomials
A-APR.1	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
	Understand the relationship between zeros and factors of polynomials
A-APR.3	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial (limit to 1st- and 2nd-degree polynomials).
	Creating Equations (A-CED) *
	Create equations that describe numbers or relationships
A-CED.1	Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.**
A-CED.2	Create equations in two variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. *[Note this standard appears in future courses with a slight variation in the standard language.]*
A-CED.3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.**
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.**
	Reasoning with Equations and Inequalities (A-REI)
	Understand solving equations as a process of reasoning and explain the reasoning

Compacted Mathematics Grade 8 (with Algebra I)

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 and inequalities in one variable	
A-REI.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
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 $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions.
Solve systems of equations	
A-REI.5	Given a system of two equations in two variables, show and explain why the sum of equivalent forms of the equations produces the same solution as the original system.
A-REI.6	Solve systems of linear equations algebraically, exactly, and graphically while focusing on pairs of linear equations in two variables.
Represent and solve equations and inequalities graphically	
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, or find successive approximations. Include cases where f(x) and/or g(x) are linear, quadratic, absolute value, and exponential functions. *
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), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

Functions

Functions (F)

Define, evaluate, and compare functions	
8.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. [1]
8.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.*

Compacted Mathematics Grade 8 (with Algebra I)

8.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	
8.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.
8.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.
Interpreting Functions (F-IF)	
Understand the concept of a function and use function notation	
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 whose domain is a subset of the integers..
Interpret functions that arise in applications in terms of the context	
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; end behavior; and periodicity.**
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.*

Compacted Mathematics Grade 8 (with Algebra I)

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 functions (linear and quadratic) and show intercepts, maxima, and minima.. b. Graph square root and piecewise-defined functions, including absolute value functions.
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.
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.*
Building Functions (F-BF)	
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 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 $f(x) + k$, $kf(x)$, $f(kx)$, 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.*
Linear, Quadratic, and Exponential Models (F-LE) *	
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.* a. Prove that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals. 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 linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).*

Compacted Mathematics Grade 8 (with Algebra I)

Interpret expressions for functions in terms of the situation they model	
F-LE.5	Interpret the parameters in a linear or exponential function in terms of a context.*
Geometry	
Geometry (G)	
Understand and apply the Pythagorean Theorem	
8.G.6	Explain a proof of the Pythagorean Theorem and its converse.
8.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.
8.G.8	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
Statistics and Probability	
Statistics and Probability (SP)	
Investigate patterns of association in bivariate data	
8.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.
8.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.
8.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.*
8.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. 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 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?*
Interpreting Categorical and Quantitative Data (S-ID)	
Summarize, represent, and interpret data on a single count or measurement variable	
S-ID.1	Represent and analyze 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 different data sets.*

Compacted Mathematics Grade 8 (with Algebra I)

S-ID.3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).*
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.*
S-ID.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.* a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.* b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association.
Interpret linear models	
S-ID.7	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.*
S-ID.8	Compute (using technology) and interpret the correlation coefficient of a linear fit.*
S-ID.9	Distinguish between correlation and causation.*

[1] Function notation is not required at Grade 8

* Modeling Standards (**High School standards only**)

Additional Resource

2016 Mississippi College- and Career-Standards Scaffolding Document

The primary purpose of the *2016 Mississippi College- and Career-Readiness Standards Scaffolding Document* is to provide teachers with a deeper understanding of the Standards as they plan for classroom instruction. Based on the 2016 Mississippi College- and Career-Readiness Standards for Mathematics, this document provides a close analysis of the requirements for student mastery. Because of the rigor and depth of the Standards, scaffolding instruction to meet the needs of all learners is essential to individual success. The Scaffolding Document will aid teachers' understanding of how to teach the Standards through a natural progression of student mastery. The Scaffolding Document can be found at **http://www.mde.k12.ms.us/ESE/ccr**.

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.

Compacted Mathematics Grade 8 (with Integrated Math I)

In Compacted Mathematics Grade 8 (with Integrated Math I), a one-credit course, instruction should focus on three critical areas from Grade 8: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; and (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem. Each critical area is described below.

