Office of Academic Education
Effective Date: 2025-2026 School Year
7 Miss. Admin. Code, Part 135

2025 Mississippi College- and Career-Readiness Standards

Mathematics

MISSISSIPPI DEPARTMENT OF EDUCATION

Mississippi Department of Education

Lance Evans, Ed.D.
State Superintendent of Education

Donna Boone, Ph.D.
Chief Academic Officer

Wendy Clemons
Associate State Superintendent
Office of Secondary Education

Michelle Nowell, Ph.D.
Executive Director
Office of Elementary Education and Reading

Ma'Kesha Adams
Director of Curriculum & Instruction
Office of Secondary Education

Tommisha Johnson, Ed.S.
State K–12 Mathematics Director
Office of Secondary Education

Table of Contents

Acknowledgements

2025 Mississippi College- and Career-Readiness Standards (MS CCRS) for Mathematics Review Committee

The Mississippi Department of Education gratefully acknowledges the hard work of the following individuals for their involvement and feedback in the readoption process of the 2025 Mississippi College- and Career-Readiness Standards for Mathematics.

Ranella Anderson, Ph.D.
Jackson Public School District

Rebecca Anderson
Harrison County School District

Melinda Austin
Desoto County School District

Jamel Boatman
Holmes County Consolidated School District

Kasey Blankenship
Madison County School District

Lindsey Byerley
Harrison County School District

Elizabeth Cook
Mississippi Department of Education

Lisia Cook
Vicksburg-Warren School District

Candis Crigler
Petal School District

Amy Davis, Ed.S.
Union County School District

Susan Dunkley
Lamar County School District

Mary Elizabeth Garcia
Rankin County School District

Rosie Gillispie, Ed.S.
Madison County School District

Lateeah Grady-Keller
West Jasper Consolidated School District

Kelsey Hill
Jackson Public School District

Rufus Hill, Ed.S.
Mississippi Department of Education

Julie James, Ph.D.
University of Mississippi-CMSE

Tommisha Johnson, Ed.S.
Mississippi Department of Education

Austyn Jones
Biloxi Public School District

Cicely Jones
Hattiesburg Public School District

Bethany LaValley, Ph.D.
University of Mississippi-CMSE

Kim Minshew
Rankin County School District

Marlena Nance
Mississippi Department of Education

Peggy Pylate
Pascagoula-Gautier School District

Pamela Rayburn, Ed.S.
Madison County School District

Alice Steimle, Ph.D.
University of Mississippi-CMSE

Kandra Wilkins
University of Mississippi-MDE

Kanequa Willis, Ed.S.
Mississippi Department of Education

Candies Winfun-Cook, Ph.D.
Oxford School District

Readoption Process

2025 MS CCR Standards for Mathematics

The 2016 Mississippi College- and Career-Readiness Standards (MS CCRS) were reviewed through a stakeholder survey, as no national updates necessitated a full-scale revision. The survey aimed to validate the standards or identify specific areas for review to ensure continued relevance and alignment with educational goals.

The survey included three sections:

1. **Demographics:** Collected data on respondents' congressional district, grade levels taught, teaching experience, role, highest degree, and notable achievements.
2. **Standards Rating:** Used a Likert scale to evaluate perceptions of the MS CCRS, assessing clarity, grade-level progression, relevance to real-world skills, and alignment with workplace competencies like problem-solving and collaboration.
3. **Standards Review (Optional):** Allowed respondents to submit specific standards for review, focusing on clarity, grade-level appropriateness, learning progression, and content accuracy, accompanied by actionable feedback.

The survey yielded 418 responses, with 77 submissions of a K-12 Mathematics standard for review.

The mathematics review committee included a diverse group of veteran educators from all congressional districts with specific grade band experience, aided by 6 MDE employees serving as facilitators or note-takers. Each mathematics review committee comprised seven members for each grade band, K–5, 6–8, and 9–12. The committee reviews resulted in 15 total edits to the mathematics standards: five in grades K–5, three in grades 6–8, and seven in the high school courses.

For a full list of edits, refer to the 2016 and 2025 Standards Comparison Guide in Appendix C.

Introduction

Mission Statement

The Mississippi Department of Education (MDE) 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 2025 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 2025 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 within the state of Mississippi, 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 revised or developed in alignment with the (MS CCRS) for Mathematics include Foundations of Algebra, Advanced Technical Mathematics, Advanced Mathematics Plus, Algebra III (formerly Pre-Calculus), and Calculus.

The Southern Regional Education Board (SREB) Ready for High School Math serves as a transition course to high school mathematics, while the Essentials for College Math and SREB Math Ready courses act as transition courses to college mathematics.

Implementation

The required year for the 2025 Mississippi College- and Career-Readiness Standards for Mathematics is 2025-2026.

Overview

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.

2025 MSCCRS for Mathematics Instructional Framework

Vision for Mathematics Education

The instructional framework for the 2025 Mississippi College- and Career-Readiness Standards (MS CCRS) in Mathematics encapsulates the vision for ensuring that all Mississippi students are equipped with the mathematical knowledge and skills necessary to access higher education opportunities, thrive in professional careers, and become informed citizens capable of understanding and influencing the world around them.

This framework is a dynamic, interconnected approach to mathematics education that integrates the Instructional Shifts for Mathematics, Standards for Mathematical Content, Standards for Mathematical Practice, Effective Mathematics Teaching Practices, and the National Council of Teachers of Mathematics (NCTM) Position Statements. These elements collectively contribute to the development of a mathematically proficient individual. The cyclical structure of the framework emphasizes that all components are essential and interconnected. This continuous integration of practices, standards, and values ensures a robust and coherent mathematics education program for Mississippi's public schools.

Instructional Shifts for Mathematics

The Instructional Shifts for Mathematics emphasize changes in mathematics teaching to improve student outcomes. These shifts, grounded in the MS CCRS, promote:

1. **Focus:** Focus where the Standards focus.

The MS CCRS calls for a greater focus in mathematics. Focus means significantly narrowing the scope of content in each grade so that students achieve at higher levels and experience more deeply that which remains. Rather than racing to cover many topics in a mile-wide, inch-deep curriculum, the MS CCRS are intentionally designed with a clear focus on key concepts and skills at each grade level. This instructional shift requires teachers to narrow and deepen significantly the way time and energy is spent in the classroom. With a greater focus on fewer topics, instruction is directed toward deeply engaging with the major work of each grade level as follows:

- In grades K–2: Concepts, skills, and problem solving related to addition, subtraction, and place value
- In grades 3–5: Concepts, skills, and problem solving related to multiplication and division of whole numbers and fractions
- In grade 6: Ratios and proportional relationships, and early algebraic expressions and equations
- In grade 7: Ratios and proportional relationships, and arithmetic of rational numbers
- In grade 8: Linear algebra and linear functions
- In HS courses: CCRS content Widely Applicable as Prerequisites for a Range of College Majors, Postsecondary Programs and Careers[1]

The strong focus of the Standards in early grades is arithmetic, along with the components of measurement that support it. That includes the concepts underlying arithmetic, the skills of arithmetic computation, and the ability to apply arithmetic to solve problems and put arithmetic to engaging uses. Arithmetic in the K–5 standards is an important life skill, as well as a thinking subject and a rehearsal for algebra in the middle grades. This focus will help students gain strong foundations, including a solid understanding of concepts, a high degree of procedural skill and fluency, and the ability to apply the math they know to solve problems inside and outside the classroom.

Focus remains important through the middle and high school grades in order to prepare students for college and careers. National surveys have repeatedly concluded that postsecondary instructors value greater mastery of a smaller set of prerequisites over shallow exposure to a wide array of topics so that students can build on what they know and apply what they know to solve substantial problems. Therefore, a college- and career-ready curriculum should devote most of the high school students' time to building the knowledge and skills that are the essential prerequisites for a wide range of college majors, post-secondary programs, and careers.

2. **Coherence:** Think across grades/courses and link to major topics within each grade/course.

Coherence is about making math make sense. Mathematics is not a list of disconnected topics, tricks, or mnemonics; it is a coherent body of knowledge made up of interconnected concepts. Ensuring coherence involves attending to connections between topics, where the learning connects across grades and links to major mathematical ideas, ensuring a logical progression of concepts. Consequently, the Standards are designed around coherent progressions that build and expand knowledge from grade to grade.

To achieve coherence, vertical connections are crucial: these are the links from one grade to the next that allow students to progress in their mathematical education. For example, a kindergarten student might add two numbers using a "count all" strategy, but grade 1 students are expected to use "counting on" and more sophisticated strategies. In 4th grade, students must "apply and extend previous understandings of multiplication to multiply a fraction by a whole number" (Standard 4.NF.4). This extends to 5th grade, when students are expected to build on that skill to "apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction" (Standard 5.NF.4). Each standard is not a new event, but an extension of previous learning. Therefore, it is critical for teachers to think across grades and examine the progressions in the standards to see how major content develops over time.

Coherence across grades relies on the careful, deliberate, and progressive development of ideas within each grade level. This intentional progression ensures that foundational concepts are solidified before moving to more complex ideas.[2] In high school, a lack of coherence often leads to students memorizing too many isolated techniques without understanding the underlying structure that connects them. Emphasizing coherence reduces this clutter in the curriculum. For instance, recognizing that the distance formula and the trigonometric identity $\sin^2(t) + \cos^2(t) = 1$ are both rooted in the Pythagorean theorem helps students understand and reconstruct these concepts rather than merely memorizing them.

It should also be noted that the Standards do not specify the progression of material within a single grade, but connections at a single grade level can be used to improve focus by closely linking secondary topics to the major work of the grade. For example, in grade 3, bar graphs are not "just another topic to cover." Rather, the standard about bar graphs asks students to use information presented in bar graphs to solve word problems using the four operations of arithmetic. Instead of allowing bar graphs to detract from the focus on arithmetic, the Standards are showing how bar graphs can be positioned in support of the major work of the grade. In this way, coherence can also support focus.

To help identify coherence, the Standards within each domain, or conceptual categories in high school, are organized under cluster headings. These cluster headings play a vital role in connecting related concepts, building on prior knowledge, and extending learning to future concepts.

3. **Rigor**: Maintain Pursue conceptual understanding, procedural skill and fluency, and application with equal intensity.

Rigor refers to a deep, authentic command of mathematical concepts, not making math harder or introducing topics at earlier grades. To help students meet the expectations of the Standards, educators will need to pursue, with equal intensity, three aspects of rigor in the major work of each grade: (1) conceptual understanding, (2) procedural skill and fluency, and (3) applications.

Conceptual understanding: The standards call for conceptual understanding of key concepts, such as place value and ratios. Students must be able to access concepts from a number of perspectives in order to see math as more than a set of mnemonics or discrete procedures.

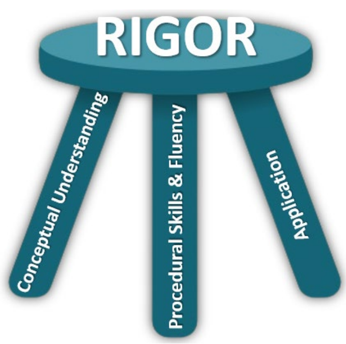
Procedural skills and fluency: The standards call for speed and accuracy in calculation. Students must practice core functions, such as single-digit multiplication, in order to have access to more complex concepts and procedures. Fluency must be addressed in the classroom or through supporting materials, as some students might require more practice than others.

> **NOTE:** The Standards for Mathematical Practice set expectations for using mathematical language and representations to reason, solve problems, and model. These expectations are related to fluency: precision in the use of language, seeing structure in expressions, and reasoning from the concrete to the abstract correspond to high orders of fluency in the acquisition of mathematical language, especially in the form of symbolic expressions and graphs. Though the High School content standards do not set explicit expectations for fluency, fluency is important in high school mathematics. High School mathematics builds new and more sophisticated fluencies on top of the earlier fluencies from K-8 that centered on numerical calculation.

Application: The standards call for students to use math in situations that require mathematical knowledge. Correctly applying mathematical knowledge depends on students having a solid conceptual understanding and procedural fluency.

Identifying the aspect of Rigor called for by the Standard: The language of the Standards provides clear clues to the specific aspect of rigor being emphasized, guiding educators in aligning instruction to the intended focus. Words such as "understand" are used in the Standards to set explicit expectations for conceptual understanding, and those such as "fluently" are used to set explicit expectations for fluency. Phrases like "real-world problems" are used to highlight opportunities for application, while the star symbol (*) flags opportunities for modeling. (Modeling is both a Standard for Mathematical Practice and a content category in High School.)

The image of a three-legged stool effectively represents the instructional shift of rigor, illustrating how students' mathematical proficiency and mastery of content rely on three essential components: conceptual understanding, procedural skill and fluency, and application. Just as a stool cannot stand with one leg removed, a student's mathematical foundation becomes unstable if any one of these components is neglected, underscoring the importance of maintaining balance and emphasis on all three to fully support student success.



Instruction that overemphasizes one aspect of rigor at the expense of others should be avoided. For example, stressing fluency in computation without incorporating conceptual understanding undermines students' ability to make sense of algorithms and learn them effectively. Similarly, focusing solely on conceptual understanding without dedicating time to developing fluency fails to prepare students for practical applications. Overemphasizing pure mathematics neglects the motivational and practical benefits of real-world applications, while a focus solely on applications disregards the foundational understanding necessary for deeper mathematical learning. Such imbalances place unnecessary strain on teachers and students. Instead, instruction should aim to integrate and balance all three components of rigor—conceptual understanding, fluency, and application—within the major work of each grade.

[1] See Table 6, Appendix C.

[2] See the MS CCRS Progressions Document, https://mathematicalmusings.org/

Standards for Mathematical Content

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 (SMPs) describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council's report Adding It Up: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy).

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

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

2. Reason abstractly and quantitatively.

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

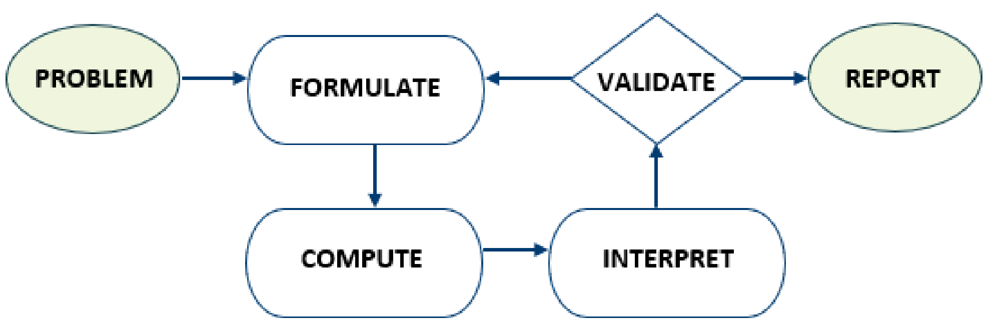
Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well-remembered $7 \times 5 + 7 \times 3$, 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 $\frac{(y-2)}{(x-1)} = 3$. 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.

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.

Connecting the Standards for Mathematical Practice to the Standards for Mathematics Content

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.

The Effective Mathematics Teaching Practices

An excellent mathematics program requires effective teaching that engages students in meaningful learning through individual and collaborative experiences that promote their ability to make sense of mathematical ideas and reason mathematically (*Principles to Actions: Ensuring Mathematical Success for All*, NCTM, 2014).

The eight Effective Mathematics Teaching Practices (EMTPs) provide a framework for strengthening the teaching and learning of mathematics. This research-informed framework of teaching and learning identifies these eight Mathematics Teaching Practices, which represent a core set of high-leverage practices and essential teaching skills necessary to promote deep mathematics learning.

1. Establish mathematics goals to focus learning.

Effective teaching of mathematics establishes clear goals for the mathematics that students are learning, situates goals within learning progressions, and uses the goals to guide instructional decisions.

2. Implement tasks that promote reasoning and problem solving.

Effective teaching of mathematics engages students in solving and discussing tasks that promote mathematical reasoning and problem solving and allow multiple entry points and varied solution strategies.

3. Use and connect mathematical representations.

Effective teaching of mathematics engages students in making connections among mathematical representations to deepen understanding of mathematics concepts and procedures and as tools for problem solving.

4. Facilitate meaningful mathematical discourse.

Effective teaching of mathematics facilitates discourse among students to build a shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments.

5. Pose purposeful questions.

Effective teaching of mathematics uses purposeful questions to assess and advance students' reasoning and sense making about important mathematical ideas and relationships.

6. Build procedural fluency from conceptual understanding.

Effective teaching of mathematics builds fluency with procedures on a foundation of conceptual understanding so that students, over time, become skillful in using procedures flexibly as they solve contextual and mathematical problems.

7. Support productive struggle in learning mathematics.

Effective teaching of mathematics consistently provides students, individually and collectively, with opportunities and supports to engage in productive struggle as they grapple with mathematical ideas and relationships.

8. Elicit and use evidence of student thinking.

Effective teaching of mathematics uses evidence of student thinking to assess progress toward mathematical understanding and to adjust instruction continually in ways that support and extend learning.

Connecting the Effective Mathematics Teaching Practices to the Standards for Mathematical Practices

The **Effective Mathematics Teaching Practices (EMTPs)**, as outlined by the National Council of Teachers of Mathematics (NCTM), provide actionable strategies for educators to facilitate meaningful mathematics instruction. The **Standards for Mathematical Practice (SMPs)**, embedded in the Mississippi College- and Career-Readiness Standards (MS CCRS), describe the mathematical behaviors and dispositions students should develop. Aligning the EMTPs with the SMPs creates a coherent framework that ensures teaching practices elicit and cultivate the desired practices in students. Below, is a sample of how the EMTPs can be connected to corresponding SMPs to illustrate how teachers can use high-leverage strategies to promote these behaviors.

EMTP 1: Establish mathematics goals to focus learning ↔ EMTP 8: Elicit and use evidence of student thinking

Establishing clear, specific mathematical goals provides instruction focus and direction, ensuring that teachers and students have a shared understanding of the intended learning outcomes. These goals create a framework for teachers to identify and assess evidence of student thinking during lessons. By eliciting and using this evidence, teachers can monitor student progress toward the learning goals, make informed instructional adjustments, and provide targeted feedback. Together, these practices create a cohesive system where goals guide learning, and evidence ensures that the learning is meaningful, precise, and aligned with the desired outcomes.

EMTP 2: Implement tasks that promote reasoning and problem solving ↔ SMP 2: Reason abstractly and quantitatively

High-quality tasks encourage students to reason abstractly by analyzing the relationships between quantities and engage quantitatively by contextualizing problems, fostering a balance between intuition and logic.

EMTP 4: Facilitate meaningful mathematical discourse and EMTP 5: Pose purposeful questions ↔ SMP 3: Construct viable arguments and critique the reasoning of others

Meaningful discourse and purposeful questioning provide students opportunities to articulate their reasoning, critique the logic of peers, and build strong arguments, creating a collaborative and reflective mathematical culture.

EMTP 3: Use and connect mathematical representations ↔ SMP 4: Model with mathematics and SMP 5: Use appropriate tools strategically

By engaging students in varied representations, teachers help them model real-world situations effectively and make strategic decisions about which tools and representations best support their problem-solving processes.

EMTP 6: Build procedural fluency from conceptual understanding ↔ SMP 7: Look for and make use of structure and SMP 8: Look for and express regularity in repeated reasoning

Building fluency from conceptual understanding ensures students recognize patterns and structures, enabling them to approach problems efficiently and with a strong conceptual foundation that supports long-term success.

EMTP 7: Support productive struggle in learning mathematics ↔ SMP 1: Make sense of problems and persevere in solving them and SMP 6: Attend to precision

Encouraging productive struggle allows students to grapple with challenging tasks, promoting perseverance and careful attention to detail as they refine their understanding and develop mathematical resilience.

The alignment between EMTPs and SMPs emphasizes the interdependence of effective teaching practices and student mathematical behaviors. By leveraging these connections, educators can create dynamic and responsive instructional environments that foster both procedural skill and conceptual understanding, ensuring all students are equipped for success in mathematics and beyond.

NCTM Position Statements

Access and Equity in Mathematics Education

The Mississippi Department of Education (MDE) strongly advocates for fostering access and equity in all mathematics classrooms to ensure that every student can succeed. Achieving access and equity in mathematics education requires maintaining high expectations, providing access to high-quality curriculum and instruction, allocating adequate learning time, and employing differentiated strategies to effectively engage all students. Educators must believe in the potential of every student and focus on creating opportunities for growth through challenging curriculum, innovative technologies, extracurricular offerings, and tailored supports. Collaboration among teachers and specialists is crucial for addressing diverse student needs, fostering growth mindsets, and implementing equitable teaching practices. High-quality professional development is essential to equip educators with the skills and knowledge needed to support success for all learners.

The **Access and Equity in Mathematics Education** Position of the National Council of Teachers of Mathematics (NCTM) states:

> "Creating, supporting, and sustaining a culture of access and equity require being responsive to students' backgrounds, experiences, cultural perspectives, traditions, and knowledge when designing and implementing a mathematics program and assessing its effectiveness. Acknowledging and addressing factors that contribute to differential outcomes among groups of students are critical to ensuring that all students routinely have opportunities to experience high-quality mathematics instruction, learn challenging mathematics content, and receive the support necessary to be successful. Addressing equity and access includes both ensuring that all students attain mathematics proficiency and increasing the numbers of students from all racial, ethnic, linguistic, gender, and socioeconomic groups who attain the highest levels of mathematics achievement." (*NCTM, 2014,* **http://www.nctm.org**.)

Teaching Mathematics to Students with Disabilities

The MDE strongly advocates for ensuring that students with disabilities receive the necessary supports to succeed in mathematics.

Students with disabilities have the right to equitable access and appropriate support that enable them to succeed with grade- or course-level mathematics content. High-quality instruction, aligned with rigorous academic standards and targeted interventions, is crucial for their achievement. Additionally, it is essential that educators believe in the abilities of all students, creating a supportive learning environment where students with disabilities are empowered to reach their full potential in mathematics.

The **Teaching Mathematics to Students with Disabilities** Position of the National Council for Teachers of Mathematics (NCTM) and the Council for Exceptional Children (CEC) states:

> “The National Council of Teachers of Mathematics (NCTM) and the Council for Exceptional Children (CEC) jointly recognize the important role of educators in ensuring students with disabilities have access to and success with grade/course-level standards, receive high-quality instruction and are supported by systems that believe in their abilities." (NCTM, 2024, http://www.nctm.org.*)*

High Expectations

The MDE strongly advocates for maintaining high expectations in mathematics education by fostering mathematical communities focused on ensuring all students have access to challenging tasks and curricula that emphasize reasoning, problem-solving, and real-world applications.

Students bring diverse mathematical understandings and backgrounds to the classroom, which can be leveraged to enhance learning for all. These differences highlight individual strengths in various mathematical problems and topics, supporting their identity as accomplished learners. To maintain high expectations, it is essential to foster classroom experiences that create a mathematical community—one focused on problem-solving, communication, and making sense of mathematics. Engaging students in challenging tasks that require effort and perseverance builds motivation and strengthens their mathematical reasoning and problem-solving skills.

The **High Expectations** Position of the National Council for Teachers of Mathematics (NCTM) states:

> “To teach mathematics with high expectations means that teachers (1) recognize that each and every student, from prekindergarten through college, is able to solve challenging mathematical tasks successfully; (2) build in each student a positive mathematical identity and a sense of agency; (3) design instruction that builds on students’ prior knowledge and experiences; (4) teach in ways that ensure that each and every student is reasoning and making sense of mathematics on a daily basis; and (5) reflect on ways that tasks and teaching can be improved to provide greater access, challenge, and support for every learner. " (*NCTM, 2016,* http://www.nctm.org*.)*

Procedural Fluency: Reasoning and Decision-Making, Not Rote Application of Procedures

The MDE emphasizes the importance of the effective development of procedural fluency. Procedural fluency is the ability to apply mathematical procedures efficiently, flexibly, and accurately, transfer them to different contexts, and recognize when a particular strategy is more appropriate. It goes beyond simple memorization of algorithms and includes relational thinking and strategic reasoning. Ensuring that conceptual understanding precedes procedural instruction and that both are explicitly connected meaningfully is crucial. Students should be exposed to various strategies and taught basic facts using number relationships rather than rote memorization. Effective assessment methods attend to efficiency and flexibility, avoiding timed tests that may hinder students. High-quality teaching of procedural fluency positions students as capable learners with reasoning and decision-making skills at the core, fostering mathematical agency.

The **Procedural Fluency: Reasoning and Decision-Making, Not Rote Application of Procedures** Position of the National Council for Teachers of Mathematics (NCTM) states:

> "Procedural fluency is an essential component of equitable teaching and is necessary to developing mathematical proficiency and mathematical agency. Each and every student must have access to teaching that connects concepts to procedures, explicitly develops a reasonable repertoire of strategies and algorithms, provides substantial opportunities for students to learn to choose from among the strategies and algorithms in their repertoire, and implements assessment practices that attend to all components of fluency." *(NCTM, 2023,* **http://www.nctm.org***.)*

Curricular Coherence

The Mississippi Department of Education (MDE) strongly advocates for the adoption and implementation of a high-quality mathematics curriculum in all schools.

A well-articulated, high-quality, and coherent mathematics curriculum is essential for establishing clear learning goals, supporting teachers in understanding students' pathways through mathematical progressions, and fostering conceptual understanding. As described in *Principles and Standards for School Mathematics* (NCTM, 2000), such a curriculum emphasizes the development of key mathematical ideas across grades, specifying when concepts and skills should be introduced and mastered. High-quality curricula situate mathematics in problem-solving contexts, promoting students' understanding and reasoning while linking topics within and across mathematical domains to present mathematics as a unified discipline. Schools, districts, and publishers play a critical role by providing resources, professional learning communities (PLCs), and time for collaboration, ensuring teachers can adopt consistent instructional strategies, assessments, and tools that create a cohesive learning environment with clear and consistent expectations for all students.

The **Curriculum Coherence and Open Education Resources** Position of the National Council for Teachers of Mathematics (NCTM) states:

> "A coherent, well-articulated curriculum is an essential tool for guiding teacher collaboration, goal-setting, analysis of student thinking, and implementation. In a time when open educational resources are increasingly available, it is imperative that teachers be provided with curricular materials that clearly lay out well-reasoned organizations of student learning progressions with regard to mathematical content and reasoning. " (*NCTM, 2016,* **http://www.nctm.org**.)

Equitable Integration of Technology for Mathematics

The MDE strongly advocates for the use of technology in all mathematics classrooms and recognizes its pivotal role in advancing mathematics education. It enables students to identify, interpret, evaluate, and critique the mathematics embedded in various social, scientific, commercial, and political contexts. Technology influences the mathematics that is taught and enhances students' learning.

As a catalyst for change and innovation, technological advancements allow for the creation of mathematical models and the exploration of large data sets, fundamentally transforming how mathematics is taught and learned. It is essential that these technological developments are thoughtfully integrated into mathematics programs and classrooms to keep the focus on effective and meaningful student learning experiences.

The appropriate use of instructional technology is to be integrated throughout the 2025 Mississippi College- and Career-Readiness Standards for Mathematics. Teaching strategies at each grade level course incorporate technology in the form of instructional software, physical or virtual manipulatives, online resources, and calculators in grades 6-12.

The **Equitable Integration of Technology for Mathematics Learning** Position of the National Council for Teachers of Mathematics (NCTM) states:

> " Using the capabilities of technology is essential for educators and learners to inform and transform how they learn, experience, communicate, assess, and do mathematics. Technology should be used to develop and deepen learner understanding, stimulate interest in the mathematics being learned, and increase mathematical proficiency. When

> technology is used strategically, it provides more equitable access and opportunities for each and every learner to actively engage and participate in the learning of mathematics." (*NCTM, 2023,* http://www.nctm.org.)