(1) Students use linear equations and systems of linear equations to represent, analyze, and solve a variety of problems. Students recognize equations for proportions ($y/x = m$ or $y = mx$) as special linear equations ($y = mx + b$), understanding that the constant of proportionality (m) is the slope, and the graphs are lines through the origin. They understand that the slope (m) of a line is a constant rate of change, so that if the input or x-coordinate changes by an amount A, the output or y-coordinate changes by the amount $m \cdot A$. Students also use a linear equation to describe the association between two quantities in bivariate data (such as arm span vs. height for students in a classroom). At this grade, fitting the model, and assessing its fit to the data are done informally. Interpreting the model in the context of the data requires students to express a relationship between the two quantities in question and to interpret components of the relationship (such as slope and y-intercept) in terms of the situation. Students strategically choose and efficiently implement procedures to solve linear equations in one variable, understanding that when they use the properties of equality and the concept of logical equivalence, they maintain the solutions of the original equation. Students solve systems of two linear equations in two variables and relate the systems to pairs of lines in the plane; these intersect, are parallel, or are the same line. Students use linear equations, systems of linear equations, linear functions, and their understanding of slope of a line to analyze situations and solve problems.

(2) Students grasp the concept of a function as a rule that assigns to each input exactly one output. They understand that functions describe situations where one quantity determines another. They can translate among representations and partial representations of functions (noting that tabular and graphical representations may be partial representations), and they describe how aspects of the function are reflected in the different representations.

(3) Students use ideas about distance and angles, how they behave under translations, rotations, reflections, and dilations, and ideas about congruence and similarity to describe and analyze two-dimensional figures and to solve problems. Students show that the sum of the angles in a triangle is the angle formed by a straight line, and that various configurations of lines give rise to similar triangles because of the angles created when a transversal cuts parallel lines. Students

Compacted Mathematics Grade 8 (with Integrated Math I)
(continued)

understand the statement of the Pythagorean Theorem and its converse, and can explain why the Pythagorean Theorem holds, for example, by decomposing a square in two different ways. They apply the Pythagorean Theorem to find distances between points on the coordinate plane, to find lengths, and to analyze polygons. Students complete their work on volume by solving problems involving cones, cylinders, and spheres.

In Integrated Mathematics I, the fundamental purpose of this course is to formalize and extend the mathematics that students learned in the middle grades. The critical areas deepen and extend understanding of linear relationships, in part by contrasting them with exponential phenomena, and in part by applying linear models to data that exhibit a linear trend. Integrated Mathematics I uses properties and theorems involving congruent figures to deepen and extend understanding of geometric knowledge from prior grades. The final unit in the course ties together the algebraic and geometric ideas studied. The Mathematical Practice Standards apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations. Each critical area is described below.

(1) By the end of eighth grade students have had a variety of experiences working with expressions and creating equations. In this first unit, students continue this work by using quantities to model and analyze situations, to interpret expressions, and by creating equations to describe situations.

(2) In earlier grades, students define, evaluate, and compare functions, and use them to model relationships between quantities. In this unit, students will learn function notation and develop the concepts of domain and range. They move beyond viewing functions as processes that take inputs and yield outputs and start viewing functions as objects in their own right. They explore many examples of functions, including sequences; they interpret functions given graphically, numerically, symbolically, and verbally, translate between representations, and understand the limitations of various representations. They work with functions given by graphs and tables, keeping in mind that, depending upon the context, these representations are likely to be approximate and incomplete. Their work includes functions that can be described or approximated by formulas as well as those that cannot. When functions describe relationships between quantities arising from a context, students reason with the units in which those quantities are measured. Students build on and informally extend their understanding of integer exponents to consider exponential functions. They compare and contrast linear and exponential functions, distinguishing between additive and multiplicative change. They interpret arithmetic sequences as linear functions and geometric sequences as exponential functions.

Compacted Mathematics Grade 8 (with Integrated Math I)
(continued)

(3) By the end of eighth grade, students have learned to solve linear equations in one variable and have applied graphical and algebraic methods to analyze and solve systems of linear equations in two variables. This unit builds on these earlier experiences by asking students to analyze and explain the process of solving an equation and to justify the process used in solving a system of equations. Students develop fluency writing, interpreting, and translating between various forms of linear equations and inequalities, and using them to solve problems. They master the solution of linear equations and apply related solution techniques and the laws of exponents to the creation and solution of simple exponential equations. Students explore systems of equations and inequalities, and they find and interpret their solutions. All of this work is grounded on understanding quantities and on relationships between them.

(4) This area builds upon prior students' prior experiences with data, providing students with more formal means of assessing how a model fits data. Students use regression techniques to describe approximately linear relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit.

(5) In previous grades, students were asked to draw triangles based on given measurements. They also have prior experience with rigid motions: translations, reflections, and rotations and have used these to develop notions about what it means for two objects to be congruent. In this unit, students establish triangle congruence criteria, based on analyses of rigid motions and formal constructions. They solve problems about triangles, quadrilaterals, and other polygons. They apply reasoning to complete geometric constructions and explain why they work.