Artificial Intelligence and Mathematics Teaching

The MDE strongly advocates for the equitable integration of technology in all mathematics classrooms. With widely available technology tools, it is crucial for educators to consider the capabilities, benefits, risks, and ethical ramifications associated with using Artificial Intelligence (AI).

Historical context shows that mathematics educators have long grappled with the integration of knowledge-generating tools like calculators and search engines, and now AI tools. While these tools offer computational assistance, they do not replace the need for teaching math fundamentals and problem-solving skills. AI outputs can be biased or inaccurate, so it is crucial to educate students on verifying and using primary sources. The use of AI tools encourages a shift from shallow assessments to those that blend computational skills with creative problem solving, emphasizing a deeper understanding of mathematical concepts. AI tools can also facilitate personalized learning by reducing the need for creating multiple test versions, streamlining the assessment process while maintaining focus on core learning goals.

The **Artificial Intelligence and Mathematics Teaching** Position of the National Council for Teachers of Mathematics (NCTM) states:

> " Artificial Intelligence (AI)-driven tools can respond to students' thinking and interests in ways that previous tools could not. By drawing from large language sets, AI has the potential to adjust application-based problems to student interests and identify the sense students have made even in their incorrect answers. Students will continue to need teachers' mathematical, pedagogical, and relational expertise, though teachers are also likely to benefit from AI-driven tools. In some cases, AI may serve as a teaching assistant, but students will need teachers to help them create a bridge between prior knowledge, new knowledge, and shared knowledge. Teachers must tell students to be very skeptical about AI results, especially about the unique challenges of using tools that may have been trained on biased datasets. This skepticism can be woven into existing pedagogical and assessment techniques. Knowing this, educators need to be involved in developing and testing AI tools in math education to stay up to date with current AI trends to best prepare students for an AI future. Contrary to some popular opinions, this effort will require teachers with even deeper knowledge of math instruction and assessment—math teachers with more experience, not less.." (*NCTM, 2024,* http://www.nctm.org.)

Document Organization

The MS CCRS encompass all currently available mathematics course options for grades K–12 and is organized into grade bands: Lower and Upper Elementary (K–5), Middle School (6–8), and High School (9–12).

- **For grades K–8**, the standards are grouped by **conceptual domains**, which are further broken down into smaller clusters.
- **For high school**, the standards are organized by **major conceptual categories**, which are then divided into domains and clusters.

To provide a visual reference, the conceptual domains and categories are color-coded to highlight the progression of content across grades K–12. *Refer to the Mathematics Concept Progression Diagram on page 31*.

The domains and conceptual categories for each grade level are as follows:

- **Grade K:** Counting and Cardinality
- **Grades K–5:** Operations and Algebraic Thinking; Numbers and Operations in Base Ten; Numbers and Operations—Fractions (Grades 3–5); Measurement and Data
- **Grades 6–8:** Ratios and Proportional Relationships (Grades 6–7); The Number System; Expressions and Equations; Geometry; Statistics and Probability; Functions (Grade 8)
- **High School (Grades 9-12):** Number and Quantity; Algebra; Functions; Modeling; Geometry; Statistics and Probability

The following two pages provide guidance on **how to read the standards**, offering clarity for interpretation. After the standards, the appendices include a **Glossary**, **Tables**, and **Additional Resources**.

How to Read K–8 Grade Level Standards

Counting and Cardinality (CC)[1]

Know Number Names and the Count Sequence[2]

Identifier[3]	Standard[4]
K.CC.1 • *Grade Level* • *Conceptual Domain* • *Standard Number*	• Count to 100 by ones. • Count to 100 by tens.

Note[5]

[1] **Conceptual domains** are larger groups of related standards. Standards from different domains may sometimes be closely related.

[2] **Standard Cluster heading—Clusters** are groups of related standards within a domain. Note that standards from different clusters may sometimes be closely related, because mathematics is a connected subject.

[3] **Standards Identifiers** - K-8 courses follow the identification pattern *Grade level.Conceptual Domain. Standard Number*

[4] **Standards** define what students should understand and be able to do.

[5] **Footnotes** provide additional information or clarification about specific standards or concepts. They often include explanations, examples, or references to related standards to support deeper understanding or application.

These Standards do not dictate curriculum or teaching methods. *For example, just because topic A appears before topic B in the standards for a given grade, does not necessarily mean that topic A must be taught before topic B.*

How to Read High School Course Standards

Number and Quantity (N)[1]

Quantities (N-Q) [2] *

Use Properties of Rational and Irrational Numbers[3]

Identifier[5]	**Standard**[4]
N-Q.1 • *Conceptual Category* • *Conceptual Domain* • *Standard Number*	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. *[6]

Note[7]

[1] **Conceptual categories** portray a coherent view of high school mathematics and cross a number of traditional course boundaries, potentially up through and including calculus.

[2] **Conceptual domains** are larger groups of related standards within a conceptual category. Standards from different conceptual domains may sometimes be closely related.

[3] **Standard Cluster heading—Clusters** are groups of related standards within a domain. Note that standards from different clusters may sometimes be closely related, because mathematics is a connected subject.

[4] **Standards** define what students should understand and be able to do.

[5] **Standards Identifiers** - HS courses follow the identification pattern *Conceptual Category-Conceptual Domain. Standard Number*.

> ***Additional Note:*** The HS courses Foundations of Algebra, Advanced Technical Math, Advanced Mathematics Plus, and Calculus follow the identification of *Course Name.Conceptual Category.Standard Number* (i.e., the Calculus course, Conceptual Category Algebra, standard one would read as C.A.1).

[6] **Modeling Standards** appear throughout the high school standards indicated by a star symbol (*). The star symbol sometimes appears on the heading for a group of standards; in that case, it should be understood to apply to all standards in that group.

[7] **Footnotes** provide additional information or clarification about specific standards or concepts. They often include explanations, examples, or references to related standards to support deeper understanding or application.

These Standards do not dictate curriculum or teaching methods. *For example, just because topic A appears before topic B in the standards for a given grade, does not necessarily mean that topic A must be taught before topic B.*

Mathematics Conceptual Progression

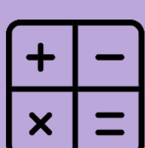
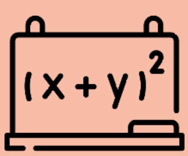
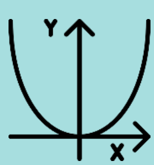
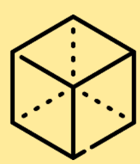
Kindergarten-Grade 8

Conceptual Domains

K	1	2	3	4	5	6	7	8
Counting and Cardinality (CC)								
Number and Operations in Base Ten (NBT)						Ratios and Proportional Relationships (RP)		
			Number and Operations—Fractions (NF)			The Number System (NS)		
Operation and Algebraic Thinking (OA)						Expressions and Equations (EE)		
								Functions (F)
Geometry (G)								
Measurement and Data (MD)						Statistics and Probability (SP)		

High School

Conceptual Categories

Number and Quantity (N)	Algebra (A)	Functions (F)	Geometry (G)	Statistics and Probability (S)
				

Elementary School

Grades K-5

CCR Math Kindergarten

In Kindergarten, instruction should focus on two critical areas: (1) representing, relating, and operating on whole numbers- initially with sets of objects; and (2) describing shapes and space. More learning time in Kindergarten should be devoted to number than to other topics. Each critical area is described below.

(1) Students use numbers, including written numerals, to represent quantities and to solve quantitative problems, such as counting objects in a set; counting out a given number of objects; comparing sets or numerals; and modeling simple joining and separating situations with sets of objects, or eventually with equations such as 5 + 2 = 7 and 7 – 2 = 5. (Kindergarten students should see addition and subtraction equations, and student writing of equations in kindergarten is encouraged, but it is not required.) Students choose, combine, and apply effective strategies for answering quantitative questions, including quickly recognizing the cardinalities of small sets of objects, counting and producing sets of given sizes, counting the number of objects in combined sets, or counting the number of objects that remain in a set after some are taken away.

(2) Students describe their physical world using geometric ideas (e.g., shape, orientation, spatial relations) and vocabulary. They identify, name, and describe basic two-dimensional shapes, such as squares, triangles, circles, rectangles, and hexagons, presented in a variety of ways (e.g., with different sizes and orientations), as well as three-dimensional shapes such as cubes, cones, cylinders, and spheres. They use basic shapes and spatial reasoning to model objects in their environment and to construct more complex shapes.

The content of this grade level is centered on the mathematics domains of **Counting and Cardinality** (Grade K), **Operations and Algebraic Thinking** (Grades K-5), **Numbers and Operations in Base Ten** (Grades K-5), **Measurement and Data** (Grades K-5), and **Geometry** (Grades K-8). Instruction in these domains should be designed to expose students to experiences that reflect the value of mathematics, enhance students' confidence in their ability to do mathematics, and help students communicate and reason mathematically.

College- and Career-Readiness Standards:
Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
K.SMP.1	Make sense of problems and persevere in solving them.
K.SMP.2	Reason abstractly and quantitatively.
K.SMP.3	Construct viable arguments and critique the reasoning of others.
K.SMP.4	Model with mathematics.
K.SMP.5	Use appropriate tools strategically.
K.SMP.6	Attend to precision.
K.SMP.7	Look for and make use of structure.
K.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but **required** standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

Elementary-Grades—Conceptual Domain:

Counting and Cardinality (CC)

Know Number Names and the Count Sequence

Identifier	Standard
K.CC.1	a. Count to 100 by ones. b. Count to 100 by tens.
K.CC.2	Count forward beginning from a given number within the known sequence (instead of having to begin at 1).
K.CC.3	Write numbers from 0 to 20. Represent a number of objects with a written numeral 0-20 (with 0 representing a count of no objects).

Count to Tell the Number of Objects

Identifier	Standard
K.CC.4	Understand the relationship between numbers and quantities; connect counting to cardinality. a. When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object. b. Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted. c. Understand that each successive number name refers to a quantity that is one larger.
K.CC.5	Count to answer "how many?" questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1–20, count out that many objects.

Compare Numbers

Identifier	Standard
K.CC.6	Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.[1]
K.CC.7	Compare two numbers between 1 and 20 presented as written numerals.

Elementary-Grades—Conceptual Domain:
Operations and Algebraic Thinking (OA)

Understand Addition as Putting Together and Adding To, and Understand Subtraction as Taking Apart and Taking From

Identifier	Standard
K.OA.1	Represent addition and subtraction, *in which all parts and whole of the problem are within 10*, with objects, fingers, mental images, drawings[2], sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.
K.OA.2	Solve addition and subtraction word problems *within 10 involving situations of adding to, taking from, putting together and taking apart with unknowns in all positions* by using objects or drawings to represent the problem.
K.OA.3	Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., 5 = 2 + 3 and 5 = 4 + 1).
K.OA.4	For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.
K.OA.5	a. ***FLUENTLY*** add within 5. b. ***FLUENTLY*** subtract within 5.

Elementary-Grades—Conceptual Domain:
Number and Operations in Base Ten (NBT)

Work with Numbers 11-19 to Gain Foundations for Place Value

Identifier	Standard
K.NBT.1	Compose and decompose numbers from 11 to 19 into ten ones and some further ones to understand that these numbers are composed of ten ones and one, two, three, four, five, six, seven, eight, or nine ones, e.g., by using objects or drawings, and record each composition or decomposition by a drawing or equation (e.g., 18 = 10 + 8).

Elementary-Grades—Conceptual Domain:
Measurement and Data (MD)

Describe and Compare Measurable Attributes

Identifier	Standard
K.MD.1	Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.
K.MD.2	Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference. *For example, directly compare the heights of two children and describe one child as taller/shorter.*

Classify Objects and Count the Number of Objects in Each Category

Identifier	Standard
K.MD.3	Classify objects into given categories; count the numbers of objects in each category and sort the categories by count.[3]

Elementary-Grades—Conceptual Domain:
Geometry (G)

Identify and Describe Shapes (Squares, Circles, Triangles, Rectangles, Hexagons, Cubes, Cones, Cylinders, and Spheres)

Identifier	Standard
K.G.1	Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as *above, below, beside, in front of, behind,* and *next to*.
K.G.2	Correctly name shapes regardless of their orientations or overall size.
K.G.3	Identify shapes as two-dimensional (lying in a plane, "flat") or three-dimensional ("solid").

Analyze, Compare, Create, and Compose Shapes

Identifier	Standard
K.G.4	Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and vertices/"corners") and other attributes (e.g., having sides of equal length).
K.G.5	Model objects in the world by drawing two-dimensional shapes and building three-dimensional shapes.
K.G.6	Compose simple shapes to form larger shapes. For example, *"Can you join these two triangles with full sides touching to make a rectangle?"*

NOTES

[1] Include groups with up to ten objects.
[2] Drawings need not show details, but should show the mathematics in the problem. (This applies wherever drawings are mentioned in the Standards.)
[3] Limit category counts to be less than or equal to 10.

CCR Math Grade 1

In Grade 1, instruction should focus on four critical areas: (1) developing understanding of addition, subtraction, and strategies for addition and subtraction within 20; (2) developing understanding of whole number relationships and place value, including grouping in tens and ones; (3) developing understanding of linear measurement and measuring lengths as iterating length units; and (4) reasoning about attributes of, and composing and decomposing geometric shapes. Each critical area is described below.

(1) Students develop strategies for adding and subtracting whole numbers based on their prior work with small numbers. They use a variety of models, including discrete objects and length-based models (e.g., cubes connected to form lengths), to model add-to, take-from, put-together, take-apart, and compare situations to develop meaning for the operations of addition and subtraction, and to develop strategies to solve arithmetic problems with these operations. Students understand connections between counting and addition and subtraction (e.g., adding two is the same as counting on two). They use properties of addition to add whole numbers and to create and use increasingly sophisticated strategies based on these properties (e.g., "making tens") to solve addition and subtraction problems within 20. By comparing a variety of solution strategies, children build their understanding of the relationship between addition and subtraction.

(2) Students develop, discuss, and use efficient, accurate, and generalizable methods to add within 100 and subtract multiples of 10. They compare whole numbers (at least to 100) to develop understanding of and solve problems involving their relative sizes. They think of whole numbers between 10 and 100 in terms of tens and ones (especially recognizing the numbers 11 to 19 as composed of a ten and some ones). Through activities that build number sense, they understand the order of the counting numbers and their relative magnitudes.

(3) Students develop an understanding of the meaning and processes of measurement, including underlying concepts such as iterating (the mental activity of building up the length of an object with equal-sized units) and the transitivity principle for indirect measurement.[1]

(4) Students compose and decompose plane or solid figures (e.g., put two triangles together to make a quadrilateral) and build understanding of part-whole relationships as well as the properties of the original and composite shapes. As they combine shapes, they recognize them from different perspectives and orientations, describe their geometric attributes, and determine how they are alike and different, to develop the background for

measurement and for initial understandings of properties such as congruence and symmetry.

The content within this grade level is centered on the mathematics domains of **Operations and Algebraic Thinking** (Grades K-5), **Numbers and Operations in Base Ten** (Grades K-5), **Measurement and Data** (Grades K-5), and **Geometry** (Grades K-8). Instruction in these domains should be designed to expose students to experiences that reflect the value of mathematics, enhance students' confidence in their ability to do mathematics, and help students communicate and reason mathematically.

NOTE

[1] Students should apply the principle of transitivity of measurement to make indirect comparisons, but they need not use this technical term.

College- and Career-Readiness Standards:

Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
1.SMP.1	Make sense of problems and persevere in solving them.
1.SMP.2	Reason abstractly and quantitatively.
1.SMP.3	Construct viable arguments and critique the reasoning of others.
1.SMP.4	Model with mathematics.
1.SMP.5	Use appropriate tools strategically.
1.SMP.6	Attend to precision.
1.SMP.7	Look for and make use of structure.
1.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but **required** standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

Elementary-Grades—Conceptual Domain:

Operations and Algebraic Thinking (OA)

Represent and Solve Problems Involving Addition and Subtraction

Identifier	Standard
1.OA.1	Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, *e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem*.[2]
1.OA.2	Solve word problems that call for the addition of three whole numbers whose sum is less than or equal to 20, *e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.*

Understand and Apply Properties of Operations and the Relationship between Addition and Subtraction

Identifier	Standard
1.OA.3	Apply properties of operations as strategies to add and subtract.[3] *Examples: If 8 + 3 = 11 is known, then 3 + 8 = 11 is also known. (Commutative property of addition.) To add 2 + 6 + 4, the second two numbers can be added to make a ten, so 2 + 6 + 4 = 2 + 10 = 12. (Associative property of addition.)*
1.OA.4	Understand subtraction as an unknown-addend problem. *For example, subtract 10 – 8 by finding the number that makes 10 when added to 8.*

Add and Subtract within 20

Identifier	Standard
1.OA.5	Relate counting to addition and subtraction (*e.g., by counting on 2 to add 2*).
1.OA.6	Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten (*e.g., 8 + 6 = 8 + 2 + 4 = 10 + 4 = 14*); decomposing a number leading to a ten (*e.g., 13 – 4 = 13 – 3 – 1 = 10 – 1 = 9*); using the relationship between addition and subtraction (*e.g., knowing that 8 + 4 = 12, one knows 12 – 8 = 4*); and creating equivalent but easier or known sums (*e.g., adding 6 + 7 by creating the known equivalent 6 + 6 + 1 = 12 + 1 = 13*).

Work with Addition and Subtraction Equations

Identifier	Standard
1.OA.7	Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. *For example, which of the following equations are true and which are false? 6 = 6, 7 = 8 – 1, 5 + 2 = 2 + 5, 4 + 1 = 5 + 2.*
1.OA.8	Determine the unknown whole number in an addition or subtraction equation relating three whole numbers. *For example, determine the unknown number that makes the equation true in each of the equations 8 + ? = 11, 5 = □ – 3, 6 + 6 = □.*

Elementary-Grades—Conceptual Domain:

Number and Operations in Base Ten (NBT)

Extend the Counting Sequence

Identifier	Standard
1.NBT.1	Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.

Understand Place Value

Identifier	Standard
1.NBT.2	Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases: a. 10 can be thought of as a bundle of ten ones — called a “ten.” b. The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones. c. The numbers 10, 20, 30, 40, 50, 60, 70, 80, and 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones).
1.NBT.3	Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <.

Use Place Value Understanding and Properties of Operations to Add and Subtract

Identifier	Standard
1.NBT.4	Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten.
1.NBT.5	Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used.
1.NBT.6	Subtract multiples of 10 in the range 10–90 from multiples of 10 in the range 10–90 (positive or zero differences), using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.

Elementary-Grades—Conceptual Domain:

Measurement and Data (MD)

Measure Lengths Indirectly and by Iterating Length Units

Identifier	Standard
1.MD.1	Order three objects by length; compare the lengths of two objects indirectly by using a third object.
1.MD.2	Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. *Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps*.

Tell and Write Time with Respect to a Clock and a Calendar

Identifier	Standard
1.MD.3a	Tell and write time in hours and half hours using analog and digital clocks.
1.MD.3b	Identify the days of the week and the number of days in a week.
1.MD.3c	Identify the months of the year, the number of months in a year, and the number of weeks in a month.

Represent and Interpret Data

Identifier	Standard
1.MD.4	Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.

Work with Money

Identifier	Standard
1.MD.5a	Identify the value of all U.S. coins (penny, nickel, dime, quarter, half-dollar, and dollar coins). Use appropriate cent and dollar notation (*e.g., 25¢, $1*).
1.MD.5b	Know the comparative values of all U.S. coins (*e.g., a dime is of greater value than a nickel*).
1.MD.5c	Count like U.S. coins up to the equivalent of a dollar.
1.MD.5d	Find the equivalent value for all greater value U.S. coins using like-value smaller coins (*e.g., 5 pennies equal 1 nickel; 10 pennies equal a dime, but not 1 nickel, and 5 pennies equal 1 dime*).

Elementary-Grades—Conceptual Domain:

Geometry (G)

Reason with Shapes and Their Attributes

Identifier	Standard
1.G.1	Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes.
1.G.2	Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape, and compose new shapes from the composite shape.[4]
1.G.3	Partition circles and rectangles into two and four equal shares; describe the shares using the words *halves*, *fourths*, and *quarters*, and use the phrases *half of*, *fourth of*, and *quarter of*. Describe the whole as two of, or four of the shares. Understand for these examples that decomposing into more equal shares creates smaller shares.

NOTES

[2] See Glossary, Table 1.

[3] Students need not use formal terms for these properties.

[4] Students do not need to learn formal names such as “right rectangular prism.”

CCR Math Grade 2

In Grade 2, instruction should focus on four critical areas: (1) extending understanding of base-ten notation; (2) building fluency with addition and subtraction; (3) using standard units of measure; and (4) describing and analyzing shapes. Each critical area is described below.

(1) Students extend their understanding of the base-ten system. This includes ideas of counting in fives, tens, and multiples of hundreds, tens, and ones, as well as number relationships involving these units, including comparing. Students understand multi-digit numbers (up to 1000) written in base-ten notation, recognizing that the digits in each place represent amounts of thousands, hundreds, tens, or ones (e.g., 853 is 8 hundreds + 5 tens + 3 ones).

(2) Students use their understanding of addition to develop fluency with addition and subtraction within 100. They solve problems within 1000 by applying their understanding of models for addition and subtraction, and they develop, discuss, and use efficient, accurate, and generalizable methods to compute sums and differences of whole numbers in base-ten notation, using their understanding of place value and the properties of operations. They select and accurately apply methods that are appropriate for the context and the numbers involved to mentally calculate sums and differences for numbers with only tens or only hundreds.

(3) Students recognize the need for standard units of measure (centimeter and inch) and they use rulers and other measurement tools with the understanding that linear measure involves an iteration of units. They recognize that the smaller the unit, the more iterations they need to cover a given length.

(4) Students describe and analyze shapes by examining their sides and angles. Students investigate, describe, and reason about decomposing and combining shapes to make other shapes. Through building, drawing, and analyzing two- and three-dimensional shapes, students develop a foundation for understanding area, volume, congruence, similarity, and symmetry in later grades.

The content within this grade level is centered on the mathematics domains of **Operations and Algebraic Thinking** (Grades K-5), **Numbers and Operations in Base Ten** (Grades K-5), **Measurement and Data** (Grades K-5), and **Geometry** (Grades K-8). Instruction in these domains should be designed to expose students to experiences that reflect the value of mathematics, enhance students' confidence in their ability to do mathematics, and help students communicate and reason mathematically.

College- and Career-Readiness Standards:
Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
2.SMP.1	Make sense of problems and persevere in solving them.
2.SMP.2	Reason abstractly and quantitatively.
2.SMP.3	Construct viable arguments and critique the reasoning of others.
2.SMP.4	Model with mathematics.
2.SMP.5	Use appropriate tools strategically.
2.SMP.6	Attend to precision.
2.SMP.7	Look for and make use of structure.
2.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but **required** standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

Elementary-Grades—Conceptual Domain:
Operations and Algebraic Thinking (OA)

Represent and Solve Problems Involving Addition and Subtraction

Identifier	Standard
2.OA.1	Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.[1]

Add and Subtract within 20

Identifier	Standard
2.OA.2	Fluently add and subtract within 20 using mental strategies[2]. By end of Grade 2, know from memory all sums of two one-digit numbers.

Work with Equal Groups of Objects to Gain Foundations for Multiplication

Identifier	Standard
2.OA.3	Determine whether a group of objects (up to 20) has an odd or even number of members, e.g., by pairing objects or counting them by 2s; write an equation to express an even number as a sum of two equal addends.
2.OA.4	Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends.

Elementary-Grades—Conceptual Domain:
Number and Operations in Base Ten (NBT)

Understand Place Value

Identifier	Standard
2.NBT.1	Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; *e.g., 706 equals 7 hundreds, 0 tens, and 6 ones*. Understand the following as special cases: a. 100 can be thought of as a bundle of 10 tens — called a “hundred.” b. The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones).

Identifier	Standard
2.NBT.2	Count within 1000; skip-count by 5s starting at any number ending in 5 or 0. Skip-count by 10s and 100s starting at any number.
2.NBT.3	Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.
2.NBT.4	Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using >, =, and < symbols to record the results of comparisons.

Use Place Value Understanding and Properties of Operations to Add and Subtract

Identifier	Standard
2.NBT.5	***Fluently*** add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.
2.NBT.6	Add up to four two-digit numbers using strategies based on place value and properties of operations.
2.NBT.7	Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.
2.NBT.8	Mentally add 10 or 100 to a given number 100–900, and mentally subtract 10 or 100 from a given number 100–900.
2.NBT.9	Explain why addition and subtraction strategies work, using place value and the properties of operations.[3]

Elementary-Grades—Conceptual Domain:

Measurement and Data (MD)

Measure and Estimate Length in Standard Units

Identifier	Standard
2.MD.1	Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.
2.MD.2	Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen.
2.MD.3	Estimate lengths using units of inches, feet, centimeters, and meters.
2.MD.4	Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard-length unit.

Relate Addition and Subtraction to Length

Identifier	Standard
2.MD.5	Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem.
2.MD.6	Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, ..., and represent whole-number sums and differences within 100 on a number line diagram.

Work with Time with Respect to a Clock and a Calendar, and work with Money

Identifier	Standard
2.MD.7	Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m.
2.MD.8a	Solve word problems involving dollar bills, quarters, dimes, nickels, and pennies, using $ and ¢ symbols appropriately. *Example: If you have 2 dimes and 3 pennies, how many cents do you have?*
2.MD.8b	Fluently use a calendar to answer simple real-world problems such as "*How many weeks are in a year?*" or "*James gets a $5 allowance every 2 months; how much money will he have at the end of each year?*"

Represent and Interpret Data

Identifier	Standard
2.MD.9	Generate measurement data by measuring lengths of several objects to the nearest whole unit, or by making repeated measurements of the same object. Show the measurements by making a line plot, where the horizontal scale is marked off in whole-number units.
2.MD.10	Draw a picture graph and a bar graph (with a single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems[4] using information presented in a bar graph.

Elementary-Grades—Conceptual Domain:

Geometry (G)

Reason with Shapes and Their Attributes

Identifier	Standard
2.G.1	Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces.[5] Identify triangles, quadrilaterals, pentagons, hexagons, and cubes.
2.G.2	Partition a rectangle into rows and columns of same-size squares and count to find the total number of them.
2.G.3	Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words *halves, thirds, half of, a third of*, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.

NOTES

[1] See Glossary, Table 1.

[2] See standard 1.OA.6 for a list of mental strategies.

[3] Explanations may be supported by drawings or objects.

[4] See Glossary, Table 1.

[5] Sizes are compared directly or visually, not compared by measuring.

CCR Math Grade 3

In Grade 3, instruction should focus on four critical areas: (1) developing an understanding of multiplication and division and strategies for Multiplication and division within 100; (2) developing an understanding of fractions, especially unit fractions (fractions with a numerator of 1); (3) developing an understanding of the structure of rectangular arrays and of area; and (4) describing and analyzing two-dimensional shapes. Each critical area is described below.

(1) Students develop an understanding of the meanings of multiplication and division of whole numbers through activities and problems involving equal-sized groups, arrays, and area models; multiplication is finding an unknown product, and division is finding an unknown factor in these situations. For equal-sized group situations, division can require finding the unknown number of groups or the unknown group size. Students use properties of operations to calculate products of whole numbers, using increasingly sophisticated strategies based on these properties to solve multiplication and division problems involving single-digit factors. By comparing a variety of solution strategies, students learn the relationship between multiplication and division.

(2) Students develop an understanding of fractions, beginning with unit fractions. Students view fractions in general as being built out of unit fractions, and they use fractions along with visual fraction models to represent parts of a whole. Students understand that the size of a fractional part is relative to the size of the whole. For example, $\frac{1}{2}$ of the paint in a small bucket could be less paint than $\frac{1}{3}$ of the paint in a larger bucket, but $\frac{1}{3}$ of a ribbon is longer than $\frac{1}{5}$ of the same ribbon because when the ribbon is divided into 3 equal parts, the parts are longer than when the ribbon is divided into 5 equal parts. Students are able to use fractions to represent numbers equal to, less than, and greater than one. They solve problems that involve comparing fractions by using visual fraction models and strategies based on noticing equal numerators or denominators.

(3) Students recognize area as an attribute of two-dimensional regions. They measure the area of a shape by finding the total number of same-size units of area required to cover the shape without gaps or overlaps, a square with sides of unit length being the standard unit for measuring area. Students understand that rectangular arrays can be decomposed into identical rows or into identical columns. By decomposing rectangles into rectangular arrays of squares, students connect area to multiplication, and justify using multiplication to determine the area of a rectangle.

(4) Students describe, analyze, and compare properties of two-dimensional shapes. They compare and classify shapes by their sides and angles, and connect these with definitions of shapes. Students also relate their fraction work to geometry by expressing the area of part of a shape as a unit fraction of the whole.

The content within this grade level is centered on the mathematics domains of **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), and **Geometry** (Grades K-8). Instruction in these domains should be designed to expose students to experiences that reflect the value of mathematics, enhance students' confidence in their ability to do mathematics, and help students communicate and reason mathematically.

College- and Career-Readiness Standards:

Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
3.SMP.1	Make sense of problems and persevere in solving them.
3.SMP.2	Reason abstractly and quantitatively.
3.SMP.3	Construct viable arguments and critique the reasoning of others.
3.SMP.4	Model with mathematics.
3.SMP.5	Use appropriate tools strategically.
3.SMP.6	Attend to precision.
3.SMP.7	Look for and make use of structure.
3.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but **required** standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

Elementary-Grades—Conceptual Domain:

Operations and Algebraic Thinking (OA)

Represent and Solve Problems Involving Multiplication and Division

Identifier	Standard
3.OA.1	Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each. *For example, describe a context in which a total number of objects can be expressed as 5 × 7.*
3.OA.2	Interpret whole-number quotients of whole numbers, e.g., interpret 56 ÷ 8 as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each. *For example, describe a context in which a number of shares or a number of groups can be expressed as 56 ÷ 8.*
3.OA.3	Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.[1]
3.OA.4	Determine the unknown whole number in a multiplication or division equation relating three whole numbers, with factors 0-10. *For example, determine the unknown number that makes the equation true in each of the equations 8 × ? = 48, 5 = ? ÷ 3, 6 × 6 = ?.*

Understand Properties of Multiplication and the Relationship Between Multiplication and Division

Identifier	Standard
3.OA.5	Apply properties of operations as strategies to multiply and divide.[2] *Examples: If 6 × 4 = 24 is known, then 4 × 6 = 24 is also known. (Commutative property of multiplication.) 3 × 5 × 2 can be found by 3 × 5 = 15, then 15 × 2 = 30, or by 5 × 2 = 10, then 3 × 10 = 30. (Associative property of multiplication.) Knowing that 8 × 5 = 40 and 8 × 2 = 16, one can find 8 × 7 as 8 × (5 + 2) = (8 × 5) + (8 × 2) = 40 + 16 = 56. (Distributive property.)*
3.OA.6	Understand division as an unknown-factor problem, where a remainder does not exist. *For example, find 32 ÷ 8 by finding the number that makes 32 when multiplied by 8 with no remainder.*

Multiply and Divide within 100

Identifier	Standard
3.OA.7	Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division (e.g., knowing that 8 × 5 = 40, one knows 40 ÷ 5 = 8) or properties of operations. Know from memory all products of two one-digit numbers; and fully understand the concept when a remainder does not exist under division.

Solve problems Involving the Four Operations, and Identify and Explain Patterns in Arithmetic

Identifier	Standard
3.OA.8	Solve two-step (two operational steps) word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies, including rounding[3]. Include problems with whole dollar amounts.
3.OA.9	Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations. *For example, observe that 4 times a number is always even, and explain why 4 times a number can be decomposed into two equal addends.*

Elementary-Grades—Conceptual Domain:

Number and Operations in Base Ten[2] (NBT)

Use Place Value Understanding and Properties of Operations to Perform Multi-Digit Arithmetic[4]

Identifier	Standard
3.NBT.1	Use place value understanding to round whole numbers to the nearest 10 or 100.
3.NBT.2	***Fluently*** add and subtract (including subtracting across zeros) within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction. Include problems with whole dollar amounts.
3.NBT.3	Multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., 9 × 80, 5 × 60) using strategies based on place value and properties of operations.

Elementary-Grades—Conceptual Domain:

Number and Operations—Fractions[5] (NF)

Develop Understanding of Fractions as Numbers

Identifier	Standard
3.NF.1	Understand a fraction $\frac{1}{b}$ as the quantity formed by 1 part when a whole is partitioned into *b* equal parts; understand a fraction $\frac{a}{b}$ as the quantity formed by *a* parts of size $\frac{1}{b}$.
3.NF.2	Understand a fraction as a number on the number line; represent fractions on a number line diagram. a. Represent a fraction $\frac{1}{b}$ on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into *b* equal parts. Recognize that each part has size $\frac{1}{b}$ and that the endpoint of the part based at 0 locates the number $\frac{1}{b}$ on the number line. b. Represent a fraction $\frac{a}{b}$ on a number line diagram by marking off *a* lengths $\frac{1}{b}$ from 0. Recognize that the resulting interval has size $\frac{a}{b}$ and that its endpoint locates the number $\frac{a}{b}$ on the number line.
3.NF.3	Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size. a. Understand two fractions as equivalent (equal) if they are the same size, or the same point on a number line. Recognize that comparisons are valid only when the two fractions refer to the same whole. b. Recognize and generate simple equivalent fractions, e.g., $\frac{1}{2} = \frac{2}{4}$, $\frac{4}{6} = \frac{2}{3}$. Explain why the fractions are equivalent, e.g., by using a visual fraction model. c. Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. Examples: Express 3 in the form $3 = \frac{3}{1}$; recognize that $\frac{6}{1} = 6$; locate $\frac{4}{4}$ and 1 at the same point of a number line diagram. d. Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.

Elementary-Grades—Conceptual Domain:

Measurement and Data (MD)

Solve Problems Involving Measurement and Estimation of Intervals of Time, Liquid Volumes, and Masses of Objects

Identifier	Standard
3.MD.1	Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.
3.MD.2	Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l).[6] Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.[7]

Represent and Interpret Data

Identifier	Standard
3.MD.3	Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. *For example, draw a bar graph in which each square in the bar graph might represent 5 pets.*
3.MD.4	Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters.

Geometric Measurement: Understand Concepts of Area and Relate Area to Multiplication and to Addition

Identifier	Standard
3.MD.5	Recognize area as an attribute of plane figures and understand concepts of area measurement. a. A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area. b. A plane figure which can be covered without gaps or overlaps by *n* unit squares is said to have an area of *n* square units.
3.MD.6	Measure areas by counting unit squares (square *cm*, square *m*, square *in*, square *ft*, and improvised units).

3.MD.7	Relate area to the operations of multiplication and addition. a. Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths. b. Multiply side lengths to find areas of rectangles with whole-number side lengths (where factors can be between 1 and 10, inclusively) in the context of solving real-world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning. c. Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths a and $b + c$ is the sum of $a \times b$ and $a \times c$. Use area models to represent the distributive property in mathematical reasoning. d. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real-world problems. Recognize area as additive.

Geometric Measurement: Recognize Perimeter as an Attribute of Plane Figures and Distinguish Between Linear and Area Measures

Identifier	**Standard**
3.MD.8	Solve real-world and mathematical problems involving perimeters of polygons, including: finding the perimeter given the side lengths, finding an unknown side length, and exhibiting (including, but not limited to, modeling, drawing, designing, and creating) rectangles with the same perimeter and different areas or with the same area and different perimeters.

Elementary-Grades—Conceptual Domain:

Geometry (G)

Reason with Shapes and Their Attributes

Identifier	**Standard**
3.G.1	Understand that shapes in different categories (e.g., rhombuses, rectangles, circles, and others) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.
3.G.2	Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. *For example, partition a shape into 4 parts with equal area, and describe the area of each part as* $\frac{1}{4}$ *of the area of the shape.*

NOTES

[1] See Glossary, Table 2.

[2] Students need not use formal terms for these properties.

[3] This standard is limited to problems posed with whole numbers and having whole-number answers; students should know how to perform operations in the conventional order when there are no parentheses to specify a particular order (Order of Operations).

[4] A range of algorithms may be used.

[5] Grade 3 expectations in this domain are limited to fractions with denominators 2, 3, 4, 6, and 8.

[6] Excludes compound units such as cm^3 and finding the geometric volume of a container.

[7] Excludes multiplicative comparison problems (problems involving notions of “times as much”; see Glossary, Table 2).

CCR Math Grade 4

In Grade 4, instruction should focus on three critical areas: (1) developing understanding and fluency with multi-digit multiplication, and developing understanding of dividing to find quotients involving multi-digit dividends; (2) developing an understanding of fraction equivalence, addition and subtraction of fractions with like denominators, and multiplication of fractions by whole numbers; and (3) understanding that geometric figures can be analyzed and classified based on their properties, such as having parallel sides, perpendicular sides, particular angle measures, and symmetry. Each critical area is described below.

(1) Students generalize their understanding of place value to 1,000,000, understanding the relative sizes of numbers in each place. They apply their understanding of models for multiplication (equal-sized groups, arrays, and area models), place value, and properties of operations, in particular the distributive property, as they develop, discuss, and use efficient, accurate, and generalizable methods to compute products of multi-digit whole numbers. Depending on the numbers and the context, they select and accurately apply appropriate methods to estimate or mentally calculate products. They develop fluency with efficient procedures for multiplying whole numbers; understand and explain why the procedures work based on place value and properties of operations; and use them to solve problems. Students apply their understanding of models for division, place value, properties of operations, and the relationship of division to multiplication as they develop, discuss, and use efficient, accurate, and generalizable procedures to find quotients involving multi-digit dividends. They select and accurately apply appropriate methods to estimate and mentally calculate quotients, and interpret remainders based upon the context.

(2) Students develop understanding of fraction equivalence and operations with fractions. They recognize that two different fractions can be equal (e.g., $\frac{15}{9} = \frac{5}{3}$), and they develop methods for generating and recognizing equivalent fractions. Students extend previous understandings about how fractions are built from unit fractions, composing fractions from unit fractions, decomposing fractions into unit fractions, and using the meaning of fractions and the meaning of multiplication to multiply a fraction by a whole number.

(3) Students describe, analyze, compare, and classify two-dimensional shapes. Through building, drawing, and analyzing two-dimensional shapes, students deepen their understanding of properties of two-dimensional objects and the use of them to solve problems involving symmetry.

The content within this grade level is centered on the mathematics domains of **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), and **Geometry** (Grades K-8). Instruction in these domains should be designed to expose students to experiences that reflect the value of mathematics, enhance students' confidence in their ability to do mathematics, and help students communicate and reason mathematically.

College- and Career-Readiness Standards:

Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
4.SMP.1	Make sense of problems and persevere in solving them.
4.SMP.2	Reason abstractly and quantitatively.
4.SMP.3	Construct viable arguments and critique the reasoning of others.
4.SMP.4	Model with mathematics.
4.SMP.5	Use appropriate tools strategically.
4.SMP.6	Attend to precision.
4.SMP.7	Look for and make use of structure.
4.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but **required** standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

Elementary-Grades—Conceptual Domain:

Operations and Algebraic Thinking (OA)

Use the Four Operations with Whole Numbers to Solve Problems

Identifier	Standard
4.OA.1	Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.
4.OA.2	Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.[1]
4.OA.3	Solve multistep (two or more operational steps) word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies, including rounding.

Gain Familiarity with Factors and Multiples

Identifier	Standard
4.OA.4	Find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1–100 is prime or composite.

Generate and Analyze Patterns

Identifier	Standard
4.OA.5	Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. For example, given the rule “Add 3” and the starting number 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate in this way.

Elementary-Grades—Conceptual Domain:
Number and Operations in Base Ten[2] (NBT)

Generalize Place Value Understanding for Multi-Digit Whole Numbers

Identifier	Standard
4.NBT.1	Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right. *For example, recognize that 700 ÷ 70 = 10 by applying concepts of place value and division.*
4.NBT.2	Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.
4.NBT.3	Use place value understanding to round multi-digit whole numbers to any place.

Use Place Value Understanding and Properties of Operations to Perform Multi-Digit Arithmetic

Identifier	Standard
4.NBT.4	***Fluently*** add and subtract (including subtracting across zeros) multi-digit whole numbers using the standard algorithm.
4.NBT.5	Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.
4.NBT.6	Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

Elementary-Grades—Conceptual Domain:

Number and Operations—Fractions[3] (NF)

Extend Understanding of Fraction Equivalence and Ordering

Identifier	Standard
4.NF.1	Recognizing that the value of "n" cannot be 0, explain why a fraction $\frac{a}{b}$ is equivalent to a fraction $\frac{(n \times a)}{(n \times b)}$ by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.
4.NF.2	Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as $\frac{1}{2}$. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.

Build Fractions from Unit Fractions by Applying and Extending Previous Understandings of Operations on Whole Numbers

Identifier	Standard
4.NF.3	Understand a fraction $\frac{a}{b}$ with a > 1 as a sum of fractions $\frac{1}{b}$. a. Understand addition and subtraction of fractions as joining and separating parts referring to the same whole. b. Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model (including, but not limited to: concrete models, illustrations, tape diagram, number line, area model, etc.). *Examples:* $\frac{3}{8} = \frac{1}{8} + \frac{1}{8} + \frac{1}{8}$; $\frac{3}{8} = \frac{1}{8} + \frac{2}{8}$; $2\frac{1}{8} = 1 + 1 + \frac{1}{8} = \frac{8}{8} + \frac{8}{8} + \frac{1}{8}$. c. Add and subtract mixed numbers with like denominators, e.g., by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction. d. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem.

4.NF.4	Apply and extend previous understandings of multiplication to multiply a fraction by a whole number. a. Understand a fraction $\frac{a}{b}$ as a multiple of $\frac{1}{b}$. *For example, use a visual fraction model to represent $\frac{5}{4}$ as the product 5 × ($\frac{1}{4}$), recording the conclusion by the equation $\frac{5}{4}$ = 5 × ($\frac{1}{4}$).* b. Understand a multiple of $\frac{a}{b}$ as a multiple of $\frac{1}{b}$, and use this understanding to multiply a fraction by a whole number. *For example, use a visual fraction model to express 3 × ($\frac{2}{5}$) as 6 × ($\frac{1}{5}$), recognizing this product as $\frac{6}{5}$. (In general, n × ($\frac{a}{b}$) = $\frac{(n\ x\ a)}{b}$.* c. Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem. *For example, if each person at a party will eat $\frac{3}{8}$ of a pound of roast beef, and there will be 5 people at the party, how many pounds of roast beef will be needed? Between what two whole numbers do you expect your answer to lie?*

Understand Decimal Notation for Fractions, and Compare Decimal Fractions

Identifier	**Standard**
4.NF.5	Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100.[4] *For example, express $\frac{3}{10}$ as $\frac{30}{100}$, and add $\frac{3}{10}$ + $\frac{4}{100}$ = $\frac{34}{100}$.*
4.NF.6	Use decimal notation for fractions with denominators 10 or 100. *For example, rewrite 0.62 as $\frac{62}{100}$; describe a length as 0.62 meters; locate 0.62 on a number line diagram.*
4.NF.7	Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual model.

Elementary-Grades—Conceptual Domain:

Measurement and Data (MD)

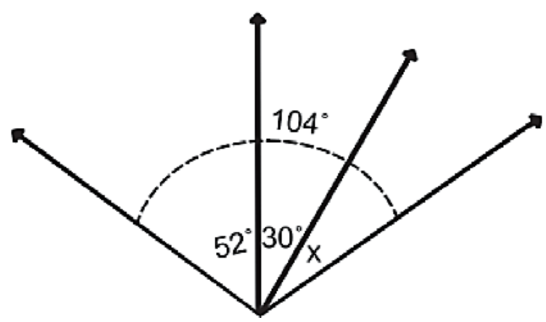
Solve Problems Involving Measurement and Conversion of Measurements from a Larger Unit to a Smaller Unit

Identifier	Standard
4.MD.1	Know relative sizes of measurement units within one system of units including km, m, cm, mm; kg, g, mg; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. *For example, know that 1 ft is 12 times as long as 1in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36),…*
4.MD.2	Use the four operations to solve word problems involving • intervals of time • money • distances • liquid volumes • masses of objects including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.
4.MD.3	Apply the area and perimeter formulas for rectangles in real-world and mathematical problems. *For example, find the width of a rectangular room, given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor*.

Represent and Interpret Data

Identifier	Standard
4.MD.4	Make a line plot to display a data set of measurements in fractions of a unit ($\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$). Solve problems involving addition and subtraction of fractions by using information presented in line plots. *For example, from a line plot find and interpret the difference in length between the longest and shortest specimens in an insect collection.*

Geometric Measurement: Understand Concepts of Angle and Measure Angles

Identifier	Standard
4.MD.5	Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement: a. An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through $\frac{1}{360}$ of a circle is called a "one-degree angle," and can be used to measure angles. b. An angle that turns through *n* one-degree angles is said to have an angle measure of *n* degrees.
4.MD.6	Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.
4.MD.7	Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems, e.g., by using an equation with a symbol for the unknown angle measure. *Example: Find the missing angle using an equation.* 

Elementary-Grades—Conceptual Domain:
Geometry (G)

Draw and Identify Lines and Angles, and Classify Shapes by Properties of their Lines and Angles

Identifier	Standard
4.G.1	Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.
4.G.2	Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Categorize triangles by sides and angles (equilateral, isosceles, right, and scalene).
4.G.3	Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.

NOTES

[1] See Glossary, Table 2.
[2] Grade 4 expectations in this domain are limited to whole numbers less than or equal I to 1,000,000.
[3] Grade 4 expectations in this domain are limited to fractions with denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100.
[4] Students who can generate equivalent fractions can develop strategies for adding fractions with unlike denominators in general. But addition and subtraction with unlike denominators in general is not a requirement at this grad.

CCR Math Grade 5

In Grade 5, instruction should focus on three critical areas: (1) developing fluency with addition and subtraction of fractions, and developing understanding of the multiplication of fractions and of division of fractions in limited cases (unit fractions divided by whole numbers and whole numbers divided by unit fractions); (2) extending division to 2-digit divisors, integrating decimal fractions into the place value system and developing understanding of operations with decimals to hundredths, and developing fluency with whole number and decimal operations; and (3) developing understanding of volume. Each critical area is described below.

(1) Students apply their understanding of fractions and fraction models to represent the addition and subtraction of fractions with unlike denominators as equivalent calculations with like denominators. They develop fluency in calculating sums and differences of fractions, and make reasonable estimates of them. Students also use the meaning of fractions, of multiplication and division, and the relationship between multiplication and division to understand and explain why the procedures for multiplying and dividing fractions make sense. (Note: this is limited to the case of dividing unit fractions by whole numbers and whole numbers by unit fractions.)

(2) Students develop understanding of why division procedures work based on the meaning of base-ten numerals and properties of operations. They finalize fluency with multi-digit addition, subtraction, multiplication, and division. They apply their understandings of models for decimals, decimal notation, and properties of operations to add and subtract decimals to hundredths. They develop fluency in these computations, and make reasonable estimates of their results. Students use the relationship between decimals and fractions, as well as the relationship between finite decimals and whole numbers (i.e., a finite decimal multiplied by an appropriate power of 10 is a whole number), to understand and explain why the procedures for multiplying and dividing finite decimals make sense. They compute products and quotients of decimals to hundredths efficiently and accurately.

(3) Students recognize volume as an attribute of three-dimensional space. They understand that volume can be measured by finding the total number of same-size units of volume required to fill the space without gaps or overlaps. They understand that a 1- unit by 1-unit by 1-unit cube is the standard unit for measuring volume. They select appropriate units, strategies, and tools for solving problems that involve estimating and measuring volume. They decompose three-dimensional shapes and find volumes of right rectangular prisms by viewing them as decomposed into layers of arrays of cubes. They

measure necessary attributes of shapes in order to determine volumes to solve real world and mathematical problems.

The content within this grade level is centered on the mathematics domains of **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), and **Geometry** (Grades K-8). Instruction in these domains should be designed to expose students to experiences that reflect the value of mathematics, enhance students' confidence in their ability to do mathematics, and help students communicate and reason mathematically.

College- and Career-Readiness Standards:

Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
5.SMP.1	Make sense of problems and persevere in solving them.
5.SMP.2	Reason abstractly and quantitatively.
5.SMP.3	Construct viable arguments and critique the reasoning of others.
5.SMP.4	Model with mathematics.
5.SMP.5	Use appropriate tools strategically.
5.SMP.6	Attend to precision.
5.SMP.7	Look for and make use of structure.
5.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but required standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

Elementary-Grades—Conceptual Domain:

Operations and Algebraic Thinking (OA)

Write and Interpret Numerical Expressions

Identifier	Standard
5.OA.1	Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.
5.OA.2	Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. *For example, express the calculation "add 8 and 7, then multiply by 2" as 2 × (8 + 7). Recognize that 3 × (18,932 + 921) is three times as large as 18,932 + 921, without having to calculate the indicated sum or product.*

Analyze Patterns and Relationships

Identifier	Standard
5.OA.3	Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. *For example, given the rule "Add 3" and the starting number 0, and given the rule "Add 6" and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.*

Elementary-Grades—Conceptual Domain:

Number and Operations in Base Ten (NBT)

Understand the Place Value System

Identifier	Standard
5.NBT.1	Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and $\frac{1}{10}$ of what it represents in the place to its left (e.g., "In the number 3.33, the underlined digit represents $\frac{3}{10}$, which is 10 times the amount represented by the digit to its right ($\frac{3}{100}$) and is $\frac{1}{10}$ the amount represented by the digit to its left (3)).
5.NBT.2	Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a

Identifier	Standard
	decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.
5.NBT.3	Read, write, and compare decimals to thousandths. a. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., 347.392 = 3 × 100 + 4 × 10 + 7 × 1 + 3 × $(\frac{1}{10})$ + 9 × $(\frac{1}{100})$ + 2 × $(\frac{1}{1000})$. b. Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.
5.NBT.4	Use place value understanding to round decimals to any place.

Perform Operation with Multi-Digit Whole Numbers and with Decimals to the Hundredths

Identifier	Standard
5.NBT.5	***Fluently*** multiply multi-digit whole numbers using the standard algorithm.
5.NBT.6	Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.
5.NBT.7	Add, subtract, multiply, and divide decimals to hundredths, using concrete models (to include, but not limited to: base ten blocks, decimal tiles, etc.) or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.

Elementary-Grades—Conceptual Domain:
Number and Operations—Fractions (NF)

Use Equivalent Fractions as a Strategy to Add and Subtract Fractions

Identifier	Standard
5.NF.1	Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. *For example,* $\frac{2}{3} + \frac{5}{4} = \frac{8}{12} + \frac{15}{12} = \frac{23}{12}$*. (In general,* $\frac{a}{b} + \frac{c}{d} = (\frac{ad+bc}{bd}$*.)*
5.NF.2	Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. *For example, recognize an incorrect result* $\frac{2}{5} + \frac{1}{2} = \frac{3}{7}$*, by observing that* $\frac{3}{7} < \frac{1}{2}$*.*

Apply and Extend Previous Understandings of Multiplication and Division to Multiply and Divide Fractions

Identifier	Standard
5.NF.3	Interpret a fraction as division of the numerator by the denominator ($\frac{a}{b} = a \div b$). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem. *For example, interpret* $\frac{3}{4}$ *as the result of dividing 3 by 4, noting that* $\frac{3}{4}$ *multiplied by 4 equals 3, and that when 3 wholes are shared equally among 4 people each person has a share of size* $\frac{3}{4}$*. If 9 people want to share a 50-pound sack of rice equally by weight, how many pounds of rice should each person get? Between what two whole numbers does your answer lie?*
5.NF.4	Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. a. Interpret the product $(\frac{a}{b}) \times q$ as a part of a partition of q into b equal parts; equivalently, as the result of a sequence of operations $a \times q \div b$. *For example, use a visual fraction model to show* $(\frac{2}{3}) \times 4 = \frac{8}{3}$*, and create a story context for this equation. Do the same with* $(\frac{2}{3}) \times (\frac{4}{5}) = \frac{8}{15}$*. (In general,* $(\frac{a}{b}) \times (\frac{c}{d}) = \frac{ac}{bd}$*.)* b. Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.

Identifier	Standard
5.NF.5	Interpret multiplication as scaling (resizing), by: a. Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication. b. Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence $\frac{a}{b} = \frac{(n \times a)}{(n \times b)}$ to the effect of multiplying $\frac{a}{b}$ by 1.
5.NF.6	Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.
5.NF.7	Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.[1] a. Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. *For example, create a story context for* $(\frac{1}{3}) \div 4$*, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that* $(\frac{1}{3}) \div 4 = \frac{1}{12}$ *because* $(\frac{1}{12}) \times 4 = \frac{1}{3}$. b. Interpret division of a whole number by a unit fraction, and compute such quotients. *For example, create a story context for* $4 \div (\frac{1}{5})$*, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that* $4 \div (\frac{1}{5}) = 20$ *because* $20 \times (\frac{1}{5}) = 4$. c. Solve real-world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, how much chocolate will each person get if 3 people share* $\frac{1}{2}$ *lb of chocolate equally? How many* $\frac{1}{3}$ *cup servings are in 2 cups of raisins?*

Elementary-Grades—Conceptual Domain:
Measurement and Data (MD)

Convert Like Measurement Units Within a Given Measurement System

Identifier	Standard
5.MD.1	Convert among different-sized standard measurement units within a given measurement system (customary and metric) (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.

Represent and Interpret Data

Identifier	Standard
5.MD.2	Make a line plot to display a data set of measurements in fractions of a unit ($\frac{1}{2}, \frac{1}{4}, \frac{1}{8}$). Use operations on fractions for this grade to solve problems involving information presented in line plots. *For example, given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally.*

Geometric Measurement: Understand Concepts of Volume and Relate Volume to Multiplication and to Addition

Identifier	Standard
5.MD.3	Recognize volume as an attribute of solid figures and understand concepts of volume measurement. a. A cube with side length 1 unit, called a “unit cube,” is said to have “one cubic unit” of volume, and can be used to measure volume. b. A solid figure which can be packed without gaps or overlaps using *n* unit cubes is said to have a volume of *n* cubic units.
5.MD.4	Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.

Convert Like Measurement Units Within a Given Measurement System

Identifier	Standard
5.MD.5	Relate volume to the operations of multiplication and addition and solve real-world and mathematical problems involving volume. a. Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by

Identifier	Standard
	the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication. b. Apply the formulas V = l × w × h and V = B × h for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real-world and mathematical problems. c. Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real-world problems.

Elementary-Grades—Conceptual Domain:

Geometry (G)

Graph Points on the Coordinate Plane to Solve Real-World and Mathematical Problems

Identifier	Standard
5.G.1	Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., *x*-axis and *x*-coordinate, *y*-axis and *y*-coordinate).
5.G.2	Represent real-world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

Classify Two-Dimensional Figures into Categories Based on Their Properties

Identifier	Standard
5.G.3	Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. *For example, all rectangles have four right angles, and squares are rectangles, so all squares have four right angles.*
5.G.4	Classify two-dimensional figures in a hierarchy based on properties.

NOTES

[1] Students able to multiply fractions in general can develop strategies to divide fractions in general, by reasoning about the relationship between multiplication and division. But division of a fraction by a fraction is not a requirement at this grade.