(6) Building on their work with the Pythagorean Theorem in 8th grade to find distances, students use a rectangular coordinate system to verify geometric relationships, including properties of special triangles and quadrilaterals and slopes of parallel and perpendicular lines.

The content of this document is centered on the mathematics domains of **Counting and Cardinality** (Grade K), **Operations and Algebraic Thinking; Numbers and Operations in Base Ten** (Grades K-5); **Numbers and Operations—Fractions** (Grades 3-5); **Measurement and Data** (Grades K-5); **Ratios and Proportional Relationships** (Grades 6-7); **the Number System, Expressions & Equations, Geometry, Statistics & Probability** (Grades 6-8); **Functions** (Grade 8), and the high school conceptual categories of **Number and Quantity**, **Algebra**, **Functions**, **Modeling, Geometry**, and **Statistics & Probability**. Instruction in these domains and conceptual categories should be designed to expose students to experiences, which reflect the value of mathematics, to enhance students' confidence in their ability to do mathematics, and to help students communicate and reason mathematically.

Compacted Mathematics Grade 8 (with Integrated Math I)

Number and Quantity	
Quantities (N-Q)*	
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.2	Define appropriate quantities for the purpose of descriptive modeling.*
N-Q.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.*
Algebra	
Expressions and Expressions (EE)	
Analyze and solve linear equations and pairs of simultaneous linear equations	
8.EE.8	Analyze and solve pairs of simultaneous 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.*
Seeing Structure in Expressions (A-SSE)	
Interpret the structure of expressions	
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.*
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%.*

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Creating Equations (A-CED) *	
Create equations that describe numbers or relationships	
A-CED.1	Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.**
A-CED.2	Create equations in two variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.* *[Note this standard appears in future courses with a slight variation in the standard language.]*
A-CED.3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.**
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.**
Reasoning with Equations and Inequalities (A-REI)	
Solve equations and inequalities in one variable	
A-REI.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
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 algebraically, exactly, and graphically while focusing on pairs of linear equations in two variables.
Represent and solve equations and inequalities graphically	
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, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, quadratic, absolute value, and exponential functions.*
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), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

Compacted Mathematics Grade 8 (with Integrated Math I)

Functions

Functions (F)

Define, evaluate, and compare functions	
8.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. [1]
8.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.*
8.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	
8.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.
8.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.

Interpreting Functions (F-IF)

Understand the concept of a function and use function notation	
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 whose domain is a subset of the integers.

Compacted Mathematics Grade 8 (with Integrated Math I)

Interpret functions that arise in applications in terms of the context	
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; end behavior; and periodicity.**
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.*
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 functions (linear and quadratic) and show intercepts, maxima, and minima.
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.*
Building Functions (F-BF)	
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 or steps for calculation from a context.
F-BF.2	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.*
Linear, Quadratic, and Exponential Models (F-LE) *	
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.* a. Prove that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals. 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.

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F-LE.2	Construct linear and exponential functions, including arithmetic and geometric 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 or exponential function in terms of a context.*
Geometry	
Geometry (G)	
Understand and apply the Pythagorean Theorem	
8.G.6	Explain a proof of the Pythagorean Theorem and its converse.
8.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.
8.G.8	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
Congruence (G-CO)	
Experiment with transformations in the plane	
G-CO.1	Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.
G-CO.2	Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).
G-CO.3	Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
G-CO.4	Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
G-CO.5	Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
Understand congruence in terms of rigid motions	
G-CO.6	Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.

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G-CO.7	Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.
G-CO.8	Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.
Prove geometric theorems	
G-CO.9	Prove theorems about lines and angles. *Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.*
G-CO.10	Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.*
G-CO.11	Prove theorems about parallelograms. *Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.*

Statistics and Probability

Statistics and Probability (SP)

Investigate patterns of association in bivariate data	
8.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.
8.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.
8.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.*
8.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. 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 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?*

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Interpreting Categorical and Quantitative Data (S-ID)	
Summarize, represent, and interpret data on a single count or measurement variable	
S-ID.1	Represent and analyze 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 different data sets.*
S-ID.3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).*
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.*
S-ID.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.* a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. *Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.* c. Fit a linear function for a scatter plot that suggests a linear association.
Interpret linear models	
S-ID.7	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.*
S-ID.8	Compute (using technology) and interpret the correlation coefficient of a linear fit.*
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