Supplemental Elementary School Math Courses

Supplemental Mathematics (Grades 1-4) and (Grades 5-6) courses, formerly Compensatory Mathematics, are designed to provide targeted interventions of core mathematics concepts.[1]

Students in need of instructional support, intervention, or remediation may be enrolled in a Supplemental Mathematics course under the following stipulations:

The Supplemental Mathematics course:

(1) must be taken in concert with a credit-bearing course at the same grade level;
(2) includes content supportive of the accompanying credit-bearing course;
(3) should incorporate the Standards for Mathematical Practice (SMPs); and
(4) may be taken as an elective, but will **not** satisfy the number of mathematics Carnegie units required for graduation.

Instruction within the supplemental mathematics courses 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.

NOTE

[1] Documentation of Tier II and III interventions is required. ***MS State Board Policy Manual***: Rule 41.1 intervention.

Secondary & Middle School

Grades 6–8

Middle School Overview

The *2025 Mississippi College- and Career-Readiness Standards* (MS CCRS) recognize grades 6-8 as the middle grades, with secondary education officially beginning in grade 7 and continuing through high school graduation. This distinction reflects the developmental transition during these years and aligns instructional expectations to prepare students for college and career pathways.

Evidence highlights the importance of foundational knowledge, skills, and practices acquired before advanced high school mathematics. Notably, Grades 6-8 provide some of the most critical concepts for college- and career-readiness. These include applying ratio reasoning to real-world and mathematical problems, computing fluently with positive and negative fractions and decimals, and solving problems involving angle measures, area, surface area, and volume.

Grade 7 serves as a critical bridge between middle and secondary education. At this stage, students can begin earning Carnegie units for coursework, marking the start of their progression toward meeting high school graduation requirements. This structure ensures a seamless and coherent development of skills and knowledge across educational levels.

CCR Math Grade 6

In Grade 6, instruction should focus on four critical areas: (1) connecting ratio and rate to whole number multiplication and division and using concepts of ratio and rate to solve problems; (2) completing understanding of division of fractions and extending the notion of number to the system of rational numbers, which includes negative numbers; (3) writing, interpreting, and using expressions and equations; and (4) developing understanding of statistical thinking. Each critical area is described below.

(1) Students use reasoning about multiplication and division to solve ratio and rate problems about quantities. By viewing equivalent ratios and rates as deriving from, and extending, pairs of rows (or columns) in the multiplication table, and by analyzing simple drawings that indicate the relative size of quantities, students connect their understanding of multiplication and division with ratios and rates. Thus, students expand the scope of problems for which they can use multiplication and division to solve problems, and they connect ratios and fractions. Students solve a wide variety of problems involving ratios and rates.

(2) Students use the meaning of fractions, the meanings of multiplication and division, and the relationship between multiplication and division to understand and explain why the procedures for dividing fractions make sense. Students use these operations to solve problems. Students extend their previous understandings of numbers and the ordering of numbers to the full system of rational numbers, which includes negative rational numbers, and in particular negative integers. They reason about the order and absolute value of rational numbers and about the location of points in all four quadrants of the coordinate plane.

(3) Students understand the use of variables in mathematical expressions. They write expressions and equations that correspond to given situations, evaluate expressions, and use expressions and formulas to solve problems. Students understand that expressions in different forms can be equivalent, and they use the properties of operations to rewrite expressions in equivalent forms. Students know that the solutions of an equation are the values of the variables that make the equation true. Students use properties of operations and the idea of maintaining the equality of both sides of an equation to solve simple one-step equations. Students construct and analyze tables, such as tables of quantities that are in equivalent ratios, and they use equations (such as $3x = y$) to describe relationships between quantities.

(4) Building on and reinforcing their understanding of number, students begin to develop their ability to think statistically. Students recognize that a data distribution may not have a definite center and that different ways to measure center yield different values. The median measures center in the sense that it is roughly the middle value. The mean measures center in the sense that it is the value that each data point would take on if the total of the data values were redistributed equally, and also in the sense that it is a balance point. Students recognize that a measure of variability (interquartile range or mean absolute deviation) can also be useful for summarizing data because two very different sets of data can have the same mean and median yet be distinguished by their variability. Students learn to describe and summarize numerical data sets, identifying clusters, peaks, gaps, and symmetry, considering the context in which the data were collected.

Students in Grade 6 also build on their work with area in elementary school by reasoning about relationships among shapes to determine area, surface area, and volume. They find areas of right triangles, other triangles, and special quadrilaterals by decomposing these shapes, rearranging or removing pieces, and relating the shapes to rectangles. Using these methods, students discuss, develop, and justify formulas for areas of triangles and parallelograms. Students find areas of polygons and surface areas of prisms and pyramids by decomposing them into pieces whose area they can determine. They reason about right rectangular prisms with fractional side lengths to extend formulas for the volume of a right rectangular prism to fractional side lengths. They prepare for work on scale drawings and constructions in Grade 7 by drawing polygons in the coordinate plane.

The content within this grade-level course is centered on the mathematics domains of **Ratios and Proportional Relationships** (Grades 6-7); **the Number System** (Grades 6-8)**, Expressions & Equations** (Grades 6-8)**, Geometry** (Grades K-8)**,** and **Statistics & Probability** (Grades 6-8). Instruction in these domains should be designed to expose students to experiences that reflect the value of mathematics, enhance students' confidence in their ability to do mathematics, and help students communicate and reason mathematically.

College- and Career-Readiness Standards:
Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
6.SMP.1	Make sense of problems and persevere in solving them.
6.SMP.2	Reason abstractly and quantitatively.
6.SMP.3	Construct viable arguments and critique the reasoning of others.
6.SMP.4	Model with mathematics.
6.SMP.5	Use appropriate tools strategically.
6.SMP.6	Attend to precision.
6.SMP.7	Look for and make use of structure.
6.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but **required** standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

Middle-Grades—Conceptual Domain:
Ratios and Proportional Relationships (RP)

Understand Ratio Concepts and Use Ratio Reasoning to Solve Problems

Identifier	Standard
6.RP.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. *For example, "The ratio of wings to beaks in the birdhouse at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."*
6.RP.2	Understand the concept of a unit rate $\frac{a}{b}$ associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship. *For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is $\frac{3}{4}$ cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."* [1]
6.RP.3	Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. a. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. *b.* Solve unit rate problems including those involving unit pricing and constant speed. *For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?* c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means $\frac{30}{100}$ times the quantity); solve problems involving finding the whole, given a part and the percent. d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

Middle-Grades—Conceptual Domain:

The Number System (NS)

Apply and Extend Previous Understandings of Multiplication and Division to Divide Fractions by Fractions

Identifier	Standard
6.NS.1	Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. For example, create a story context for $(\frac{2}{3}) \div (\frac{3}{4})$ and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that $(\frac{2}{3}) \div (\frac{3}{4}) = \frac{8}{9}$ because $\frac{3}{4}$ of $\frac{8}{9}$ is $\frac{2}{3}$. (In general, $(\frac{a}{b}) \div (\frac{c}{d}) = \frac{ad}{bc}$.) How much chocolate will each person get if 3 people share $\frac{1}{2}$ lb of chocolate equally? How many $\frac{3}{4}$ –cup servings are in $\frac{2}{3}$ of a cup of yogurt? How wide is a rectangular strip of land with length $\frac{3}{4}$ mi and area $\frac{1}{2}$ square mi?

Compute Fluently with Multi-Digit Numbers and Find Common Factors and Multiples

Identifier	Standard
6.NS.2	***Fluently*** divide multi-digit numbers using the standard algorithm.
6.NS.3	***Fluently*** add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.
6.NS.4	Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. *For example, express 36 + 8 as 4(9 + 2).*

Apply and Extend Previous Understandings of Numbers to the System of Rational Numbers

Identifier	Standard
6.NS.5	Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

Identifier	Standard
6.NS.6	Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates. a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., -(-3) = 3, and that 0 is its own opposite. b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes. c. Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.
6.NS.7	Understand ordering and absolute value of rational numbers. a. Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. *For example, interpret –3 > –7 as a statement that –3 is located to the right of –7 on a number line oriented from left to right.* *b.* Write, interpret, and explain statements of order for rational numbers in real-world contexts. *For example, write –3 °C >-7°C to express the fact that –3 °C is warmer than -7°C.* c. Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. *For example, for an account balance of –30 dollars, write |–30| = 30 to describe the size of the debt in dollars.* d. Distinguish comparisons of absolute value from statements about order. *For example, recognize that an account balance less than –30 dollars represents a debt greater than 30 dollars.*
6.NS.8	Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.
6.NS.9	Apply and extend previous understandings of addition and subtraction to add and subtract integers; represent addition and subtraction on a horizontal or vertical number line diagram. a. Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged*. b. Understand $p + q$ as the number located a distance $\|q\|$ from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of integers by describing real-world contexts. c. Understand subtraction of integers as adding the additive inverse, $p – q = p + (–q)$. Show that the distance between two integers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.

Identifier	Standard
	d. Apply properties of operations as strategies to add and subtract integers.

Middle-Grades—Conceptual Domain:

Expressions and Equations (EE)

Apply and Extend Previous Understandings of Arithmetic to Algebraic Expressions

Identifier	Standard
6.EE.1	Write and evaluate numerical expressions involving whole-number exponents.
6.EE.2	Write, read, and evaluate expressions in which letters stand for numbers. *a.* Write expressions that record operations with numbers and with letters standing for numbers. *For example, express the calculation "Subtract y from 5" as 5 – y.* b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. *For example, describe the expression 2(8 + 7) as a product of two factors; view (8 + 7) as both a single entity and a sum of two terms.* c. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). *For example, use the formulas* $V = s^3$ *and* $A = 6\ s^2$ *to find the volume and surface area of a cube with sides of length* $s = \frac{1}{2}$.
6.EE.3	Apply the properties of operations to generate equivalent expressions. *For example, apply the distributive property to the expression 3 (2 + x) to produce the equivalent expression 6 + 3x; apply the distributive property to the expression 24x + 18y to produce the equivalent expression 6 (4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y.*
6.EE.4	Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). *For example, the expressions y + y+ y and 3y are equivalent because they name the same number regardless of which number y stands for.*

Reason About and Solve One-Variable Equation and Inequalities

Identifier	Standard
6.EE.5	Solve an equation or inequality and understand the process by answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.
6.EE.6	Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.
6.EE.7	Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.
6.EE.8	Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.

Represent and Analyze Quantitative Relationships Between Dependent and Independent Variables

Identifier	Standard
6.EE.9	Use variables to represent two quantities in a real-world problem that change in relationship to one another. • Write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. • Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. *For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation $d = 65t$ to represent the relationship between distance and time.*

Middle-Grades—Conceptual Domain:
Geometry (G)

Solve Real-world and Mathematical Problems Involving Area, Surface Area, and Volume

Identifier	Standard
6.G.1	Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.
6.G.2	Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = lwh$ and $V = Bh$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.
6.G.3	Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.
6.G.4	Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real- world and mathematical problems.

Middle-Grades—Conceptual Domain:
Statistics and Probability (SP)

Convert Like Measurement Units Within a Given Measurement System

Identifier	Standard
6.SP.1	Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. *For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.*
6.SP.2	Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.
6.SP.3	Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.

Summarize and Describe Distributions

Identifier	Standard
6.SP.4	Display numerical data in plots on a number line, including dot plots, histograms, and box plots.
6.SP.5	Summarize numerical data sets in relation to their context, such as by: a. Reporting the number of observations. b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement. c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered. d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

NOTE

[1] Expectations for unit rates in this grade are limited to non-complex fractions.

CCR Math Grade 7

In Grade 7, instruction should focus on four critical areas: (1) developing understanding of and applying proportional relationships; (2) developing understanding of operations with rational numbers and working with expressions and linear equations; (3) solving problems involving scale drawings and informal geometric constructions, and working with two- and three-dimensional shapes to solve problems involving area, surface area, and volume; and (4) drawing inferences about populations based on samples. Each critical area is described below.

(1) Students extend their understanding of ratios and develop understanding of proportionality to solve single- and multi-step problems. Students use their understanding of ratios and proportionality to solve a wide variety of percent problems, including those involving discounts, interest, taxes, tips, and percent increase or decrease. Students solve problems about scale drawings by relating corresponding lengths between the objects or by using the fact that relationships of lengths within an object are preserved in similar objects. Students graph proportional relationships and understand the unit rate informally as a measure of the steepness of the related line, called the slope. They distinguish proportional relationships from other relationships.

(2) Students develop a unified understanding of number, recognizing fractions, decimals (that have a finite or a repeating decimal representation), and percents as different representations of rational numbers. Students extend addition, subtraction, multiplication, and division to all rational numbers, maintaining the properties of operations and the relationships between addition and subtraction, and multiplication and division. By applying these properties, and by viewing negative numbers in terms of everyday contexts (e.g., amounts owed or temperatures below zero), students explain and interpret the rules for adding, subtracting, multiplying, and dividing with negative numbers. They use the arithmetic of rational numbers as they formulate expressions and equations in one variable and use these equations to solve problems.

(3) Students continue their work with area from Grade 6, solving problems involving the area and circumference of a circle and surface area of three-dimensional objects. In preparation for work on congruence and similarity in Grade 8 they reason about relationships among two-dimensional figures using scale drawings and informal geometric constructions, and they gain familiarity with the relationships between angles formed by intersecting lines. Students work with three-dimensional figures, relating them to two-dimensional figures by examining cross-sections. They solve real-world and mathematical problems involving area, surface area, and volume of two- and three-

dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

(4) Students build on their previous work with single data distributions to compare two data distributions and address questions about differences between populations. They begin informal work with random sampling to generate data sets and learn about the importance of representative samples for drawing inferences.

The content within this grade-level course is centered on the mathematics domains of **Ratios and Proportional Relationships** (Grades 6-7); **the Number System** (Grades 6-8)**, Expressions & Equations** (Grades 6-8)**, Geometry** (Grades K-8)**,** and **Statistics & Probability** (Grades 6-8). Instruction in these domains should be designed to expose students to experiences that reflect the value of mathematics, enhance students' confidence in their ability to do mathematics, and help students communicate and reason mathematically.

College- and Career-Readiness Standards:
Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
7.SMP.1	Make sense of problems and persevere in solving them.
7.SMP.2	Reason abstractly and quantitatively.
7.SMP.3	Construct viable arguments and critique the reasoning of others.
7.SMP.4	Model with mathematics.
7.SMP.5	Use appropriate tools strategically.
7.SMP.6	Attend to precision.
7.SMP.7	Look for and make use of structure.
7.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but **required** standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

Middle-Grades—Conceptual Domain:

Ratios and Proportional Relationships (RP)

Analyze Proportional Relationships and Use Them to Solve Real-world and Mathematical Problems

Identifier	Standard
7.RP.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks* $\frac{1}{2}$ *mile in each* $\frac{1}{4}$ *hour, compute the unit rate as the complex fraction* $\frac{\frac{1}{2}}{\frac{1}{4}}$ *miles per hour, equivalently 2 miles per hour.*
7.RP.2	Recognize and represent proportional relationships between quantities. a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. *c.* Represent proportional relationships by equations. *For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn.* d. Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.
7.RP.3	Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*

Middle-Grades—Conceptual Domain:
The Number System (NS)

Apply and Extend Previous Understandings of Operations with Fractions to Add, Subtract, Multiply, and Divide Rational Numbers

Identifier	**Standard**
7.NS.1	Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram. a. Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged*. b. Understand $p + q$ as the number located a distance $\|q\|$ from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts. c. Understand subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference and apply this principle in real-world contexts. d. Apply properties of operations as strategies to add and subtract rational numbers.
7.NS.2	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (–1)(–1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts. b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then $-(\frac{p}{q}) = \frac{(-p)}{q} = \frac{p}{(-q)}$. Interpret quotients of rational numbers by describing real-world contexts. c. Apply properties of operations as strategies to multiply and divide rational numbers. d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.
7.NS.3	Solve real-world and mathematical problems involving the four operations with rational numbers.[1]

Middle-Grades—Conceptual Domain:
Expressions and Equations (EE)

Use Properties of Operations to Generate Equivalent Expressions

Identifier	Standard
7.EE.1	Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
7.EE.2	Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. *For example, a + 0.05a = 1.05a means that "increase by 5%" is the same as "multiply by 1.05."*

Solve Real-life and Mathematical Problems Using Numerical and Algebraic Expressions and Equations

Identifier	Standard
7.EE.3	Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making $25 an hour gets a 10% raise, she will make an additional* $\frac{1}{10}$ *of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar* $9\frac{3}{4}$ *inches long in the center of a door that is* $27\frac{1}{2}$ *inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.*
7.EE.4	Use variables to represent quantities in a real-world or mathematical problem and construct simple equations and inequalities to solve problems by reasoning about the quantities. a. Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. Solve equations of these forms ***fluently***. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width? b. Solve word problems leading to inequalities of the form *px* + *q* > *r* or *px* + *q* < *r*, where *p*, *q*, and *r* are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make and describe the solutions.*

Middle-Grades—Conceptual Domain:
Geometry (G)

Draw, Construct, and Describe Geometrical Figures and Describe the Relationships Between Them

Identifier	Standard
7.G.1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.
7.G.2	Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.
7.G.3	Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.

Solve Real-world and Mathematical Problems Involving Angle Measure, Area, Surface Area, and Volume

Identifier	Standard
7.G.4	Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.
7.G.5	Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.
7.G.6	Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals and polygons including cubes, right prisms, and pyramids.

Middle-Grades—Conceptual Domain:

Statistics and Probability (SP)

Use Random Sampling to Draw Inferences About a Population

Identifier	Standard
7.SP.1	Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.
7.SP.2	Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. *For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.*

Draw Informal Comparative Inferences about Two Populations

Identifier	Standard
7.SP.3	Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. *For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability on either team; on a dot plot, the separation between the two distributions of heights is noticeable.*
7.SP.4	Use measures of center and measures of variability (*i.e., inter-quartile range*) for numerical data from random samples to draw informal comparative inferences about two populations. *For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.*

Investigate Chance Processes and Develop, Use, and Evaluate Probability Models

Identifier	Standard
7.SP.5	Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around $\frac{1}{2}$ indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
7.SP.6	Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency and predict the approximate relative frequency given the probability. *For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.*
7.SP.7	Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. a. Develop a uniform probability model by assigning equal probability to all outcomes and use the model to determine probabilities of events. *For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.* b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. *For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?*
7.SP.8	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. a. Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs. b. Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event. c. Design and use a simulation to generate frequencies for compound events. *For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?*

NOTE

[1] Computations with rational numbers extend the rules for manipulating fractions to complex fractions.

CCR Math 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 ($\frac{y}{x} = m$ 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.

(2) 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.

(3) 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.

(4) 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 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 within this grade-level course is centered on the mathematics domains of **the Number System** (Grades 6-8), **Expressions & Equations** (Grades 6-8), **Functions** (Grade 8), **Geometry** (Grades K-8), and **Statistics & Probability** (Grades 6-8). Instruction in these domains should be designed to expose students to experiences that reflect the value of mathematics, enhance students' confidence in their ability to do mathematics, and help students communicate and reason mathematically.

College- and Career-Readiness Standards:

Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
8.SMP.1	Make sense of problems and persevere in solving them.
8.SMP.2	Reason abstractly and quantitatively.
8.SMP.3	Construct viable arguments and critique the reasoning of others.
8.SMP.4	Model with mathematics.
8.SMP.5	Use appropriate tools strategically.
8.SMP.6	Attend to precision.
8.SMP.7	Look for and make use of structure.
8.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but **required** standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

Middle-Grades—Conceptual Domain:
The Number System (NS)

Know that there are Numbers that are Not Rational, and Approximate Them by Rational Numbers

Identifier	Standard
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.*

Middle-Grades—Conceptual Domain:
Expressions and Equations (EE)

Work with Radicals and Integer Exponents

Identifier	Standard
8.EE.1	Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example,* $3^2 \times 3^{-5} = 3^{-3} = \frac{1}{3^3} = \frac{1}{27}$.
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

Identifier	Standard
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.

Analyze and Solve Linear Equations and Pairs of Simultaneous Linear Equations

Identifier	Standard
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.*

Middle-Grades—Conceptual Domain:
Functions (F)

Define, Evaluate, and Compare Functions

Identifier	Standard
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

Identifier	Standard
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.

Middle-Grades—Conceptual Domain:
Geometry (G)

Understand Congruence and Similarity using Physical Models, Transparencies, or Geometry Software

Identifier	Standard
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

Identifier	Standard
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

Identifier	Standard
8.G.9	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems

Middle-Grades—Conceptual Domain:

Statistics and Probability (SP)

Investigate Patterns of Association in Bivariate Data

Identifier	Standard
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* $\frac{cm}{hr}$ *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?*

NOTE

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

Middle School—Acceleration

The Standards ensure students are prepared for Algebra I in 8th grade by incorporating the necessary prerequisites in grades K–7. Mastery of this content enables students to successfully engage in Algebra I, while the grade 8 standards provide rigorous algebraic concepts that seamlessly transition students into the Algebra I course. Some students can move through mathematics quickly. These students may take high school mathematics beginning in eighth grade or earlier to take college-level mathematics in high school.

Students capable of progressing more quickly deserve thoughtful attention to ensure they are both challenged and mastering the full range of mathematical content and skills without skipping critical concepts. It is essential to maintain continuity in the mathematics learning progression, ensuring students fully understand all important topics. To support this, the MDE has developed a carefully designed sequence of **compacted courses**.

> *The term "compacted" refers to condensing or streamlining content to allow students to progress through material more quickly, often at an accelerated pace. This approach, commonly used in gifted education or advanced programs, enables students to master standard curriculum topics efficiently, creating space for more advanced content. Unlike skipping content, compacting involves compressing material, requiring a faster pace to complete while ensuring all key concepts are covered.*

The Middle School Compacted Math Pathway compresses three courses—CCR Math Grade 7, CCR Math Grade 8, and CCR Algebra I—into two years (a 3:2 compaction). The MS CCRS Compacted Grade 7 course includes all Grade 7 standards and part of Grade 8 standards, while the MS CCRS Compacted Grade 8 course includes the remaining Grade 8 standards and all MS CCRS Algebra I content.[1] *See the Suggested Middle School Math Pathways below.*

Suggested Middle School Math Pathways

Traditional Pathway

CCR Math Grade 6 (279901)	CCR Math Grade 7 (270101)	CCR Math Grade 8 (270720)

Accelerated Pathway

CCR Math Grade 6 (279901)	CCR Compacted Math Grade 7 w/ Grade 8 (270710)	CCR Compacted Math Grade 8 w/ Algebra I (270721)

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.

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.

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 the 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.

NOTE

[1] The CCR Compacted Math Grade 8 with Algebra I course includes the High School Conceptual Categories (*see pp. 148-156)*.

CCR Compacted Math Grade 7

In Compacted Mathematics Grade 7 (with Grade 8), ***a one-credit course***, instruction should focus on four critical areas from Grade 7: (1) applying proportional relationships; (2) developing understanding of operations with rational numbers and working with expressions and linear equations; (3) solving problems involving scale drawings and informal geometric constructions, and working with two- and three-dimensional shapes to solve problems involving area, surface area, and volume; and (4) drawing inferences about populations based on samples. Each critical area is described below.

(1) Students extend their understanding of ratios and develop understanding of proportionality to solve single- and multi-step problems. Students use their understanding of ratios and proportionality to solve a wide variety of percent problems, including those involving discounts, interest, taxes, tips, and percent increase or decrease. Students solve problems about scale drawings by relating corresponding lengths between the objects or by using the fact that relationships of lengths within an object are preserved in similar objects. Students graph proportional relationships and understand the unit rate informally as a measure of the steepness of the related line, called the slope. They distinguish proportional relationships from other relationships.

(2) Students develop a unified understanding of number, recognizing fractions, decimals (that have a finite or a repeating decimal representation), and percents as different representations of rational numbers. Students extend addition, subtraction, multiplication, and division to all rational numbers, maintaining the properties of operations and the relationships between addition and subtraction, and multiplication and division. By applying these properties, and by viewing negative numbers in terms of everyday contexts (e.g., amounts owed or temperatures below zero), students explain and interpret the rules for adding, subtracting, multiplying, and dividing with negative numbers. They use the arithmetic of rational numbers as they formulate expressions and equations in one variable and use these equations to solve problems.

(3) Students continue their work with area from Grade 6, solving problems involving the area and circumference of a circle and surface area of three-dimensional objects. In preparation for work on congruence and similarity in Grade 8 they reason about relationships among two-dimensional figures using scale drawings and informal geometric constructions, and they gain familiarity with the relationships between angles formed by intersecting lines. Students work with three-dimensional figures, relating them to two-dimensional figures by examining cross-sections. They solve real-world problems

involving area, surface area, and volume of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes and right prisms.

(4) Students build on their previous work with single data distributions to compare two data distributions and address questions about differences between populations. They begin informal work with random sampling to generate data sets and learn about the importance of representative samples for drawing inferences.

From Math Grade 8, 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 ($\frac{y}{x} = m$ 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 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 within this grade-level course is centered on the mathematics domains of **Ratios and Proportional Relationships** (Grades 6-7); **the Number System** (Grades 6-8), **Expressions & Equations** (Grades 6-8), **Geometry** (Grades K-8), and **Statistics & Probability** (Grades 6-8). Instruction in these domains should be designed to expose students to experiences that reflect the value of mathematics, enhance students' confidence in their ability to do mathematics, and help students communicate and reason mathematically.

College- and Career-Readiness Standards:
Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
7.SMP.1	Make sense of problems and persevere in solving them.
7.SMP.2	Reason abstractly and quantitatively.
7.SMP.3	Construct viable arguments and critique the reasoning of others.
7.SMP.4	Model with mathematics.
7.SMP.5	Use appropriate tools strategically.
7.SMP.6	Attend to precision.
7.SMP.7	Look for and make use of structure.
7.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but required standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

Middle-Grades—Conceptual Domain:

Ratios and Proportional Relationships (RP)

Analyze Proportional Relationships and use them to Solve Real-world and Mathematical Problems

Identifier	Standard
7.RP.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks* $\frac{1}{2}$ *mile in each* $\frac{1}{4}$ *hour, compute the unit rate as the complex fraction* $\frac{\frac{1}{2}}{\frac{1}{4}}$ *miles per hour, equivalently 2 miles per hour.*
7.RP.2	Recognize and represent proportional relationships between quantities. a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. c. Represent proportional relationships by equations. *For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t = pn.* d. Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate.
7.RP.3	Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*

Middle-Grades—Conceptual Domain:
The Number System (NS)

Apply and Extend Previous Understandings of Operations with Fractions to Add, Subtract, Multiply, and Divide Rational Numbers

Identifier	Standard
7.NS.1	Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram. a. Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged*. b. Understand $p + q$ as the number located a distance $\|q\|$ from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts. c. Understand subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference and apply this principle in real-world contexts. d. Apply properties of operations as strategies to add and subtract rational numbers.
7.NS.2	Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (–1)(–1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts. b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with non-zero divisor) is a rational number. If p and q are integers, then $-(\frac{p}{q}) = \frac{(-p)}{q} = \frac{p}{(-q)}$. Interpret quotients of rational numbers by describing real-world contexts. c. Apply properties of operations as strategies to multiply and divide rational numbers. d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.
7.NS.3	Solve real-world and mathematical problems involving the four operations with rational numbers.[1]

Know that there are Numbers that are Not Rational, and Approximate them by Rational Numbers

Identifier	Standard
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.*

Middle-Grades—Conceptual Domain:

Expressions and Equations (EE)

Use Properties of Operations to Generate Equivalent Expressions

Identifier	Standard
7.EE.1	Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
7.EE.2	Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. *For example, a + 0.05a = 1.05a means that "increase by 5%" is the same as "multiply by 1.05."*

Solve Real-life and Mathematical Problems Using Numerical and Algebraic Expressions and Equations

Identifier	Standard
7.EE.3	Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example: If a woman making $25 an hour gets a 10% raise, she will make an additional* $\frac{1}{10}$ *of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar* $9\frac{3}{4}$ *inches long in the center of a door that is* $27\frac{1}{2}$ *inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.*

Identifier	Standard
7.EE.4	Use variables to represent quantities in a real-world or mathematical problem and construct simple equations and inequalities to solve problems by reasoning about the quantities. a. Solve word problems leading to equations of the form px + q = r and p(x + q) = r, where p, q, and r are specific rational numbers. Solve equations of these forms ***fluently***. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width? b. Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example: As a salesperson, you are paid $50 per week plus $3 per sale. This week you want your pay to be at least $100. Write an inequality for the number of sales you need to make and describe the solutions.*

Work with Radicals and Integer Exponents

Identifier	Standard
8.EE.1	Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example,* $3^2 \times 3^{-5} = 3^{-3} = \frac{1}{3^3} = \frac{1}{27}$.
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

Identifier	Standard
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.

Middle-Grades—Conceptual Domain:

Geometry (G)

Draw, Construct, and Describe Geometrical Figures and Describe the Relationships Between Them

Identifier	Standard
7.G.1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.
7.G.2	Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.
7.G.3	Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.

Solve Real-world and Mathematical Problems Involving Angle Measure, Area, Surface Area, and Volume

Identifier	Standard
7.G.4	Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

Identifier	Standard
7.G.5	Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.
7.G.6	Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals and polygons including cubes, right prisms, and pyramids.

Understand Congruence and Similarity using Physical Models, Transparencies, or Geometry Software

Identifier	Standard
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.*

Solve Real-world and Mathematical Problems Involving Volume of Cylinders, Cones, and Spheres

Identifier	Standard
8.G.9	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Middle-Grades—Conceptual Domain:

Statistics and Probability (SP)

Use Random Sampling to Draw Inferences About a Population

Identifier	Standard
7.SP.1	Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.
7.SP.2	Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. *For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data. Gauge how far off the estimate or prediction might be.*

Draw Informal Comparative Inferences about Two Populations

Identifier	Standard
7.SP.3	Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability. *For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability on either team; on a dot plot, the separation between the two distributions of heights is noticeable.*
7.SP.4	Use measures of center and measures of variability (*i.e., inter-quartile range*) for numerical data from random samples to draw informal comparative inferences about two populations. *For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.*

Investigate Chance Processes and Develop, Use, and Evaluate Probability Models

Identifier	Standard
7.SP.5	Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around $\frac{1}{2}$ indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.

Identifier	Standard
7.SP.6	Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability. *For example, when rolling a number cube 600 times, predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times.*
7.SP.7	Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. a. Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events. *For example, if a student is selected at random from a class, find the probability that Jane will be selected and the probability that a girl will be selected.* b. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process. *For example, find the approximate probability that a spinning penny will land heads up or that a tossed paper cup will land open-end down. Do the outcomes for the spinning penny appear to be equally likely based on the observed frequencies?*
7.SP.8	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. a. Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs. b. Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., “rolling double sixes”), identify the outcomes in the sample space which compose the event. c. Design and use a simulation to generate frequencies for compound events. *For example, use random digits as a simulation tool to approximate the answer to the question: If 40% of donors have type A blood, what is the probability that it will take at least 4 donors to find one with type A blood?*

NOTE

[1] Computations with rational numbers extend the rules for manipulating fractions to complex fractions.

CCR Compacted Math Grade 8

In Compacted Mathematics Grade 8 (with Algebra I), ***a one-credit course***, instruction should focus on 3 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 ($\frac{y}{x}$ = *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 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.

(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 within this grade-level course is centered on the mathematics domains of **the Number System** (Grades 6-8)**, Expressions & Equations** (Grades 6-8)**, Functions** (Grade 8), **Geometry** (Grades K-8)**,** and **Statistics & Probability** (Grades 6-8), and the high school conceptual categories of **Number and Quantity**, **Algebra**, **Functions**, **Modeling, Geometry**, and **Statistics & Probability**.[1] Instruction in these domains and conceptual categories should be designed to expose students to experiences that reflect the value of mathematics, enhance students' confidence in their ability to do mathematics, and help students communicate and reason mathematically.

NOTE

[1] For a detailed description of each High School Conceptual Category, see the *High School Conceptual Categories* section (pp. 148-156).

College- and Career-Readiness Standards:
Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
8.SMP.1	Make sense of problems and persevere in solving them.
8.SMP.2	Reason abstractly and quantitatively.
8.SMP.3	Construct viable arguments and critique the reasoning of others.
8.SMP.4	Model with mathematics.
8.SMP.5	Use appropriate tools strategically.
8.SMP.6	Attend to precision.
8.SMP.7	Look for and make use of structure.
8.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but **required** standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

High School—Conceptual Category:
Number and Quantity

The Real Number System (N-RN)

Use Properties of Rational and Irrational Numbers

Identifier	Standard
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) *

Use Properties of Rational and Irrational Numbers

Identifier	Standard
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 the Quantities section of the High School Number and Quantity Conceptual Category section of this document.]
N-Q.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. *

Middle-School—Conceptual Domain:
Expressions and Equations (EE)

Analyze and Solve Linear Equations and Pairs Simultaneous Linear Equations

Identifier	Standard
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.

High-School—Conceptual Category:
Algebra (A)

Seeing Structure in Expressions (A-SSE)

Interpret the Structure of Expressions

Identifier	Standard
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.*
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

Identifier	Standard
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* $[1.15^{\frac{1}{12}}]^{12t} \approx 1.012^{12t}$ *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

Identifier	Standard
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

Identifier	Standard
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

Identifier	Standard
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 exponential functions.* *

Identifier	Standard
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

Identifier	Standard
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

Identifier	Standard
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

Identifier	Standard
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 using algebraic processes and approximately (e.g. graphically) while focusing on pairs of linear equations in two variables.

Represent and Solve Equations and Inequalities Graphically

Identifier	Standard
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.

Middle-School—Conceptual Domain:

Functions

Define, Evaluate, and Compare Functions

Identifier	Standard
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.*

Identifier	Standard
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

Identifier	Standard
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.

High-School—Conceptual Category: Functions

Interpreting Functions (F-IF)

Understand the Concept of a Function and use Function Notation

Identifier	Standard
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	Use the fact that sequences are functions whose domain is a subset of the integers to identify sequences and generate their explicit formulas.

Interpret Functions that Arise in Applications in Terms of Context

Identifier	Standard
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; and end behavior.* *
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

Identifier	Standard
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

Identifier	Standard
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

Identifier	Standard
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.

Linear, Quadratic, and Exponential Models (F-LE) *

Construct and Compare Linear, Quadratic, and Exponential Models and Solve Problems

Identifier	Standard
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). *

Interpret Expressions for Functions in Terms of the Situations they Model

Identifier	Standard
F-LE.5	Interpret the parameters in a linear or exponential function in terms of a context. *

Middle-School—Conceptual Domain:
Geometry (G)

Understand and Apply the Pythagorean Theorem

Identifier	Standard
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.

Middle-School—Conceptual Domain:
Statistics and Probability (SP)

Investigate Patterns of Association in Bivariate Data

Identifier	Standard
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* $1.5\ \frac{cm}{hr}$ *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?*

High-School—Conceptual Category:

Statistics and Probability (S)

Interpreting Categorical and Quantitative Data (S-ID)

Summarize, Represent, and Interpret Data on a Single Count or Measurement Variable

Identifier	Standard
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 a Single Count or Measurement Variable

Identifier	Standard
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

Identifier	Standard
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. *

NOTE

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

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

SREB Ready for High School Math

The Southern Region Education Board (SREB) Ready for High School Math Course, is a ***one-credit course*** designed only for 8th and/or 9th graders.

This course offers an earlier intervention, reaching underprepared students as they enter high school, which for many students is the most critical time in their education in determining future success. This course emphasizes the understanding of math concepts rather than just memorizing procedures. In SREB Ready for High School Math, students learn why to use a certain formula or method to solve a problem. By engaging students in real-world applications, SREB Ready for High School Math develops critical-thinking skills that students will use throughout their high school studies.

The SREB Ready for High School Math course consists of eight units, focuses on sixty-eight key readiness standards, and culminates with a capstone project. The content within this course is centered on the mathematics from throughout middle school and even earlier, agreed to as essential college- and career-readiness standards for most students, and is aligned with the domains of **the Number System**, **Ratios and Proportional Relationships**, **Expressions & Equations**, **Functions**, **Geometry**, and **Statistics & Probability**. Instruction in these domains 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.

Instruction within the supplemental mathematics courses 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.

For the most current SREB Ready for High School Math course description, standards, and materials, visit: https://www.sreb.org/ready-high-school-math.

College- and Career-Readiness Standards:
Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
R.SMP.1	Make sense of problems and persevere in solving them.
R.SMP.2	Reason abstractly and quantitatively.
R.SMP.3	Construct viable arguments and critique the reasoning of others.
R.SMP.4	Model with mathematics.
R.SMP.5	Use appropriate tools strategically.
R.SMP.6	Attend to precision.
R.SMP.7	Look for and make use of structure.
R.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but **required** standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

Middle-Grades—Conceptual Domain:
The Number System (NS)

The Number System

Identifier	Standard
UNIT $\frac{1}{2}$	This introductory unit encourages a deeper understanding of order, comparison and computation of fractions through the exploration of different fraction models. Students will reflect upon which model works best to represent different situations and create connections between those models. This unit also introduces students to the general approach to instruction and modes of thinking and questioning they will encounter in the remainder of the course.
UNIT 1	This unit solidifies students' understanding of the relationships among fractions, decimals and percents. The unit introduces students to scientific notation and irrational numbers. Students explore the context of scientific notation, and the forms of numbers used in solving math problems.

Middle-Grades—Conceptual Domain:
Ratios and Proportional Relationships (RP)

Ratios and Proportional Relationships

Identifier	Standard
UNIT 2	This introductory unit encourages a deeper understanding of order, comparison and computation of fractions through the exploration of different fraction models. Students will reflect upon which model works best to represent different situations and create connections between those models. This unit also introduces students to the general approach to instruction and modes of thinking and questioning they will encounter in the remainder of the course.

Middle-Grades—Conceptual Domain:
Statistics and Probability (SP)

Probability and One-Variable Statistics

Identifier	Standard
UNIT 3	This unit solidifies students' understanding of simple probability and one-variable statistics, including but not limited to describing distributions, sampling and statistical measures. Students explore ways mathematics can provide models to interpret data, make predictions and better understand the world. The limitations of statistics are discussed.

Middle-Grades—Conceptual Domain:
Expressions and Equations (EE)

Expressions, Equations, and Inequalities

Identifier	Standard
UNIT 4	This unit solidifies students' understanding of the structure of expressions and solving equations. Illustrations, drawings and models are used to represent and solve equations and inequalities, helping to develop understanding of acceptable solutions. Students explore the relationships between properties of equations and algebraic expressions.

Middle-Grades—Conceptual Domain:
Geometry

Graph Points on the Coordinate Plane to Solve Real-World and Mathematical Problems

Identifier	Standard
UNIT 5	This unit teaches students how to draw, translate and describe geometrical figures, understand congruence, use the Pythagorean Theorem and discuss relationships among different shapes in the context of real-world mathematical problems. Students explore how angles, parallel lines, congruent figures, triangles and quadrilaterals occur in real-life situations.

Middle-Grades—Conceptual Domain:
Functions (F)

Functions and Linear Relationships

Identifier	Standard
UNIT 6	Students identify the characteristics that distinguish functions from relations and identify functions as linear or nonlinear. Students investigate linear relationships in depth through tables, equations and graphs. Students develop linear models for real-world situations. Students relate slope as a rate of change and the y-intercept contextually to real-world problems.

Supplemental Middle School Math Courses

Supplemental Mathematics (Grades 5-6) and (Grades 7-8) courses, formerly Compensatory Mathematics, are designed to provide targeted interventions of core mathematics concepts.[1]

Students in need of instructional support, intervention, or remediation may be enrolled in a Supplemental Mathematics course under the following stipulations:

The Supplemental Mathematics course:

(1) must be taken in concert with a credit-bearing course at the same grade level;
(2) includes content supportive of the accompanying credit-bearing course;
(3) should incorporate the Standards for Mathematical Practice (SMPs); and
(4) may be taken as an elective, but will **not** satisfy the number of mathematics Carnegie units required for graduation.

Instruction within the supplemental mathematics courses 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.

NOTE

[1] Documentation of Tier II and III interventions is required. ***MS State Board Policy Manual***: Rule 41.1 intervention.

Secondary & High School

Grades 9–12

High School Overview

The high school standards specify the mathematics that all students should study in order to be college and career ready. Additional mathematics that students might learn in order to take advanced courses are included in the Advanced Mathematics Plus and Algebra III courses. The high school standards are listed in conceptual categories:

- Number and Quantity
- Algebra
- Functions
- Modeling
- Geometry
- Statistics and Probability

Conceptual categories portray a coherent view of high school mathematics; a student's work with functions, for example, crosses a number of traditional course boundaries, potentially up through and including calculus.

Modeling is best interpreted not as a collection of isolated topics but in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by an asterisk (*). The asterisk (*) symbol sometimes appears on the heading for a group of standards; in that case, it should be understood to apply to all standards in that group.

High School—Conceptual Categories

NUMBER AND QUANTITY

Numbers and Number Systems. During the years from kindergarten to eighth grade, students must repeatedly extend their conception of number. At first, "number" means "counting number": 1, 2, 3... Soon after that, 0 is used to represent "none" and the whole numbers are formed by the counting numbers together with zero. The next extension is fractions. At first, fractions are barely numbers and tied strongly to pictorial representations. Yet by the time students understand division of fractions, they have a strong concept of fractions as numbers and have connected them, via their decimal representations, with the base-ten system used to represent the whole numbers. During middle school, fractions are augmented by negative fractions to form the rational numbers. In Grade 8, students extend this system once more, augmenting the rational numbers with the irrational numbers to form the real numbers. In high school, students will be exposed to yet another extension of number, when the real numbers are augmented by the imaginary numbers to form the complex numbers.

With each extension of number, the meanings of addition, subtraction, multiplication, and division are extended. In each new number system—integers, rational numbers, real numbers, and complex numbers—the four operations stay the same in two important ways: They have the commutative, associative, and distributive properties and their new meanings are consistent with their previous meanings.

Extending the properties of whole-number exponents leads to new and productive notation. For example, properties of whole-number exponents suggest that $(5^{\frac{1}{3}})^3$ should be $5^{\left(\frac{1}{3}\right)3}$ = 5^1 = 5 and that $5^{\frac{1}{3}}$ should be the cube root of 5.

Calculators, spreadsheets, and computer algebra systems can provide ways for students to become better acquainted with these new number systems and their notation. They can be used to generate data for numerical experiments, to help understand the workings of matrix, vector, and complex number algebra, and to experiment with non-integer exponents.

Quantities. In real world problems, the answers are usually not numbers but quantities: numbers with units, which involves measurement. In their work in measurement up through Grade 8, students primarily measure commonly used attributes such as length, area, and volume. In high school, students encounter a wider variety of units in modeling, e.g., acceleration, currency conversions, derived quantities such as person-hours and heating degree days, social science rates such as per-capita income, and rates in everyday life such as points scored per game or batting averages. They also encounter novel situations in which they themselves must conceive the attributes of interest. For example, to find a good measure of overall highway safety, they might propose measures such as fatalities per year, fatalities per year per driver, or fatalities per vehicle-mile traveled. Such a conceptual process is sometimes called quantification. Quantification is important for science, as when surface area suddenly “stands out” as an important variable in evaporation. Quantification is also important for companies, which must conceptualize relevant attributes and create or choose suitable measures for them.

ALGEBRA

Expressions. An expression is a record of a computation with numbers, symbols that represent numbers, arithmetic operations, exponentiation, and, at more advanced levels, the operation of evaluating a function. Conventions about the use of parentheses and the order of operations assure that each expression is unambiguous. Creating an expression that describes a computation involving a general quantity requires the ability to express the computation in general terms, abstracting from specific instances.

Reading an expression with comprehension involves analysis of its underlying structure. This may suggest a different but equivalent way of writing the expression that exhibits some different aspect of its meaning. For example, $p + 0.05p$ can be interpreted as the addition of a 5% tax to a price p. Rewriting $p + 0.05p$ as $1.05p$ shows that adding a tax is the same as multiplying the price by a constant factor.

Algebraic manipulations are governed by the properties of operations and exponents, and the conventions of algebraic notation. At times, an expression is the result of applying operations to simpler expressions. For example, $p + 0.05p$ is the sum of the simpler expressions p and $0.05p$. Viewing an expression as the result of operation on simpler expressions can sometimes clarify its underlying structure.

A spreadsheet or a computer algebra system (CAS) can be used to experiment with algebraic expressions, perform complicated algebraic manipulations, and understand how algebraic manipulations behave.

Equations and inequalities. An equation is a statement of equality between two expressions, often viewed as a question asking for which values of the variables the expressions on either side are in fact equal. These values are the solutions to the equation. An identity, in contrast, is true for all values of the variables; identities are often developed by rewriting an expression in an equivalent form.

The solutions of an equation in one variable form a set of numbers; the solutions of an equation in two variables form a set of ordered pairs of numbers, which can be plotted in the coordinate plane. Two or more equations and/or inequalities form a system. A solution for such a system must satisfy every equation and inequality in the system.

An equation can often be solved by successively deducing from it one or more simpler equations. For example, one can add the same constant to both sides without changing the solutions, but squaring both sides might lead to extraneous solutions. Strategic competence in solving includes looking ahead for productive manipulations and anticipating the nature and number of solutions.

Some equations have no solutions in a given number system, but have a solution in a larger system. For example, the solution of $x + 1 = 0$ is an integer, not a whole number; the solution of $2x + 1 = 0$ is a rational number, not an integer; the solutions of $x^2 – 2 = 0$ are real numbers, not rational numbers; and the solutions of $x^2 + 2 = 0$ are complex numbers, not real numbers.

The same solution techniques used to solve equations can be used to rearrange formulas. For example, the formula for the area of a trapezoid, $A = (\frac{(b_1+b_2)}{2})h$, can be solved for h using the same deductive process.

Inequalities can be solved by reasoning about the properties of inequality. Many, but not all, of the properties of equality continue to hold for inequalities and can be useful in solving them.

Connections to Functions and Modeling.

Expressions can define functions, and equivalent expressions define the same function. Asking when two functions have the same value for the same input leads to an equation; graphing the two functions allows for finding approximate solutions of the equation. Converting a verbal description to an equation, inequality, or system of these is an essential skill in modeling.

FUNCTIONS

Functions describe situations where one quantity determines another. For example, the return on $10,000 invested at an annualized percentage rate of 4.25% is a function of the length of time the money is invested. Because we continually make theories about dependencies between quantities in nature and society, functions are important tools in the construction of mathematical models.

In school mathematics, functions usually have numerical inputs and outputs and are often defined by an algebraic expression. For example, the time in hours it takes for a car to drive 100 miles is a function of the car's speed in miles per hour, *v*; the rule $T(v) = \frac{100}{v}$ expresses this relationship algebraically and defines a function whose name is *T*.

The set of inputs to a function is called its domain. We often infer the domain to be all inputs for which the expression defining a function has a value, or for which the function makes sense in a given context.

A function can be described in various ways, such as by a graph (e.g., the trace of a seismograph); by a verbal rule, as in, "I'll give you a state, you give me the capital city;" by an algebraic expression like $f(x) = a + bx$; or by a recursive rule. The graph of a function is often a useful way of visualizing the relationship of the function models, and manipulating a mathematical expression for a function can throw light on the function's properties.

Functions presented as expressions can model many important phenomena. Two important families of functions characterized by laws of growth are linear functions, which grow at a constant rate, and exponential functions, which grow at a constant percent rate. Linear functions with a constant term of zero describe proportional relationships.

A graphing utility or a computer algebra system can be used to experiment with properties of these functions and their graphs and to build computational models of functions, including recursively defined functions.

Connections to Expressions, Equations, Modeling, and Coordinates.

Determining an output value for a particular input involves evaluating an expression; finding inputs that yield a given output involves solving an equation. Questions about when two functions have the same value for the same input lead to equations, whose solutions can be visualized from the intersection of their graphs. Because functions describe relationships between quantities, they are frequently used in modeling. Sometimes functions are defined by a recursive process, which can be displayed effectively using a spreadsheet or other technology.

MODELING

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.

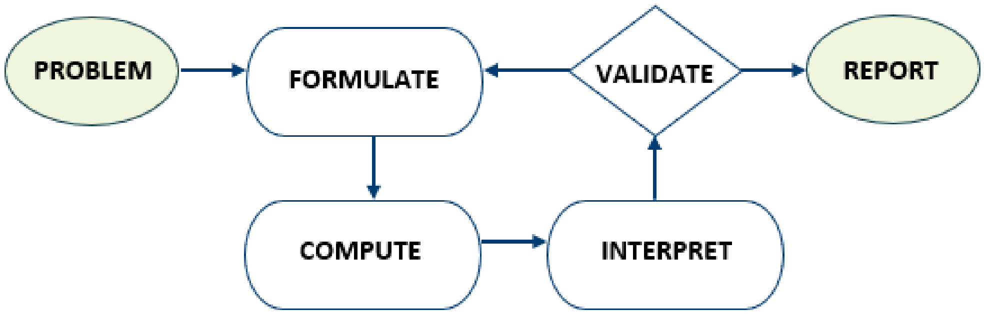
A model can be very simple, such as writing total cost as a product of unit price and number bought, or using a geometric shape to describe a physical object like a coin. Even such simple models involve making choices. It is up to us whether to model a coin as a three-dimensional cylinder, or whether a two-dimensional disk works well enough for our purposes. Other situations—modeling a delivery route, a production schedule, or a comparison of loan amortizations—need more elaborate models that use other tools from the mathematical sciences. Real-world situations are not organized and labeled for analysis; formulating tractable models, representing such models, and analyzing them is appropriately a creative process. Like every such process, this depends on acquired expertise as well as creativity.

Some examples of such situations might include:

- Estimating how much water and food is needed for emergency relief in a devastated city of 3 million people, and how it might be distributed.
- Planning a table tennis tournament for 7 players at a club with 4 tables, where each player plays against each other player.
- Designing the layout of the stalls in a school fair so as to raise as much money as possible.
- Analyzing stopping distance for a car.
- Modeling savings account balance, bacterial colony growth, or investment growth.
- Engaging in critical path analysis, e.g., applied to turnaround of an aircraft at an airport.
- Analyzing risk in situations such as extreme sports, pandemics, and terrorism.
- Relating population statistics to individual predictions.

In situations like these, the models devised depend on a number of factors: How precise an answer do we want or need? What aspects of the situation do we most need to understand, control, or optimize? What resources of time and tools do we have? The range of models that we can create and analyze is also constrained by the limitations of our mathematical, statistical, and technical skills, and our ability to recognize significant variables and relationships among them. Diagrams of various kinds, spreadsheets and other technology, and algebra are powerful tools for understanding and solving problems drawn from different types of real-world situations.

One of the insights provided by mathematical modeling is that essentially the same mathematical or statistical structure can sometimes model seemingly different situations. Models can also shed light on the mathematical structures themselves, for example, as when a model of bacterial growth makes more vivid the explosive growth of the exponential function.



The basic modeling cycle is summarized in the diagram. It 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.

In descriptive modeling, a model simply describes the phenomena or summarizes them in a compact form. Graphs of observations are a familiar descriptive model—for example, graphs of global temperature and atmospheric CO_2 over time.

Analytic modeling seeks to explain data on the basis of deeper theoretical ideas, albeit with parameters that are empirically based; for example, exponential growth of bacterial colonies (until cut-off mechanisms such as pollution or starvation intervene) follows from a constant reproduction rate. Functions are an important tool for analyzing such problems.

Graphing utilities, spreadsheets, computer algebra systems, and dynamic geometry software are powerful tools that can be used to model purely mathematical phenomena (e.g., the behavior of polynomials) as well as physical phenomena.

Modeling Standards. *Modeling is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by an asterisk (*).*

GEOMETRY

An understanding of the attributes and relationships of geometric objects can be applied in diverse contexts—interpreting a schematic drawing, estimating the amount of wood needed to frame a sloping roof, rendering computer graphics, or designing a sewing pattern for the most efficient use of material.

Although there are many types of geometry, school mathematics is devoted primarily to plane Euclidean geometry, studied both synthetically (without coordinates) and analytically (with coordinates). Euclidean geometry is characterized most importantly by the Parallel Postulate that through a point not on a given line there is exactly one parallel line. (Spherical geometry, in contrast, has no parallel lines.)

During high school, students begin to formalize their geometry experiences from elementary and middle school, using more precise definitions and developing careful proofs. Later in college some students develop Euclidean and other geometries carefully from a small set of axioms.

The concepts of congruence, similarity, and symmetry can be understood from the perspective of geometric transformation. Fundamental are the rigid motions: translations, rotations, reflections, and combinations of these, all of which are here assumed to preserve distance and angles (and therefore shapes generally). Reflections and rotations each explain a particular type of symmetry, and the symmetries of an object offer insight into its attributes—as when the reflective symmetry of an isosceles triangle assures that its base angles are congruent.

In the approach taken here, two geometric figures are defined to be congruent if there is a sequence of rigid motions that carries one onto the other. This is the principle of superposition. For triangles, congruence means the equality of all corresponding pairs of sides and all corresponding pairs of angles. During the middle grades, through experiences drawing triangles from given conditions, students notice ways to specify enough measures in a triangle to ensure that all triangles drawn with those measures are congruent. Once these triangle congruence criteria (ASA, SAS, and SSS) are established using rigid motions, they can be used to prove theorems about triangles, quadrilaterals, and other geometric figures.

Similarity transformations (rigid motions followed by dilations) define similarity in the same way that rigid motions define congruence, thereby formalizing the similarity ideas of “same shape” and “scale factor” developed in the middle grades. These transformations lead to the criterion for triangle similarity that two pairs of corresponding angles are congruent.

The definitions of sine, cosine, and tangent for acute angles are founded on right triangles and similarity, and, with the Pythagorean Theorem, are fundamental in many real-world and theoretical situations. The Pythagorean Theorem is generalized to non-right triangles by the Law of Cosines. Together, the Laws of Sines and Cosines embody the triangle congruence criteria for the cases where three pieces of information suffice to completely solve a triangle. Furthermore, these laws yield two possible solutions in the ambiguous case, illustrating that Side-Side-Angle is not a congruence criterion.

Analytic geometry connects algebra and geometry, resulting in powerful methods of analysis and problem solving. Just as the number line associates numbers with locations in one dimension, a pair of perpendicular axes associates pairs of numbers with locations in two dimensions. This correspondence between numerical coordinates and geometric points allows methods from algebra to be applied to geometry and vice versa. The solution set of an equation becomes a geometric curve, making visualization a tool for doing and understanding algebra. Geometric shapes can be described by equations, making algebraic manipulation into a tool for geometric understanding, modeling, and proof. Geometric transformations of the graphs of equations correspond to algebraic changes in their equations.

Dynamic geometry environments provide students with experimental and modeling tools that allow them to investigate geometric phenomena in much the same way as computer algebra systems allow them to experiment with algebraic phenomena.

Connections to Equations. The correspondence between numerical coordinates and geometric points allows methods from algebra to be applied to geometry and vice versa. The solution set of an equation becomes a geometric curve, making visualization a tool for doing and understanding algebra. Geometric shapes can be described by equations, making algebraic manipulation into a tool for geometric understanding, modeling, and proof.

STATISTICS AND PROBABILITY

Decisions or predictions are often based on data—numbers in context. These decisions or predictions would be easy if the data always sent a clear message, but the message is often obscured by variability. Statistics provides tools for describing variability in data and for making informed decisions that take it into account.

Data are gathered, displayed, summarized, examined, and interpreted to discover patterns and deviations from patterns. Quantitative data can be described in terms of key characteristics: measures of shape, center, and spread. The shape of a data distribution might be described as symmetric, skewed, flat, or bell shaped, and it might be summarized by a statistic measuring center (such as mean or median) and a statistic measuring spread (such as standard deviation or interquartile range). Different distributions can be compared numerically using these statistics or compared visually using plots. Knowledge of center and spread are not enough to describe a distribution. Which statistics to compare, which plots to use, and what the results of a comparison might mean, depend on the question to be investigated and the real-life actions to be taken.

Randomization has two important uses in drawing statistical conclusions. First, collecting data from a random sample of a population makes it possible to draw valid conclusions about the whole population, taking variability into account. Second, randomly assigning individuals to different treatments allows a fair comparison of the effectiveness of those treatments. A statistically significant outcome is one that is unlikely to be due to chance alone, and this can be evaluated only under the condition of randomness. The conditions under which data are collected are important in drawing conclusions from the data; in critically reviewing uses of statistics in public media and other reports, it is important to consider the study design, how the data were gathered, and the analyses employed as well as the data summaries and the conclusions drawn.

Random processes can be described mathematically by using a probability model: a list or description of the possible outcomes (the sample space), each of which is assigned a probability. In situations such as flipping a coin, rolling a number cube, or drawing a card, it might be reasonable to assume various outcomes are equally likely. In a probability model, sample points represent outcomes and combine to make up events; probabilities of events can be computed by applying the Addition and Multiplication Rules. Interpreting these probabilities relies on an understanding of independence and conditional probability, which can be approached through the analysis of two-way tables. Technology plays an important role in statistics and probability by making it possible to generate plots, regression functions, and correlation coefficients, and to simulate many possible outcomes in a short amount of time.

Connections to Functions and Modeling. Functions may be used to describe data; if the data suggest a linear relationship, the relationship can be modeled with a regression line, and its strength and direction can be expressed through a correlation coefficient

Best Practices for Secondary MS CCR Sequencing

> To help students meet College- and Career-Readiness ACT/SAT benchmarks in their junior year, the following course sequencing is recommended for mathematics.
> ***NOTE:*** Any additional upper-level course sequencing is acceptable.

Traditional Pathway

Grade 7	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
CCR Math Grade 7 (270101)	CCR Math Grade 8 (270720)	CCR Algebra I (270404)	CCR Geometry (270408) CCR Algebra II (270405)	CCR Algebra II (270405) CCR Geometry (270408)	• CCR Algebra III (270441) ***OR*** • CCR Advanced Mathematics Plus (270730) ***OR*** • Essentials for College Math (270715)/SREB Math Ready (270740) ***OR*** • Calculus (279912) ***OR*** • AP Pre-Calculus (270620) ***OR*** • AP Calculus AB (279908)/ AP Calculus BC (279909) ***OR*** • Dual Credit College Algebra (906401)

Accelerated Pathway

Grade 7	Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
CCR Compacted Math Grade 7 (270710)	CCR Compacted Math Grade 8 with Algebra I (270721)	• CCR Geometry (270408) • CCR Algebra II (270405)	• CCR Geometry (270408) • CCR Algebra II (270405)	• CCR Algebra III (270441) ***OR*** • Calculus (279912) ***OR*** • AP Statistics (270535) ***OR*** • AP Pre-Calculus (270620) ***OR*** • AP Calculus AB (279908)/ AP Calculus BC (279909) ***OR*** • Dual Credit College Algebra (906401) ***OR*** • Dual Credit College Trigonometry (906411)	• CCR Advanced Mathematics Plus (270730) ***OR*** • Calculus (279912) ***OR*** • AP Statistics (270535) ***OR*** • AP Pre-Calculus (270620) ***OR*** • AP Calculus AB (279908)/ AP Calculus BC (279909) ***OR*** • Dual Credit College Algebra (906401) ***OR*** • Dual Credit College Trigonometry (906411)

Common Secondary Course Sequence Options for Mathematics

Most used courses for secondary level students.

NOTE: The course codes follow the course names in parentheses. For additional courses for math classes, please refer to *MSIS Approved Secondary Course Codes Report*.

Grade 7

Traditional Option	Accelerated Option
CCR Math Grade 7 (270101)	CCR Compacted Math Grade 7 (270710)

Grade 8

Traditional Option	Accelerated Option
CCR Math Grade 8 (270720)	CCR Compacted Math Grade 8 with Algebra I (270721)

Grade 9

Option 1	Option 2	Option 3
CCR Algebra I (270404)	CCR Geometry (270408)	CCR Algebra II (270405)

Grade 10

Option 1	Option 2	Additional Options
CCR Geometry (270408)	CCR Algebra II (270405)	• CCR Algebra III (270441) **OR** • Calculus (279912) **OR** • AP Pre-Calculus (270620) **OR** • AP Calculus AB (279908)/ AP Calculus BC (279909) **OR** • Dual Credit/Dual Enrollment

Grade 11

Options
• CCR Algebra III (270441) **OR** • Calculus (279912) **OR** • AP Pre-Calculus (270620) **OR** • AP Calculus AB (279908)/ AP Calculus BC (279909) **OR** • Dual Credit/Dual Enrollment

Grade 12

Options
• CCR Algebra III (270441) ***OR*** • CCR Advanced Mathematics Plus (270730) ***OR*** • Calculus (279912) ***OR*** • AP Pre-Calculus (270620) ***OR*** • AP Calculus AB (279908)/ AP Calculus BC (279909) ***OR*** • Essentials for College Math (270715)/SREB Math Ready (270740) ***OR*** • Dual Credit/Dual Enrollment Math Course

Foundations of Algebra

Foundations of Algebra is a ***one-credit course*** offered only to 9th-grade students.

The primary purpose of the *Foundations of Algebra* course is to provide a basis for curriculum development for rising 9th-grade students in need of substantial support prior to taking Algebra I. The standards for this course were developed based on core content that should have been mastered by the end of grade 8 and key skills that will be introduced in Algebra I. These core content standards are indicated in bold font and color-coded to match their original conceptual domain or category. Additional standards have been developed to ensure conceptual understanding. Students who have already successfully completed Algebra I may not take this course. Teachers of this course are encouraged to incorporate real-world contexts, appropriate manipulatives, and technology to assist students in developing the conceptual understanding needed to master course content.

The content within the *Foundations of* Algebra course focuses on the conceptual categories of **Algebra,** and **Functions** (**equations**, **inequalities, polynomials)**, **Geometry**, and **Statistics & Probability.** Instruction in these 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.

College- and Career-Readiness Standards:

Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
FA.SMP.1	Make sense of problems and persevere in solving them.
FA.SMP.2	Reason abstractly and quantitatively.
FA.SMP.3	Construct viable arguments and critique the reasoning of others.
FA.SMP.4	Model with mathematics.
FA.SMP.5	Use appropriate tools strategically.
FA.SMP.6	Attend to precision.
FA.SMP.7	Look for and make use of structure.
FA.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but **required** standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

High-School—Conceptual Category:
Algebra (A)

Equations and Inequalities

Identifier	Standard
FA.A.1	Interpret key features of an expression (i.e., terms, factors, and coefficients). (**A-SSE.1a**)
FA.A.2	Create expressions that can be modeled by a real-world context.
FA.A.3	Use the structure of an expression to identify ways to rewrite it. (**A-SSE.2**)
FA.A.4	Simplify and evaluate numerical and algebraic expressions. (**7.EE.1**)
FA.A.5	Compare and contrast an expression and an equation and give examples of each.
FA.A.6	Given an equation, solve for a specified variable of degree one (i.e., *isolate a variable*). (**6.EE.7, 7.EE.4**)
FA.A.7	Fluently solve and check multi-step equations and inequalities with an emphasis on the distributive property, variables on both sides, and rational coefficients. Explain each step when solving a multi-step equation and inequality. Justify each step using the properties of real numbers.
FA.A.8	Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. (**7.EE.4a**)
FA.A.9	Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers. Solve inequalities of these forms fluently. (**7.EE.4b**)
FA.A.10	Graph the solution point of an equation and the solution set of an inequality in one variable on a horizontal number line. For inequalities, be able to interpret and write the solution set in a variety of ways (e.g., set notation).
FA.A.11	Justify when linear equations in one variable will yield one solution, infinitely many solutions, or no solution. (**8.EE.7a**)

High-School—Conceptual Category:

Functions (F)

Functions

Identifier	Standard
FA.F.12	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. Use function notation, where appropriate. (**F-IF.1**, **F-IF.2**)
FA.F.13	Compare and contrast a function and a relation. Use appropriate strategies to assess whether a given situation represents a function or a relation (e.g., the vertical line test).
FA.F.14	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. (**F-IF.7**)
FA.F.15	Determine the rate of change of a linear function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. (**8.F.4**) Use the rate of change to determine if two lines are parallel, perpendicular, or neither.
FA.F.16	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.4**)
FA.F.17	Create and graph the equation of a linear function given the rate of change and y-intercept. Compare and contrast up to three linear functions written in various forms (i.e., point-slope, slope-intercept, standard form).
FA.F.18	Given two points, a graph, a table of values, a mapping diagram, or a real-world context, determine the linear function that models this information. Fluently convert between the point-slope, slope-intercept, and standard form of a line.
FA.F.19	Create and identify the parent function for linear and quadratic functions in the Coordinate Plane.
FA.F.20	Compare the 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.* (Limited to linear and quadratic functions only.) (**8.F.2**)
FA.F.21	Describe the following characteristics of linear and quadratic parent functions by inspection: domain/range, increasing/decreasing intervals, intercepts, symmetry, and asymptotic behavior. Identify each characteristic in set notation or words, where appropriate. (**A3.A.8**)
FA.F.22	Graph a system of two functions, $f(x)$ and $g(x)$, on the same Coordinate Plane by hand for simple cases, and with technology for complicated cases. Explain the relationship between the point(s) of intersection and the solution to the system. Determine the solution(s) using technology, a table of values, substitution, or successive approximations. (Limited to linear and quadratic functions only.)

Identifier	Standard
	(**8.EE.7b**, **A-REI.6**, **A-REI.11**)
FA.F.23	With accuracy, graph the solutions to a linear inequality in two variables as a half-plane, and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes on the same Coordinate Plane. (**A-REI.12**) Construct graphs of linear inequalities and systems of linear inequalities without technology. Use appropriate strategies to verify points that may or may not belong to the solution set.
FA.F.24	Identify real-world contexts that can be modeled by a system of inequalities in two variables. (Limited to three inequalities.)
FA.F.25	Identify when systems of equations and inequalities have constraints. (**A-CED.3**)
FA.F.26	Perform simple translations on linear functions given in a variety of forms (e.g., two points, a graph, a table of values, a mapping, slope-intercept form, or standard form). Explain the impact on the parent function when the slope is greater than one or less than one, and the effect of increasing/decreasing the y-intercept.
FA.F.27	Given the graph of function in the form $f(x)+k$, $kf(x)$, $f(kx)$, or $f(x+k)$, where k belongs to the set of integers, identify the domain/range, increasing/decreasing intervals, intercepts, symmetry, and asymptotic behavior, where appropriate. (**F-BF.3**) Identify each characteristic in set notation or as an inequality, where appropriate. (Limited to linear and quadratic functions only.)
FA.F.28	Identify and graph real-world contexts that can be modeled by a quadratic equation.
FA.F.29	Solve quadratic equations in standard form by factoring, graphing, using tables, and the Quadratic Formula. Know when the Quadratic Formula might yield complex solutions and the location of the solutions in relation to the x-axis. Know suitable alternatives for the terminology "*solution of a quadratic"* and when each is appropriate to use.
FA.F.30	Understand the relationship between the constants of a quadratic equation and the attributes of the graph. Recognize the relationship between the value of the discriminant and the type and number of solutions (i.e., *predict the characteristics of a graph given the equation*).

High-School—Conceptual Category:
Algebra (A)

Polynomials

Identifier	Standard
FA.A.31	Describe and identify a polynomial of degree one, two, three, and four by examining a polynomial expression or a graph.
FA.A.32	Add and subtract polynomials using appropriate strategies (e.g.,by using Algebra Tiles).
FA.A.33	Factor polynomials using the greatest common factor and factor quadratics that have only rational zeros.
FA.A.34	Justify why some polynomials are prime over the rational number system.
FA.A.35	Use the zeros of a polynomial to construct a rough graph of the function. (**A-APR.3**)

High-School—Conceptual Category:
Geometry (G)

Geometry

Identifier	Standard
FA.G.36	Explain and 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.7**)
FA.G.37	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system. (**8.G.8**)
FA.G.38	Fluently use formulas and/or appropriate measuring tools to find length and angle measures, perimeter, area, volume, and surface area of polygons, circles, spheres, cones, cylinders, pyramids, and composite or irregular figures. Use them to solve real-world and mathematical problems. (**8.G.9**)
FA.G.39	Solve real-world and mathematical problems involving two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. (**7.G.6**)

High-School—Conceptual Category:
Statistics and Probability (S)

Statistics

Identifier	Standard
FA.S.40	Without technology, fluently calculate the measures of central tendency (mean, median, mode), measures of spread (range, interquartile range), and understand the impact of extreme values (outliers) on each of these values. (**6.SP.5, 8.SP.1, S-ID.3**) Justify which measure is appropriate to use when describing a data set or a real-world context.
FA.S.41	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.1**)
FA.S.42	Know when it is and is not appropriate to use a linear model to make predictions about a data set beyond a given set of values. Explain extrapolation and interpolation and the impact both have on predicted values.
FA.S.43	For scatter plots that suggest a linear association, informally fit a straight line and predict the equation for the line of best fit. (**8.SP.2**)
FA.S.44	Justify the relationship between the correlation coefficient and the rate of change for the line of best fit.
FA.S.45	Understand the difference between correlation and causation and identify real-world contexts that depict each of them. (**S-ID.9**)

CCR Algebra I

In Algebra I, a ***one-credit course***, 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.

(3) This area builds upon 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 numbers 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 within this course is centered on the mathematics high school conceptual categories of **Number and Quantity**, **Algebra**, **Functions**, **Modeling**, and **Statistics & Probability**. Instruction in these conceptual categories should be designed to expose students to experiences that reflect the value of mathematics, enhance students' confidence in their ability to do mathematics, and help students communicate and reason mathematically.

College- and Career-Readiness Standards:
Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
A.SMP.1	Make sense of problems and persevere in solving them.
A.SMP.2	Reason abstractly and quantitatively.
A.SMP.3	Construct viable arguments and critique the reasoning of others.
A.SMP.4	Model with mathematics.
A.SMP.5	Use appropriate tools strategically.
A.SMP.6	Attend to precision.
A.SMP.7	Look for and make use of structure.
A.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but **required** standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

High-School—Conceptual Category:

Number and Quantity (N)

The Real Number System (N-RN)

Use Properties of Rational and Irrational Numbers

Identifier	Standard
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) *

Use Properties of Rational and Irrational Numbers

Identifier	Standard
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 the *Quantities* section of the High School *Number and Quantity* Conceptual Category section of this document.]
N-Q.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. *

High-School—Conceptual Category:

Algebra (A)

Seeing Structure in Expressions (A-SSE)

Interpret the Structure of Expressions

Identifier	Standard
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.
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

Identifier	Standard
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 $[1.15^{\frac{1}{12}}]^{12t} \approx 1.012^{12t}$ 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

Identifier	Standard
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

Identifier	Standard
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

Identifier	Standard
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 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

Identifier	Standard
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

Identifier	Standard
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

Identifier	Standard
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 using algebraic processes and approximately (e.g., graphically) while focusing on pairs of linear equations in two variables.

Represent and Solve Equations and Inequalities Graphically

Identifier	Standard
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.

High-School—Conceptual Category:
Functions (F)

Interpreting Functions (F-IF)

Understand the Concept of a Function and use Function Notation

Identifier	Standard
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	Use the fact that sequences are functions whose domain is a subset of the integers to identify sequences and generate their explicit formulas.

Interpret Functions that Arise in Applications in Terms of Context

Identifier	Standard
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; and end behavior.* *
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

Identifier	Standard
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

Identifier	Standard
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

Identifier	Standard
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.

Linear, Quadratic, and Exponential Models (F-LE) *

Construct and Compare Linear, Quadratic, and Exponential Models and Solve Problems

Identifier	Standard
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). *

Interpret Expressions for Functions in Terms of the Situations they Model

Identifier	Standard
F-LE.5	Interpret the parameters in a linear or exponential function in terms of a context. *

High-School—Conceptual Category:

Statistics and Probability (S) *

Interpreting Categorical and Quantitative Data (S-ID)

Summarize, Represent, and Interpret Data on a Single Count or Measurement Variable

Identifier	Standard
S-ID.1	Represent and analyze data with plots on the real number line (dot plots, histograms, and box plots). *

Identifier	Standard
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

Identifier	Standard
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

Identifier	Standard
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. *

NOTE

* Modeling Standards

CCR Geometry

The fundamental purpose of the course in Geometry, ***a one-credit course***, is to formalize and extend students' geometric experiences from the middle grades. Students explore more complex geometric situations and deepen their explanations of geometric relationships, moving towards formal mathematical arguments. Important differences exist between this Geometry course and the historical approach taken in Geometry classes. Close attention should be paid to the introductory content for the Geometry conceptual category found in the high school MS CCRS. 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. The six critical areas of this course include (1) building a thorough understanding of translations, reflections, and rotations; (2) developing the understanding of similarity and several theorems; (3) extension of formulas for 2- dimensional and 3-dimensional objects; (4) extension of 8th grade geometric concepts of lines; (5) prove basic theorems about circles; and (6) work with experimental and theoretical probability. Each critical area is described below:

(1) 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 use triangle congruence as a familiar foundation for the development of formal proof. Students prove theorems—using a variety of formats—and solve problems about triangles, quadrilaterals, and other polygons. They apply reasoning to complete geometric constructions and explain why they work.

(2) Students apply their earlier experience with dilations and proportional reasoning to build a formal understanding of similarity. They identify criteria for similarity of triangles, use similarity to solve problems, and apply similarity in right triangles to understand right triangle trigonometry, with particular attention to special right triangles and the Pythagorean Theorem. Students develop the Laws of Sines and Cosines in order to find missing measures of general (not necessarily right) triangles, building on students' work with quadratic equations done in the first course. They are able to distinguish whether three given measures (angles or sides) define 0, 1, 2, or infinitely many triangles.

(3) Students' experience with two-dimensional and three-dimensional objects is extended to include informal explanations of circumference, area, and volume formulas. Additionally,

students apply their knowledge of two-dimensional shapes to consider the shapes of cross-sections and the result of rotating a two-dimensional object about a line.

(4) 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, which relates back to work done in the first course. Students continue their study of quadratics by connecting the geometric and algebraic definitions of the parabola.

(5) Students prove basic theorems about circles, such as a tangent line is perpendicular to a radius, inscribed angle theorem, and theorems about chords, secants, and tangents dealing with segment lengths and angle measures. They study relationships among segments on chords, secants, and tangents as an application of similarity. In the Cartesian coordinate system, students use the distance formula to write the equation of a circle when given the radius and the coordinates of its center. Given an equation of a circle, they draw the graph in the coordinate plane, and apply techniques for solving quadratic equations, which relates back to work done in the first course, to determine intersections between lines and circles or parabolas and between two circles.

(6) Building on probability concepts that began in the middle grades, students use the languages of set theory to expand their ability to compute and interpret theoretical and experimental probabilities for compound events, attending to mutually exclusive events, independent events, and conditional probability. Students should make use of geometric probability models wherever possible. They use probability to make informed decisions.

The content within this course is centered on the mathematics high school conceptual categories of **Geometry** and **Modeling**. Instruction in these conceptual categories should be designed to expose students to experiences that reflect the value of mathematics, enhance students' confidence in their ability to do mathematics, and help students communicate and reason mathematically.

College- and Career-Readiness Standards:
Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
G.SMP.1	Make sense of problems and persevere in solving them.
G.SMP.2	Reason abstractly and quantitatively.
G.SMP.3	Construct viable arguments and critique the reasoning of others.
G.SMP.4	Model with mathematics.
G.SMP.5	Use appropriate tools strategically.
G.SMP.6	Attend to precision.
G.SMP.7	Look for and make use of structure.
G.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but **required** standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

High-School—Conceptual Category:
Geometry (G)

Congruence (G-CO)

Experiment with Transformations in the Plane

Identifier	Standard
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

Identifier	Standard
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.
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

Identifier	Standard
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.*

Make Geometric Constructions

Identifier	Standard
G-CO.12	Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). *Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.*
G-CO.13	Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.

Similarity, Right Triangles, and Trigonometry (G-SRT)

Understand Similarity in Terms of Similarity Transformations

Identifier	Standard
G-SRT.1	Verify experimentally the properties of dilations given by a center and a scale factor: a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.
G-SRT.2	Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.

Identifier	Standard
G-SRT.3	Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

Prove Theorems involving Similarity

Identifier	Standard
G-SRT.4	Prove theorems about triangles. *Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.*
G-SRT.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

Define Trigonometric Ratios and Solve Problems involving Right Triangles

Identifier	Standard
G-SRT.6	Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.
G-SRT.7	Explain and use the relationship between the sine and cosine of complementary angles.
G-SRT.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems and rewrite expressions involving radicals to simplify and interpret solutions. *

Circles (G-C)

Understand and Apply Theorems about Circles

Identifier	Standard
G-C.1	Prove that all circles are similar.
G-C.2	Identify and describe relationships among inscribed angles, radii, and chords. *Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.*
G-C.3	Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.

Find Arc Lengths and Areas of Sectors of Circles

Identifier	Standard
G-C.5	Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.

Expressing Geometric Properties with Equations (G-GPE)

Translate Between the Geometric Description and the Equation for a Conic Section

Identifier	Standard
G-GPE.1	Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.

Use Coordinates to Prove Simple Geometric Theorems Algebraically

Identifier	Standard
G-GPE.4	Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, $\sqrt{3}$) lies on the circle centered at the origin and containing the point (0, 2).*
G-GPE.5	Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).
G-GPE.6	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
G-GPE.7	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula. *

Geometric Measurement and Dimension (G-GMD)

Explain Volume Formulas and Use Them to Solve Problems

Identifier	Standard
G-GMD.1	Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments.*
G-GMD.3	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. *

Visualize Relationships Between Two-Dimensional and Three-Dimensional Objects

Identifier	Standard
G-GMD.4	Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

Modeling with Geometry (G-MG)

Apply Geometric Concepts in Modeling Situations

Identifier	Standard
G-MG.1	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). *
G-MG.2	Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot). *
G-MG.3	Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios). *

NOTE

* Modeling Standards

CCR Algebra II

In Algebra II, ***a one-credit course***, students build on their work with linear, quadratic, and exponential functions to extend their repertoire of functions to include polynomial, rational, and radical functions. Students work closely with the expressions that define the functions, and continue to expand and hone their abilities to model situations and to solve equations, including solving quadratic equations over the set of complex numbers and solving exponential equations using the properties of logarithms. The Mathematical Practice Standards apply throughout this 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. The four critical areas of this course include (1) working extensively with polynomial operations; (2) building connections between geometry and trigonometric ratios; (3) understanding of a variety of function families; and (4) exploring statistical data. Each critical area is described below:

(1) Students develop the structural similarities between the system of polynomials and the system of integers. Students draw on analogies between polynomial arithmetic and base-ten computation, focusing on properties of operations, particularly the distributive property. Students connect multiplication of polynomials with multiplication of multi-digit integers, and division of polynomials with long division of integers. Students identify zeros of polynomials, including complex zeros of quadratic polynomials, and make connections between zeros of polynomials and solutions of polynomial equations. The unit culminates with the fundamental theorem of algebra. A central theme of this unit is that the arithmetic of rational expressions is governed by the same rules as the arithmetic of rational numbers.

(2) Building on their previous work with functions, and on their work with trigonometric ratios and circles in Geometry, students now use the coordinate plane to extend trigonometry to model periodic phenomena.

(3) Students synthesize and generalize what they have learned about a variety of function families. They extend their work with exponential functions to include solving exponential equations with logarithms. They explore the effects of transformations on graphs of diverse functions, including functions arising in an application, in order to abstract the general principle that transformations on a graph always have the same effect regardless of the type of the underlying function. They identify appropriate types of functions to model a situation, they adjust parameters to improve the model, and they compare models by analyzing appropriateness of fit and making judgments about the domain over which a model is a good fit. The description of modeling as “the process of

choosing and using mathematics and statistics to analyze empirical situations, to understand them better, and to make decisions" is at the heart of this unit. The narrative discussion and diagram of the modeling cycle should be considered when knowledge of functions, statistics, and geometry is applied in a modeling context.

(4) Students see how the visual displays and summary statistics they learned in earlier grades relate to different types of data and to probability distributions. They identify different ways of collecting data—including sample surveys, experiments, and simulations—and the role that randomness and careful design play in the conclusions that can be drawn.

The content within this course is centered on the mathematics 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 that reflect the value of mathematics, enhance students' confidence in their ability to do mathematics, and help students communicate and reason mathematically.

College- and Career-Readiness Standards:

Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
A.SMP.1	Make sense of problems and persevere in solving them.
A.SMP.2	Reason abstractly and quantitatively.
A.SMP.3	Construct viable arguments and critique the reasoning of others.
A.SMP.4	Model with mathematics.
A.SMP.5	Use appropriate tools strategically.
A.SMP.6	Attend to precision.
A.SMP.7	Look for and make use of structure.
A.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but **required** standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

High-School—Conceptual Category:

Number and Quantity (N)

The Real Number System (N-RN)

Extend the Properties of Exponents to Rational Exponents

Identifier	Standard
N-RN.1	Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define* $5^{\frac{1}{3}}$ *to be the cube root of 5 because we want* $[5^{\frac{1}{3}}]^3 = 5^{\left(\frac{1}{3}\right)3}$ *to hold, so* $[5^{\frac{1}{3}}]^3$ *must equal 5.*
N-RN.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.

Quantities (N-Q) *

Reason Quantitatively and Use Units to Solve Problems

Identifier	Standard
N-Q.2	Define appropriate quantities for the purpose of descriptive modeling. *

The Complex Number System (N-CN)

Perform Arithmetic Operations with Complex Numbers

Identifier	Standard
N-CN.1	Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a + bi$ with a and b real.
N-CN.2	Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

Use Complex Numbers in Polynomial Identities and Equations

Identifier	Standard
N-CN.7	Solve quadratic equations with real coefficients that have complex solutions.

High-School—Conceptual Category:

Algebra (A)

Seeing Structure in Expressions (A-SSE)

Interpret the Structure of Expressions

Identifier	Standard
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

Identifier	Standard
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 $[1.15^{\frac{1}{12}}]^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*
A-SSE.4	Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. *For example, calculate mortgage payments.* *

Arithmetic with Polynomials and Rational Expressions (A-APR)

Understand the Relationship Between Zeros and Factors of Polynomials

Identifier	Standard
A-APR.2	Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$.
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).

Use Polynomial Identities to Solve Problems

Identifier	Standard
A-APR.4	Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity* $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ *can be used to generate Pythagorean triples.*

Rewrite Rational Expressions

Identifier	Standard
A-APR.6	Rewrite simple rational expressions in different forms; write $\frac{a(x)}{b(x)}$ in the form $q(x) + \frac{r(x)}{b(x)}$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.

Creating Equations (A-CED) *

Create Equations that Describe Numbers or Relationships

Identifier	Standard
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 exponential functions.* *
A-CED.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. * *[Note this standard appears in previous 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. *

Reasoning with Equations and Inequalities (A-REI)

Understand Solving Equations as a Process of Reasoning and Explain the Reasoning

Identifier	Standard
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.
A-REI.2	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

Solve Equations and Inequalities in One Variable

Identifier	Standard
A-REI.4	Solve quadratic equations in one variable. 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

Identifier	Standard
A-REI.6	Solve systems of linear equations exactly using algebraic processes and approximately (e.g., graphically) while focusing on pairs of linear equations in two variables.
A-REI.7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. *For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.*

Represent and Solve Equations and Inequalities Graphically

Identifier	Standard
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, polynomial, rational, absolute value, exponential, and logarithmic functions. *

High-School—Conceptual Category:
Functions (F)

Interpreting Functions (F-IF)

Understand the Concept of a Function and use Function Notation

Identifier	Standard
F-IF.3	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1.*

Interpret Functions that Arise in Applications in Terms of Context

Identifier	Standard
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.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

Identifier	Standard
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. * c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
F-IF.8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as y = (1.02)t, y = (0.97)t, y = (1.01)12t, y = $(1.2)_{\frac{t}{10}}$, and classify them as representing exponential growth and decay.

Identifier	Standard
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

Identifier	Standard
F-BF.1	Write a function that describes a relationship between two quantities. * a. Determine an explicit expression, a recursive process, or steps for calculation from a context. b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*
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. *

Build New Functions from Existing Functions

Identifier	Standard
F-BF.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, 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.*
F-BF.4	Find inverse functions. a. Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse. *For example,* $f(x) = 2x^3$ *or* $f(x) = \frac{(x+1)}{(x-1)}$ *for* $x \neq 1$.

Linear, Quadratic, and Exponential Models (F-LE) *

Construct and Compare Linear, Quadratic, and Exponential Models and Solve Problems

Identifier	Standard
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). *
F-LE.3	Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. *
F-LE.4	For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology. *

Linear, Quadratic, and Exponential Models (F-LE) *

Interpret Expressions for Functions in Terms of the Situations they Model

Identifier	Standard
F-LE.5	Interpret the parameters in a linear or exponential function in terms of a context. *

Trigonometric Functions (F-TF)

Extend the Domain of Trigonometric Functions Using the Unit Circle

Identifier	Standard
F-TF.1	Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
F-TF.2	Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

High-School—Conceptual Category:

Geometry (G)

Expressing Geometric Properties with Equations (G-GPE)

Translate Between the Geometric Description and the Equation for a Conic Section

Identifier	Standard
G-GPE.2	Derive the equation of a parabola given a focus and directrix.

High-School—Conceptual Category:

Statistics and Probability (S) *

Interpreting Categorical and Quantitative Data (S-ID)

Summarize, Represent, and Interpret Data on a Single Count or Measurement Variable

Identifier	Standard
S-ID.4	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. *

Summarize, Represent, and Interpret Data on Two Categorical and Quantitative Variables

Identifier	Standard
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.*

Making Inferences and Justifying Conclusions (S-IC)

Understand and Evaluate Random Processes Underlying Statistical Experiments

Identifier	Standard
S-IC.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population. *
S-IC.2	Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?* *

Make Inferences and Justify Conclusions from Sample Surveys, Experiments, and Observational Studies

Identifier	Standard
S-IC.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. *
S-IC.4	Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. *
S-IC.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. *
S-IC.6	Evaluate reports based on data. *

Conditional Probability and the Rules of Probability (S-CP)

Understand Independence and Conditional Probability and use Them to Interpret Data

Identifier	Standard
S-CP.1	Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”). *
S-CP.2	Understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent. *

Identifier	Standard
S-CP.3	Understand the conditional probability of *A* given *B* as $\frac{P(A \text{ and } B)}{P(B)}$, and interpret independence of *A* and *B* as saying that the conditional probability of *A* given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B*.*
S-CP.4	Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.* *
S-CP.5	Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.* *

Use the Rules of Probability to Compute Probabilities of Compound Events in a Uniform Probability Model

Identifier	Standard
S-CP.6	Find the conditional probability of *A* given *B* as the fraction of *B*'s outcomes that also belong to *A*, and interpret the answer in terms of the model. *
S-CP.7	Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model. *

NOTE

* Modeling Standards

Advanced Technical Math

The Advanced Technical Mathematics (ATM) course, ***a one-credit course***, is only available for career and technical education (CTE) students who have completed the MS CCRS Algebra I course, passed the MAAP Algebra I end-of-course state assessment, and are a completer in one CTE pathway.

The ATM course is a higher-level mathematics course that provides mathematical understanding and skills used in CTE and entry-level positions in technical jobs.

The content within this high school level course includes comprehensive coverage of the real number system, measurement, data, expressions, equations, functions, introductory trigonometry, geometry and spatial reasoning, and is centered on the mathematics domains of **Measurement & Data** (Grades K-5), **the Number System** (Grades 6-8), **Expressions & Equations** (Grades 6-8), **Ratios and Proportional Relationships** (Grades 6-7), **Functions** (Grades 8), **Geometry** (Grades K-8). The high school conceptual categories included are **Number and Quantity**, **Algebra**, **Functions**, **Geometry,** and **Statistics & Probability**. Instruction in these domains and conceptual categories should be designed to expose students to experiences that reflect the value of mathematics, enhance students' confidence in their ability to do mathematics, and help students communicate and reason mathematically.

For additional information regarding CTE courses and curriculum, visit *https://www.rcu.msstate.edu/curriculum*.

College- and Career-Readiness Standards:

Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
ATM.SMP.1	Make sense of problems and persevere in solving them.
ATM.SMP.2	Reason abstractly and quantitatively.
ATM.SMP.3	Construct viable arguments and critique the reasoning of others.
ATM.SMP.4	Model with mathematics.
ATM.SMP.5	Use appropriate tools strategically.
ATM.SMP.6	Attend to precision.
ATM.SMP.7	Look for and make use of structure.
ATM.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but **required** standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

High-School—Conceptual Category:

Number and Quantity (N)

The Number System (NS)

The Real Number System

Identifier	Standard
ATM.NS.1	Solve real-world and mathematical problems involving the four operations with rational numbers.

Ratio and Proportional Relationships (RP)

The Real Number System

Identifier	Standard
ATM.RP.2	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas, and other quantities measured in like or different units.
ATM.RP.3	Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.
ATM.RP.4	Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
ATM.RP.5	Represent proportional relationships by equations.
ATM.RP.6	Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points $(0, 0)$ and $(1, r)$ where r is the unit rate.
ATM.RP.7	Use proportional relationships to solve multistep ratio and percent problems.

High-School—Conceptual Category:
Statistics and Probability (S)

Measurement and Data (MD)

Measurement and Data

Identifier	Standard
ATM.MD.8	Recognize volume as an attribute of solid figures and understand concepts of volume measurement wherein a cube with a side length of 1 unit, called a "unit cube," is said to have "one cubic unit" of volume and can be used to measure volume.
ATM.MD.9	Recognize volume as an attribute of solid figures and understand concepts of volume measurement wherein a solid figure which can be packed without gaps or overlaps using *n* unit cubes is said to have a volume of *n* cubic units.
ATM.MD.10	Measure volumes by counting unit cubes, using cubic *cm*, cubic *in*, cubic *ft,* and improvised units.
ATM.MD.11	Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication.
ATM.MD.12	Apply the formulas $V = l \times w \times h$ and $V = B \times h$ for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real-world and mathematical problems.
ATM.MD.13	Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real-world problems.
ATM.MD.14	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.

High-School—Conceptual Category:

Algebra (A)

Expressions and Equations (EE)

Expressions, Equations and Functions

Identifier	Standard
ATM.EE.15	Write and evaluate numerical expressions involving whole-number exponents.
ATM.EE.16	Write expressions that record operations with numbers and with letters standing for numbers.
ATM.EE.17	Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity.
ATM.EE.18	Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order.
ATM.EE.19	Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.
ATM.EE.20	Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.
ATM.EE.21	Solve word problems leading to equations of the form $px + q = r$ *and* $p(x + q) = r$, where *p, q*, and *r* are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.
ATM.EE.22	Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where *p, q, and r* are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem.
ATM.EE.23	Know and apply the properties of integer exponents to generate equivalent numerical expressions.
ATM.EE.24	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.

Identifier	Standard
ATM.EE.25	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).
ATM.EE.26	Solve linear equations and inequalities with rational number coefficients, including those whose solutions require expanding expressions using the distributive property and collecting like terms.
ATM.EE.27	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.
ATM.EE.28	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

High-School—Conceptual Category:

Functions

Functions

Expressions, Equations and Functions

Identifier	Standard
ATM.F.29	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.
ATM.F.30	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.
ATM.F.31	Write a function that describes a relationship between two quantities; and be able to 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.
ATM.F.32	Construct linear functions, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

High-School—Conceptual Category:

Geometry (G)

Geometry

Geometry and Spatial Reasoning

Identifier	Standard
ATM.G.33	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.
ATM.G.34	Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.
ATM.G.35	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
ATM.G.36	Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.
ATM.G.37	Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.
ATM.G.38	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.
ATM.G.39	Explain a proof of the Pythagorean Theorem and its converse.
ATM.G.40	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
ATM.G.41	Explain and use the relationship between the sine and cosine of complementary angles.
ATM.G.42	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
ATM.G.43	Identify and describe relationships among inscribed angles, radii, and chords.
ATM.G.44	Construct the inscribed and circumscribed circles of a triangle; and prove properties of angles for a quadrilateral inscribed in a circle.
ATM.G.45	Derive the equation of a circle of a given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.

Identifier	Standard
ATM.G.46	Use coordinates to prove simple geometric theorems algebraically.
ATM.G.47	Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems.
ATM.G.33	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.
ATM.G.34	Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

CCR Algebra III

Algebra III, ***a one-credit course***, includes content standards from the former Pre-Calculus course and the Mississippi College- and Career-Readiness Standards for Mathematics; and covers those skills and objectives necessary for success in courses higher than Algebra II. Topics of study include sequences and series, functions, and higher-order polynomials. Polynomial functions provide the context for higher-order investigations. Topics are addressed from a numeric, graphical, and analytical perspective. Technology is to be used to enhance presentation and understanding of concepts. The instructional approach should provide opportunities for students to work together collaboratively and cooperatively as they solve routine and non-routine problems. Communication strategies should include reading, writing, speaking, and critical listening as students present and evaluate mathematical arguments, proofs, and explanations about their reasoning. Algebra III is typically taken by students who have successfully completed Algebra II and Geometry.

The content within this course is centered on the mathematics 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 that reflect the value of mathematics, enhance students' confidence in their ability to do mathematics, and help students communicate and reason mathematically.

College- and Career-Readiness Standards:
Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
A.SMP.1	Make sense of problems and persevere in solving them.
A.SMP.2	Reason abstractly and quantitatively.
A.SMP.3	Construct viable arguments and critique the reasoning of others.
A.SMP.4	Model with mathematics.
A.SMP.5	Use appropriate tools strategically.
A.SMP.6	Attend to precision.
A.SMP.7	Look for and make use of structure.
A.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but **required** standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

High-School—Conceptual Category:

Number and Quantity (N)

Explore and Illustrate the Characteristics and Operations Connecting Sequences and Series

Identifier	Standard
A3.N.1	Express sequences and series using recursive and explicit formulas.
A3.N.2	Evaluate and apply formulas for arithmetic and geometric sequences and series.
A3.N.3	Calculate limits based on convergent and divergent series.
A3.N.4	Evaluate and apply infinite geometric series.
A3.N.5	Extend the meaning of exponents to include rational numbers.
A3.N.6	Simplify expressions with fractional exponents to include converting from radicals.
A3.N.7	Factor algebraic expressions containing fractional exponents.

High-School—Conceptual Category:

Algebra (A)

Analyze and Manipulate Functions

Identifier	Standard
A3.A.8	Determine characteristics of graphs of parent functions (domain/range, increasing/decreasing intervals, intercepts, symmetry, end behavior, and asymptotic behavior).
A3.A.9	Determine the end behavior of polynomial functions.

Use Polynomials Identities to Solve Problems

Identifier	Standard
A3.A.10	Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.
A3.A.11	Verify the Binomial Theorem by mathematical induction or by a combinatorial argument.

Identifier	Standard
A3.A.12	Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.
A3.A.13	Write rational expressions in simplest form. (*For* example $\frac{x^3 - x^2 - x + 1}{x^3 + x^2 - x - 1} = \frac{x-1}{x+1}$).
A3.A.14	Decompose a rational function into partial fractions.
A3.A.15	Determine asymptotes and holes of rational functions, explain how each was found, and relate these behaviors to continuity.

Perform Operations on Expressions, Equations, Inequalities, and Polynomials

Identifier	Standard
A3.A.16	Add, subtract, multiply and divide rational expressions.
A3.A.17	Solve polynomial and rational inequalities. Relate results to the behavior of the graphs.
A3.A.18	Find the composite of two given functions and find the inverse of a given function. Extend this concept to discuss the identity function f(x) = x.
A3.A.19	Simplify complex algebraic fractions (with/without variable expressions and integer exponents) to include expressing $\frac{f(x+h) - f(x)}{h}$ as single simplified fraction when $f(x) = \frac{1}{1-x}$ for example.
A3.A.20	Find the possible rational roots using the Rational Root Theorem.
A3.A.21	Find the zeros of polynomial functions by synthetic division and the Factor Theorem.
A3.A.22	Graph and solve quadratic inequalities.

High-School—Conceptual Category:

Functions (F)

Analyze Functions using Different Representations

Identifier	Standard
A3.F.23	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
A3.F.24	Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

Build a Function that Models a Relationship Between Two Quantities

Identifier	Standard
A3.F.25	Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.*

Build New Functions from Existing Functions

Identifier	Standard
A3.F.26	Verify by composition that one function is the inverse of another.
A3.F.27	Read values of an inverse function from a graph or a table, given that the function has an inverse.
A3.F.28	Produce an invertible function from a non-invertible function by restricting the domain.
A3.F.29	Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

Extend the Domain of Trigonometric Functions using the Unit Circle

Identifier	Standard
A3.F.30	Use special triangles to determine geometrically the values of sine, cosine, tangent for $\frac{\pi}{3}$, $\frac{\pi}{4}$, and $\frac{\pi}{6}$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi-x$, $\pi+x$, and $2\pi-x$ in terms of their values for x, where x is any real number.
A3.F.31	Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.

Model Periodic Phenomena with Trigonometric Functions

Identifier	Standard
A3.F.32	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. *
A3.F.33	Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.
A3.F.34	Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.

Prove and Apply Trigonometric Identities

Identifier	Standard
A3.F.35	Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.
A3.F.36	Prove the Pythagorean identity $\sin^2(\Theta) + \cos^2(\Theta) = 1$ and use it to find sin(Θ), cos(Θ), or tan(Θ) given sin(Θ), cos(Θ), or tan(Θ) and the quadrant of the angle.

High-School—Conceptual Category:

Geometry (G)

Recognize, Sketch, and Transform Graphs to Functions

Identifier	Standard
A3.G.37	Graph piecewise-defined functions and determine continuity or discontinuities.
A3.G.38	Describe the attributes of graphs and the general equations of parent functions (linear, quadratic, cubic, absolute value, rational, exponential, logarithmic, square root, cube root, and greatest integer).
A3.G.39	Explain the effects of changing the parameters in transformations of functions.
A3.G.40	Predict the shapes of graphs of exponential, logarithmic, rational, and piece-wise functions, and verify the prediction with and without technology.
A3.G.41	Relate symmetry of the behavior of even and odd functions.

Apply Trigonometry to General Triangles

Identifier	Standard
A3.G.42	Derive the formula $A = \frac{1}{2}ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
A3.G.43	Prove the Laws of Sines and Cosines and use them to solve problems.
A3.G.44	Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

High-School—Conceptual Category:
Statistics and Probability (S)

Explore and Apply Fundamental Principles of Probability

Identifier	Standard
A3.S.45	Analyze expressions in summation and factorial notation to solve problems.
A3.S.46	Prove statements using mathematical induction.

NOTE
*Modeling Standards

Advanced Mathematics Plus

Advanced Mathematics Plus is designed to be a fourth-year, ***one-credit course***, that specifies the mathematics that students should study in order to be college and career ready. The Advanced Mathematics Plus Course includes rigorous mathematical standards that will prepare students for collegiate courses dealing with higher-level trigonometric, algebraic, and calculus concepts.

The content within this course is centered on the mathematics conceptual categories of **Number and Quantity**, **Algebra**, **Functions**, **Modeling**, **Geometry**, and **Statistics & Probability**. Instruction in these domains 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.

College- and Career-Readiness Standards:
Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
AMP.SMP.1	Make sense of problems and persevere in solving them.
AMP.SMP.2	Reason abstractly and quantitatively.
AMP.SMP.3	Construct viable arguments and critique the reasoning of others.
AMP.SMP.4	Model with mathematics.
AMP.SMP.5	Use appropriate tools strategically.
AMP.SMP.6	Attend to precision.
AMP.SMP.7	Look for and make use of structure.
AMP.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but **required** standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

High-School—Conceptual Category:
Number and Quantity (N)

The Complex Number System (N-CN)

Perform Arithmetic Operations with Complex Numbers

Identifier	Standard
N-CN.3	Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.

Represent Complex Numbers and Their Operations on the Complex Plane

Identifier	Standard
N-CN.4	Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.
N-CN.5	Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. *For example,* $(-1 + \sqrt{3}\, i)^3 = 8$ *because* $(-1 + \sqrt{3}\, i)$ *has modulus 2 and argument 120°.*
N-CN.6	Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.

Use Complex Numbers in Polynomial Identities and Equations

Identifier	Standard
N-CN.8	Extend polynomial identities to the complex numbers. *For example, rewrite* $x^2 + 4$ *as* $(x + 2i)(x - 2i)$.
N-CN.9	Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.

High-School—Conceptual Category:
Algebra (A)

Arithmetic with Polynomials and Rational Expressions (A-APR)

Use Polynomial Identities to Solve Problems

Identifier	Standard
A-APR.5	Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n, where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.[1]

Rewrite Rational Expressions

Identifier	Standard
A-APR.7	Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

Reasoning with Equations and Inequalities (A-REI)

Solve Systems of Equations

Identifier	Standard
A-REI.8	Represent a system of linear equations as a single matrix equation in a vector variable.
A-REI.9	Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater).

High-School—Conceptual Category:

Functions (F)

Interpreting Functions (F-IF)

Analyze Functions using Different Representations

Identifier	**Standard**
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. * d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

Building Functions (F-BF)

Build a Function that Models a Relationship Between Two Quantities

Identifier	**Standard**
F-BF.1	Write a function that describes a relationship between two quantities. * c. Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.*

Build New Functions from Existing Functions

Identifier	**Standard**
F-BF.4	Find inverse functions. b. Verify by composition that one function is the inverse of another. c. Read values of an inverse function from a graph or a table, given that the function has an inverse. d. Produce an invertible function from a non-invertible function by restricting the domain.
F-BF.5	Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

Trigonometric Functions (F-TF)

Extend the Domain of Trigonometric Functions Using the Unit Circle

Identifier	Standard
F-TF.3	Use special triangles to determine geometrically the values of sine, cosine, tangent for $\frac{\pi}{3}$, $\frac{\pi}{4}$, and $\frac{\pi}{6}$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi - x$, $\pi + x$, and $2\pi - x$ in terms of their values for x, where x is any real number.
F-TF.4	Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.

Model Periodic Phenomena with Trigonometric Functions

Identifier	Standard
F-TF.5	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline. *
F-TF.6	Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.
F-TF.7	Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context. *

Prove and Apply Trigonometric Identities

Identifier	Standard
F-TF.9	Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

High-School—Conceptual Category:
Geometry (G)

Similarity, Right Triangles, and Trigonometry (G-SRT)

Apply Trigonometry to General Triangles

Identifier	Standard
G-SRT.9	Derive the formula $A = \frac{1}{2}ab\ sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
G-SRT.10	Prove the Laws of Sines and Cosines and use them to solve problems.
G-SRT.11	Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Circles (G-C)

Understand and Apply Theorems About Circles

Identifier	Standard
G-C.4	Construct a tangent line from a point outside a given circle to the circle.

Expressing Geometric Properties with Equations (G-GPE)

Translate Between the Geometric Description and the Equation for a Conic Section

Identifier	Standard
G-GPE.3	Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.

Geometric Measurement and Dimension (G-GMD)

Explain Volume Formulas and use Them to Solve Problems

Identifier	Standard
G-GMD.2	Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.

High-School—Conceptual Category:

Statistics and Probability (S)

Conditional Probability and the Rules of Probability (S-CP)

Use the Rules of Probability to Compute Probabilities of Compound Events in a Uniform Probability Model

Identifier	Standard
S-CP.8	Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model. *
S-CP.9	Use permutations and combinations to compute probabilities of compound events and solve problems. *

Using Probability to Evaluate Outcomes of Decisions (S-MD)

Calculate Expected Values and use Them to Solve Problems

Identifier	Standard
S-MD.1	Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions. *
S-MD.2	Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. *
S-MD.3	Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. *For example, find the theoretical probability distribution for the number of correct answers obtained*

Identifier	Standard
	by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes. *
S-MD.4	Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. *For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?* *

Use Probability to Evaluate Outcomes of Decisions

Identifier	Standard
S-MD.5	Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. * a. Find the expected payoff for a game of chance. *For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant*. b. Evaluate and compare strategies on the basis of expected values. *For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.* *
S-MD.6	Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). *
S-MD.7	Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). *

NOTES

[1] The Binomial Theorem can be proved by mathematical induction or by a combinatorial argument.

* Modeling Standard

Calculus

Calculus is a ***one-credit course*** designed for students who have successfully completed Algebra II or Algebra III, and focuses on the mathematics of change, specifically differential and integral calculus. The course emphasizes the use of graphing calculators and other technologies as essential tools for learning. Instruction should be structured to encourage collaborative problem-solving, allowing students to tackle both routine and complex challenges. Additionally, students are to engage in various forms of communication—reading, writing, speaking, and critical listening—to present, evaluate, and justify mathematical arguments, proofs, and reasoning.

The content within this course is centered on the mathematics high school conceptual categories of **Number and Quantity**, **Algebra**, **Geometry**, and **Statistics & Probability**. Instruction in these domains 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.

College- and Career-Readiness Standards:
Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
C.SMP.1	Make sense of problems and persevere in solving them.
C.SMP.2	Reason abstractly and quantitatively.
C.SMP.3	Construct viable arguments and critique the reasoning of others.
C.SMP.4	Model with mathematics.
C.SMP.5	Use appropriate tools strategically.
C.SMP.6	Attend to precision.
C.SMP.7	Look for and make use of structure.
C.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but **required** standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

High-School—Conceptual Category:
Number and Quantity (N)

Compute and Determine the Reasonableness of Results in Mathematical and Real-world Situations

Identifier	Standard
C.N.1	Estimate limits from graphs or tables.
C.N.2	Estimate numerical derivatives from graphs or tables of data.
C.N.3	Prove statements using mathematical induction.

High-School—Conceptual Category:
Algebra (A)

Demonstrate Basic Knowledge of Functions, Including their Behavior and Characteristics

Identifier	Standard
C.A.4	Predict and explain the characteristics and behavior of functions and their graphs (domain, range, increasing/decreasing intervals, intercepts, symmetry, and end behavior).
C.A.5	Investigate, describe, and determine asymptotic behavior using tables, graphs, and analytical methods
C.A.6	Determine and justify the continuity and discontinuity of functions

Evaluate the Limits and Communicate an Understanding of the Limiting Process

Identifier	Standard
C.A.7	Solve mathematical situations and application problems involving or using derivatives, including exponential, logarithmic, and trigonometric functions.
C.A.8	Calculate limits using algebraic methods.
C.A.9	Verify the behavior and direction of non-determinable limits.

Use the Definition and Formal Rules of Differentiation to Compute Derivatives

Identifier	Standard
C.A.10	State and apply the formal definition of a derivative.
C.A.11	Apply differentiation rules to sums, products, quotients, and powers of functions.
C.A.12	Use the chain rule and implicit differentiation.
C.A.13	Describe the relationship between differentiability and continuity.

Apply Derivatives to Find Solutions in a Variety of Situations

Identifier	Standard
C.A.14	Define a derivative and explain the purpose/utility of the derivative.
C.A.15	Apply the derivative as a rate of change in varied contexts, including velocity, speed, and acceleration.
C.A.16	Apply the derivative to find tangent lines and normal lines to given curves at given points.
C.A.17	Predict and explain the relationships between functions and their derivatives.
C.A.18	Model rates of change to solve related rate problems.
C.A.19	Solve optimization problems.

Employ Various Integration Properties and Techniques to Elevate Integrals

Identifier	Standard
C.A.20	State and apply the First and Second Fundamental Theorem of Calculus.
C.A.21	Apply the power rule and u-substitution to evaluate indefinite integrals.

High-School—Conceptual Category:
Geometry (G)

Geometry

Identifier	Standard
C.G.22	Demonstrate and explain the differences between average and instantaneous rates of change.
C.G.23	Apply differentiation techniques to curve sketching
C.G.24	Apply Rolle's Theorem and the Mean Value Theorem and their geometric consequences.
C.G.25	Identify and apply local linear approximations.
C.G.26	Analyze curves with attention to non-decreasing functions (monotonicity) and concavity.

High-School—Conceptual Category:
Statistics and Probability (S)

Adapt Integration Methods to Model Situations to Problems

Identifier	Standard
C.S.27	Apply integration to solve problems of area.
C.S.28	Utilize integrals to model and find solutions to real-world problems such as calculating displacement and total distance traveled.

Apply Appropriate Techniques, Tools, and Formulas to Determine Values for the Definite Integral

Identifier	Standard
C.S.29	Interpret the concept of definite integral as a limit of Riemann sums over equal subdivisions.

SREB Math Ready

The Southern Region Education Board (SREB) Math Ready course, ***a one-credit course***, is only for students classified as seniors, with an ACT sub-score of **below 15** in mathematics (*Exception- may include students classified as juniors planning to graduate prior to the spring of their senior year*).

This course is designed for students who need a fourth-year mathematics preparatory course to address skill gaps and build readiness for postsecondary academic or career paths, particularly in non-STEM fields or majors. Tailored for those who have not yet mastered the skills for Advanced Placement courses, the program emphasizes rigor, innovative instructional strategies, and conceptual learning to move beyond procedural memorization and engage students in real-world applications.

The content within the SREB Math Ready course consists of eight units: algebraic expressions, equations, measurement and proportional reasoning, linear functions, linear systems of equations, quadratic functions, exponential functions, and an optional module on summarizing and interpreting statistical data, focused on essential concepts and skills from the Algebra I, Geometry, and Algebra II MS CCRS and the eight Standards for Mathematical Practice, to ensure students are prepared for college-level mathematics and career requirements. These units are aligned with the high school conceptual categories of **Algebra**, **Functions**, **Number and Quantity**, **Geometry**, and **Statistics & Probability**. Instruction in these domains 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.

For the most current SREB Math Ready course description, standards, and materials, visit: *https://www.sreb.org/math-ready*.

College- and Career-Readiness Standards:

Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
R.SMP.1	Make sense of problems and persevere in solving them.
R.SMP.2	Reason abstractly and quantitatively.
R.SMP.3	Construct viable arguments and critique the reasoning of others.
R.SMP.4	Model with mathematics.
R.SMP.5	Use appropriate tools strategically.
R.SMP.6	Attend to precision.
R.SMP.7	Look for and make use of structure.
R.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but **required** standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

High-School—Conceptual Category:

Algebra (A)

Algebraic Expressions

Identifier	Standard
UNIT 1	The algebraic expressions unit was designed to solidify student understanding of expressions while providing the students with an opportunity to have success early in the course. The recurring theme integrated in this unit focuses on engaging students using and expanding the concepts found within purposefully chosen activities. Through guided lessons, students will manipulate, create and analyze algebraic expressions and look at the idea of whether different sets of numbers are closed under certain operations.

Equations

Identifier	Standard
UNIT 2	The equations unit calls for students to construct and evaluate problems that involve one or two steps while seeking understanding of how and why equations and inequalities are used in their daily lives. Students also use the structure of word problems and equations to rewrite and solve equations in different forms revealing different relationships.

High-School—Conceptual Categories:

Number and Quantity (N); Geometry (G)

Measurement and Proportional Reasoning

Identifier	Standard
UNIT 3	This unit deals with unit conversions, using proportions for scaling, and area and volume. The unit requires higher-order thinking and number sense in order to get to the true intent of the standards covered. It is useful in helping students make connections with math and science or other subjects.

High-School—Conceptual Category:

Functions (F)

Linear Functions

Identifier	Standard
UNIT 4	The systems unit deals with solving systems of linear equations. This involves helping students classify solutions (one, none, or infinitely many), as well as set up and solve problems using systems of equations. Students also choose the best way to solve a system of equations and explain their solutions.

High-School—Conceptual Category:

Algebra (A)

Linear Systems of Equations

Identifier	Standard
UNIT 5	This unit solidifies students' understanding of the structure of expressions and solving equations. Illustrations, drawings and models are used to represent and solve equations and inequalities, helping to develop understanding of acceptable solutions. Students explore the relationships between properties of equations and algebraic expressions.

High-School—Conceptual Category:

Functions (F)

Quadratic Functions

Identifier	Standard
UNIT 6	This unit is an expansive look at quadratic functions: their graphs, tables and algebraic functions. It stresses multiple approaches to graphing, solving and understanding quadratics, as students explore, make conjectures and draw conclusions in group-work settings. In this unit, students explore and learn from multiple applications of quadratics. The unit assumes students have seen quadratics before but may not have a concrete, transferrable understanding of quadratic functions. The unit does not cover algebraic manipulations (multiplying and factoring), as these are addressed in previous units.

Exponential Functions

Identifier	Standard
UNIT 7	This unit develops students' fluency in exponential functions through varying real-life financial applications/inquiries.

High-School—Conceptual Category:

Statistics and Probability (S)

Probability and One-Variable Statistics

Identifier	Standard
UNIT 8 (OPTIONAL)	In this unit, students further develop skills to read, analyze, and communicate (using words, tables, and graphs) relationships and patterns found in data sets of one or more variables. Students learn how to choose the appropriate statistical tools and measurements to assist in analysis, communicate results, and read and inter interpret graphs, measurements, and formulas which are crucial skills in a world overflowing with data. Students explore these concepts while modeling real contexts based on data they collect.

Essentials for College Math

The Southern Region Education Board (SREB) Essentials for College Math Course, ***a one-credit course***, is only for students classified as seniors, with an ACT sub-score of **15-18** in mathematics (*Exception- may include students classified as juniors planning to graduate prior to the spring of their senior year*).

For additional information pertaining specifically to this course, see the ***Essentials for College Math and Essentials for College Literacy Requirements MS State Board Policy Manual***: Rule 28.6, and the ***Mississippi Institutions for Higher Learning Policy*** 608.

This course is designed for students who need a fourth-year mathematics preparatory course to address skill gaps and build readiness for postsecondary academic or career paths, particularly in non-STEM fields or majors. Tailored for those who have not yet mastered the skills for Advanced Placement courses, the program emphasizes rigor, innovative instructional strategies, and conceptual learning to move beyond procedural memorization and engage students in real-world applications.

The content within the Essentials for College Math course consists of eight units: algebraic expressions, equations, measurement and proportional reasoning, linear functions, linear systems of equations, quadratic functions, exponential functions, and an optional module on summarizing and interpreting statistical data, focused on essential concepts and skills from the Algebra I, Geometry, and Algebra II MS CCRS and the eight Standards for Mathematical Practice, to ensure students are prepared for college-level mathematics and career requirements. These units are aligned with the high school conceptual categories of **Algebra**, **Functions**, **Number and Quantity**, **Geometry**, and **Statistics & Probability**. Instruction in these domains 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.

For the most current SREB Essentials for College Math course description, standards, and materials, visit: *https://www.sreb.org/math-ready*.

College- and Career-Readiness Standards:

Standards for Mathematical Practice (SMP)

Approach Mathematics Confidently and Adaptively, Applying Understanding and Skills Effectively across Diverse Contexts

Identifier	Standard
R.SMP.1	Make sense of problems and persevere in solving them.
R.SMP.2	Reason abstractly and quantitatively.
R.SMP.3	Construct viable arguments and critique the reasoning of others.
R.SMP.4	Model with mathematics.
R.SMP.5	Use appropriate tools strategically.
R.SMP.6	Attend to precision.
R.SMP.7	Look for and make use of structure.
R.SMP.8	Look for and express regularity in repeated reasoning.

NOTE

The Standards for Mathematical Practice (SMPs) should be fully integrated with the content standards and taught with the same level of importance across all grade levels and high school courses. The SMPs, rooted in essential principles such as problem-solving, reasoning, communication, and mathematical proficiency, are not optional but **required** standards that must be incorporated into instruction. By aligning the SMPs with the content standards, students develop a deeper understanding of mathematical concepts, apply procedures flexibly, and engage in meaningful problem-solving. To emphasize their importance, the SMPs have been assigned a standard identifier for each grade level and course, ensuring their consistent application in curriculum planning, daily instruction, and assessments.

High-School—Conceptual Category:
Algebra (A)

Algebraic Expressions

Identifier	Standard
UNIT 1	The algebraic expressions unit was designed to solidify student understanding of expressions while providing the students with an opportunity to have success early in the course. The recurring theme integrated in this unit focuses on engaging students using and expanding the concepts found within purposefully chosen activities. Through guided lessons, students will manipulate, create and analyze algebraic expressions and look at the idea of whether different sets of numbers are closed under certain operations.

Equations

Identifier	Standard
UNIT 2	The equations unit calls for students to construct and evaluate problems that involve one or two steps while seeking understanding of how and why equations and inequalities are used in their daily lives. Students also use the structure of word problems and equations to rewrite and solve equations in different forms revealing different relationships.

High-School—Conceptual Categories:
Number and Quantity (N); Geometry (G)

Measurement and Proportional Reasoning

Identifier	Standard
UNIT 3	This unit deals with unit conversions, using proportions for scaling, and area and volume. The unit requires higher-order thinking and number sense in order to get to the true intent of the standards covered. It is useful in helping students make connections with math and science or other subjects.

High-School—Conceptual Category:
Functions (F)

Linear Functions

Identifier	Standard
UNIT 4	The systems unit deals with solving systems of linear equations. This involves helping students classify solutions (one, none, or infinitely many), as well as set up and solve problems using systems of equations. Students also choose the best way to solve a system of equations and explain their solutions.

High-School—Conceptual Category:
Algebra (A)

Linear Systems of Equations

Identifier	Standard
UNIT 5	This unit solidifies students' understanding of the structure of expressions and solving equations. Illustrations, drawings and models are used to represent and solve equations and inequalities, helping to develop understanding of acceptable solutions. Students explore the relationships between properties of equations and algebraic expressions.

High-School—Conceptual Category:
Functions (F)

Quadratic Functions

Identifier	Standard
UNIT 6	This unit is an expansive look at quadratic functions: their graphs, tables and algebraic functions. It stresses multiple approaches to graphing, solving and understanding quadratics, as students explore, make conjectures and draw conclusions in group-work settings. In this unit, students explore and learn from multiple applications of quadratics. The unit assumes students have seen quadratics before but may not have a concrete, transferrable understanding of quadratic functions. The unit does not cover algebraic manipulations (multiplying and factoring), as these are addressed in previous units.

Exponential Functions

Identifier	Standard
UNIT 7	This unit develops students' fluency in exponential functions through varying real-life financial applications/inquiries.

High-School—Conceptual Category:

Statistics and Probability (S)

Probability and One-Variable Statistics

Identifier	Standard
UNIT 8 (OPTIONAL)	In this unit, students further develop skills to read, analyze, and communicate (using words, tables, and graphs) relationships and patterns found in data sets of one or more variables. Students learn how to choose the appropriate statistical tools and measurements to assist in analysis, communicate results, and read and inter interpret graphs, measurements, and formulas which are crucial skills in a world overflowing with data. Students explore these concepts while modeling real contexts based on data they collect.

Advanced Placement (AP) Precalculus

AP Precalculus, ***a one-credit course***, is designed to be the equivalent of a first-semester college precalculus course, and provides students with an understanding of the concepts of college algebra, trigonometry, and additional topics that prepare students for further college-level mathematics courses. This course explores a variety of function types and their applications—polynomial, rational, exponential, logarithmic, trigonometric, polar, parametric, vector-valued, implicitly defined, and linear transformation functions using matrices. The mathematical practices of procedural and symbolic fluency, multiple representations, and communication and reasoning are developed throughout the course.

The AP Precalculus course aims to prepare students for advanced coursework in mathematics or other fields engaged in modeling change (e.g., pure sciences, engineering, or economics) and for creating useful, reasonable solutions to problems encountered in an ever-changing world.

Teachers and students should regularly use technology to reinforce the following AP Precalculus concepts:

- Perform calculations (e.g., exponents, roots, trigonometric values, logarithms)
- Graph functions and analyze graphs
- Generate a table of values for a function
- Find real zeros of functions
- Find points of intersection of graphs of functions
- Find minima/maxima of functions
- Find numerical solutions to equations in one variable
- Find regression equations to model data (linear, quadratic, cubic, quartic, exponential, logarithmic, and sinusoidal) and plot the corresponding residuals
- Perform matrix operations (e.g., multiplication, finding inverses)

For the most current Advanced Placement (AP) Precalculus for High School Math course description, standards, and materials, visit: *https://apstudents.collegeboard.org/courses/ap-precalculus*.

Advanced Placement (AP) Calculus AB

AP Calculus AB, a ***one-credit course***, is designed to be the equivalent of a first-semester college calculus course devoted to topics in differential and integral calculus. This course requires students to use definitions and theorems to build arguments and justify conclusions. The AP Calculus AB course also features a multirepresentational approach to calculus, with concepts, results, and problems expressed graphically, numerically, analytically, and verbally. A sustained emphasis on clear communication of methods, reasoning, justifications, and conclusions is essential. Teachers and students should regularly use technology to reinforce relationships among functions, to confirm written work, to implement experimentation, and to assist in interpreting results.

The AP Calculus AB course aims to prepare students for advanced coursework in mathematics or other fields engaged in modeling change (e.g., pure sciences, engineering, or economics) and for creating useful, reasonable solutions to problems encountered in an ever-changing world. Each big idea is described below.

(1) **Change (CHA)-**Using derivatives to describe rates of change of one variable with respect to another or using definite integrals to describe the net change in one variable over an interval of another allows students to understand change in a variety of contexts. It is critical that students grasp the relationship between integration and differentiation as expressed in the Fundamental Theorem of Calculus—a central idea in AP Calculus.

(2) **Limits (LIM)-** Beginning with a discrete model and then considering the consequences of a limiting case allows us to model real-world behavior and to discover and understand important ideas, definitions, formulas, and theorems in calculus: for example, continuity, differentiation, and integration.

(3) **Analysis of Functions (FUN)-** Calculus allows us to analyze the behaviors of functions by relating limits to differentiation, integration, and infinite series and relating each of these concepts to the others.

For the most current Advanced Placement (AP) Calculus AB for High School Math course description, standards, and materials, visit: *https://apstudents.collegeboard.org/courses/ap-calculus-ab*.

Advanced Placement (AP) Calculus BC

AP Calculus BC, a ***one-credit course***, is designed to be the equivalent of a first- and second-semester college calculus course and applies the content and skills learned in AP Calculus AB to parametrically defined curves, polar curves, and vector-valued functions; develops additional integration techniques and applications; and introduces the topics of sequences and series. This course requires students to use definitions and theorems to build arguments and justify conclusions. The AP Calculus BC course also features a multirepresentational approach to calculus, with concepts, results, and problems expressed graphically, numerically, analytically, and verbally. A sustained emphasis on clear communication of methods, reasoning, justifications, and conclusions is essential. Teachers and students should regularly use technology to reinforce relationships among functions, to confirm written work, to implement experimentation, and to assist in interpreting results.

The AP Calculus BC course aims to prepare students for advanced coursework in mathematics or other fields engaged in modeling change (e.g., pure sciences, engineering, or economics) and for creating useful, reasonable solutions to problems encountered in an ever-changing world. Each big idea is described below.

(1) **Change (CHA)-**Using derivatives to describe rates of change of one variable with respect to another or using definite integrals to describe the net change in one variable over an interval of another allows students to understand change in a variety of contexts. It is critical that students grasp the relationship between integration and differentiation as expressed in the Fundamental Theorem of Calculus—a central idea in AP Calculus.

(2) **Limits (LIM)-** Beginning with a discrete model and then considering the consequences of a limiting case allows students to model real-world behavior and discover and understand important ideas, definitions, formulas, and theorems in calculus: for example, continuity, differentiation, integration, **and series**.

(3) **Analysis of Functions (FUN)-** Calculus allows the analysis of the behaviors of functions by relating limits to differentiation, integration, and infinite series and relating each of these concepts to the others.

For the most current Advanced Placement (AP) Calculus BC for High School Math course description, standards, and materials, visit: *https://apstudents.collegeboard.org/courses/ap-calculus-bc*.

Advanced Placement (AP) Statistics

The AP Statistics course, ***a one-credit course***, is equivalent to a one-semester, introductory, non-calculus-based college course in statistics, and introduces students to the major concepts and tools for collecting, analyzing, and drawing conclusions from data. There are four themes evident in the content, skills, and assessment in the AP Statistics course: exploring data, sampling and experimentation, probability and simulation, and statistical inference. Students use technology, investigations, problem solving, and writing as they build conceptual understanding.

The AP Statistics course aims to prepare students for advanced coursework in statistics or other fields using statistical reasoning and for active, informed engagement with a world of data to be interpreted appropriately and applied wisely to make informed decisions. Each big idea is described below.

(1) **Variation and Distribution (VAR)-**The distribution of measures for individuals within a sample or population describes variation. The value of a statistic varies from sample to sample. Statistical methods based on probabilistic reasoning provide the basis for shared understandings about variation and about the likelihood that variation between and among measures, samples, and populations is random or meaningful.

(2) **Patterns and Uncertainty (UNC)-** Statistical tools allow students to represent and describe patterns in data and to classify departures from patterns. Simulation and probabilistic reasoning allow students to anticipate patterns in data and to determine the likelihood of errors in inference.

(3) **Data-based Predictions, Decisions, and Conclusions (DAT)-** Data-based regression models describe relationships between variables and are a tool for making predictions for values of a response variable. Collecting data using random sampling or randomized experimental design means that findings may be generalized to the part of the population from which the selection was made. Statistical inference allows students to make data-based decisions.

For the most current Advanced Placement (AP) Statistics for High School Math course description, standards, and materials, visit: *https://apstudents.collegeboard.org/courses/ap-statistics*.

Dual Credit (DC) Math Courses

The purpose of the Dual Enrollment and Credit Program is to offer structured opportunities for qualified high school students to simultaneously enroll in college courses at Mississippi (public) Institutions of Higher Learning (IHLs) or Mississippi Community or Junior Colleges (CJCs) that provide pathways leading to academic or career technical postsecondary credit. (See *Mississippi Code Title 37, § 37-15-38*.)

Students enrolled in a community college or state institution of higher learning while enrolled in high school, "a dual credit student", receives both high school and postsecondary credit for coursework regardless of the course location (high school campus, postsecondary campus, or online). One three-hour postsecondary course is equal to ***one*** high school Carnegie unit. Four-hour postsecondary lab science course(s), either in a four-hour combined format or three-hour lecture plus one-hour matching lab format, is equal to ***one*** high school Carnegie unit.

The following math courses are identified in the list of articulated courses in Appendix V of the *Procedures Manual of the State of Mississippi Dual Enrollment and Accelerated Programs (2024-2025)*. Additional courses may be available, based on local offerings.

- College Algebra (906401/MAT 1313)
- Trigonometry (906411/MAT 1323)
- Finite Math (906451/ MAT 1333)
- Business Calculus I (906920/MAT 1513)
- Statistics (906450/MAT 2323)

For specifics on Dual Credit and Dual Enrollment options, contact the local partnering postsecondary institution for detailed student learning outcomes and course syllabus information, and visit *https://mdek12.org/secondaryeducation/accelerated-programs/*, *http://www.mississippi.edu/cjc/dual_enrollment.asp* and/or reference the *Procedures Manual for the State of Mississippi Dual Enrollment and Accelerated Programs.*

Supplemental High School Math Courses

Supplemental Mathematics I, II, III, & IV (Grades 9-12) courses, formerly Compensatory Mathematics I, II, III, & IV, are designed to provide targeted interventions of core mathematics concepts.[1]

Students in need of instructional support, intervention, or remediation may be enrolled in a Supplemental Mathematics course under the following stipulations:

The Supplemental Mathematics course:

(1) must be taken in concert with a credit-bearing course at the same grade level;
(2) includes content supportive of the accompanying credit-bearing course;
(3) should incorporate the Standards for Mathematical Practice (SMPs); and
(4) may be taken as an elective, but will **not** satisfy the number of mathematics Carnegie units required for graduation.

Instruction within the supplemental mathematics courses 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.

[1] Documentation of Tier II and III interventions is required. ***MS State Board Policy Manual****: Rule 41.1 intervention*.

Additional Support

Appendix A: Glossary

K-12 Academic Vocabulary Glossary

Note: The words defined here pertain to courses derived from the *Mississippi College- and Career-Readiness Standards for Mathematics*.

A

Term	Definition
Absolute value	The distance a number is from zero. Distance is expressed as a positive value.
Addend	A number that is added to another.
Addition and subtraction within 5, 10, 20, or 1000	Addition or subtraction of two whole numbers with whole number answers, and with sum or minuend in the range 0-5, 0-10, 0-20, or 0-100, respectively. *For example: 8 + 2 = 10 is an addition within 10, 14 – 5 =9 is a subtraction within 20, and 55 – 18 = 37 is a subtraction within 100.*
Additive inverses	Two numbers whose sum is 0 are additive inverses of one another. *For example:* $\frac{3}{4}$ *and* $-\frac{3}{4}$ *are additive inverses of one another because* $\frac{3}{4} + (-\frac{3}{4}) = (-\frac{3}{4}) + \frac{3}{4} = 0$.
Algebra	The part of mathematics in which patterns and properties of numbers are generalized using variables in expressions, equations, and formulas.
Associative property of addition	See Table 3 in this Glossary.
Associative property of multiplication	See Table 3 in this Glossary.
Absolute value	The distance a number is from zero. Distance is expressed as a positive value.

B

Term	Definition
Bivariate data	Pairs of linked numerical observations. For example: a list of heights and weights for each player on a football team.
Box plot	(Also called a box-and-whisker plot) A method of visually displaying a distribution of data values by using the median, quartiles, and extremes of the data set. A box shows the middle 50% of the data.[1]

C

Term	Definition
Coefficient	The multiplicative factor of a term.
Commutative property	See Table 3 in this Glossary.
Complex fraction	A fraction $\frac{A}{B}$ where A and/or B are fractions (B is nonzero).

Computation algorithm	A set of predefined steps applicable to a class of problems that gives the correct result in every case when the steps are carried out correctly. See also: computation strategy.
Computation Strategy	Purposeful manipulations that may be chosen for specific problems, may not have a fixed order, and may be aimed at converting one problem into another. See also: computation algorithm.
Congruent	Two plane or solid figures are congruent if one can be obtained from the other by rigid motion (a sequence of rotations, reflections, and translations).
Constant	Any well-defined real number in an expression or equation that has a fixed value. For example, in the equation $x + 5 = 9$, 5 and 9 are both constants.
Counting on	A strategy for finding the number of objects in a group without having to count every member of the group. For example, if a stack of books is known to have 8 books and 3 more books are added to the top, it is not necessary to count the stack all over again. One can find the total by counting on—pointing to the top book and saying "eight," following this with "nine, ten, eleven. There are eleven books now."

D

Term	Definition
Difference	The result of removing a quantity from a set. The difference describes how much one quantity differs from another quantity. For example, in the equation $10 - 2 = 8$, 8 is the difference.
Dilation	A transformation that moves each point along the ray through the point emanating from a fixed center, and multiplies distances from the center by a common scale factor.
Dividend	The quantity to be divided.
Divisor	The quantity by which another quantity, the dividend, is to be divided.
Dot plot	See: line plot.

E

Term	Definition
Expanded form	A multi-digit number is expressed in expanded form when it is written as a sum of single-digit multiples of powers of ten. For example, $643 = 600 + 40 + 3$.
Expected value	For a random variable, the weighted average of its possible values, with weights given by their respective probabilities.

F

Term	Definition
First quartile	For a data set with a median of M, the first quartile is the median of the data values less than M. For example: For the data set {1, 3, 6, 7, 10, 12, 14, 15, 22, 120}, the first quartile is 6.[2] See also: median, third quartile, interquartile range.
Fraction	A number expressible in the form $\frac{a}{b}$ here a is a whole number and b is a positive whole number. (The word fraction in these standards always refers to a non-negative number.) See also: rational number.

I

Term	Definition
Identity property of 0	See Table 3 in this Glossary.
Independently combined probability models	Two probability models are said to be combined independently if the probability of each ordered pair in the combined model equals the product of the original probabilities of the two individual outcomes in the ordered pair.
Integer	A number expressible in the form a or –a for some whole number a.
Interquartile Range	A measure of variation in a set of numerical data, the interquartile range is the distance between the first and third quartiles of the data set. For example: For the data set {1, 3, 6, 7, 10, 12, 14, 15, 22, 120}, the interquartile range is 15 – 6 = 9. See also: first quartile, third quartile.

L

Term	Definition
Line Plot	A method of visually displaying a distribution of data values where each data value is shown as a dot or mark above a number line. Also known as a dot plot.[3]

M

Term	Definition
Mean	A measure of center in a set of numerical data computed by adding the values in a list and then dividing by the number of values in the list. [4] For example: For the data set {1, 3, 6, 7, 10, 12, 14, 15, 22, 120}, the mean is 21.
Measures of Center	A measure of central tendency is a value that attempts to describe a set of data by identifying the central position of the data set (as representative of a "typical" value in the set). The measures of central tendency are called the mean, median, and mode.
Measures of Variability	A measure that describes how spread out or scattered a set of data is. It is also known as measures of dispersion or measures of spread. Some measures of variation are called the range, interquartile range, and standard deviation.

Median	A measure of center in a set of numerical data. The median of a list of values is the value appearing at the center of a sorted version of the list—or the mean of the two central values, if the list contains an even number of values. For example: For the data set {2, 3, 6, 7, 10, 12, 14, 15, 22, 90}, the median is 11.
Midline	In the graph of a trigonometric function, the horizontal line halfway between its maximum and minimum values
Minuend	A quantity from which another is to be subtracted. For example, in the equation 10 – 2 = 8, 10 is the minuend.
Mode	The number which appears most often in a set of data.
Multiplication and division within 100	Multiplication or division of two whole numbers with whole number answers, and with product or dividend in the range 0-100. For example: 72 ÷ 8 = 9.
Multiplicative inverses	Two numbers whose product is 1 are multiplicative inverses of one another. For example: $\frac{3}{4}$ and $\frac{4}{3}$ are multiplicative inverses of one another because $\frac{3}{4} \times \frac{4}{3} = \frac{4}{3} \times \frac{3}{4} = 1$.

N

Term	Definition
Number line diagram	A diagram of the number line used to represent numbers and support reasoning about them. In a number line diagram for measurement quantities, the interval from 0 to 1 on the diagram represents the unit of measure for the quantity.

P

Term	Definition
Percent rate of change	A rate of change expressed as a percent. For example, if a population grows from 50 to 55 in a year, it grows by $\frac{5}{50}$ = 10% per year.
Polygon	A plane, closed two-dimensional figure formed by segments that do not cross. Some examples include: triangles, rectangles, and pentagons.
Probability	A number between 0 and 1 used to quantify likelihood for processes that have uncertain outcomes (such as tossing a coin, selecting a person at random from a group of people, tossing a ball at a target, or testing for a medical condition).
Probability distribution	The set of possible values of a random variable with a probability assigned to each.
Probability model	A probability model is used to assign probabilities to outcomes of a chance process by examining the nature of the process. The set of all outcomes is called the sample space, and their probabilities sum to 1. See also: uniform probability model.
Product	The result when two or more numbers are multiplied together.
Properties of equality	See Table 4 in this Glossary.

Properties of inequality	See Table 5 in this Glossary.
Properties of operations	See Table 3 in this Glossary.

Q

Term	Definition
Quadrilateral	A polygon formed by four line segments.
Qualitative data	Qualitative data is information that describes something, usually characteristics or categories relating to, measuring, or measured by the quality of something rather than its quantity.
Quantitative data	Quantitative data is data expressing a certain quantity, amount, or range. Usually, there are measurements of units relating to, measuring, or measured by the quantity of something rather than its quality.
Quantity	How much there is of something.
Quotient	The result of division. Division is the determination of how many groups can be formed or how many are in each group.

R

Term	Definition
Random variable	An assignment of a numerical value to each outcome in a sample space.
Rational expression	A quotient of two polynomials with a non-zero denominator.
Rational number	A number expressible in the form $\frac{a}{b}$ or $-\frac{a}{b}$ for some fraction $\frac{a}{b}$. The rational numbers include the integers.
Rectangle	A quadrilateral and/or parallelogram where every angle is a right angle.
Rectilinear figure	A polygon, all angles of which are right angles.
Regular Polygon	A polygon is “regular” only when all angles are equal and all sides are equal. Otherwise, it is an irregular polygon.
Reflection	A rigid transformation in which the resulting figure (image) is the mirror image of the original figure (pre-image). A transformation where each point in a shape appears at an equal distance on the opposite side of a given the line of reflection.
Repeating decimal	The decimal form of a rational number. See also: terminating decimal.
Rhombus	A quadrilateral and/or equilateral parallelogram; a plane two- dimensional figure with all four sides congruent, opposite sides parallel, and opposite angles congruent. Plural rhombi or rhombuses.

Rigid motion	A transformation of points in space consisting of a sequence of one or more translations, reflections, and/or rotations. Rigid motions are here assumed to preserve distances and angle measures.
Rotation	A rigid transformation where a figure is turned about a given, fixed point.

S

Term	Definition
Sample space	In a probability model for a random process, a list of the individual outcomes that are to be considered.
Scatter plot	A graph in the coordinate plane representing a set of bivariate data. For example, the heights and weights of a group of people could be displayed on a scatter plot.5
Similarity transformation	A rigid motion followed by a dilation.
Square	An equilateral, equiangular parallelogram; a plane two-dimensional, four-sided regular polygon with all sides equal and all internal angles equal to right angles.
Subtrahend	A quantity to be subtracted from another. For example, in the equation 10 – 2 = 8, 2 is the subtrahend.
Sum	The result of addition. Addition means to add to a set or combine sets.

T

Term	Definition
Tape diagram	A drawing that looks like a segment of tape, used to illustrate number relationships. Also known as a strip diagram, bar model, fraction strip, or length model.
Term	Either a single number or variable, or numbers and variables multiplied together. Terms are separated by + or – signs. For example, in the equation 4x – 7 = 5, 4x, 7, and 5 are all terms.
Terminating decimal	A decimal is called terminating if its repeating digit is 0.
Third quartile	For a data set with a median of M, the third quartile is the median of the data values greater than M. For example: For the data set {2, 3, 6, 7, 10, 12, 14,15, 22, 120}, the third quartile is 15. See also: median, first quartile, interquartile range.
Translation	A rigid transformation that moves every point in a figure a constant distance in a specified direction.
Transitivity principle for indirect measurement	If the length of object A is greater than the length of object B, and the length of object B is greater than the length of object C, then the length of object A is greater than the length of object C. This principle applies to the measurement of other quantities as well.
Trapezoid	A quadrilateral with at least one set of parallel sides.

U

Term	Definition
Uniform probability model	A probability model which assigns equal probability to all outcomes. See also: probability model.

V

Term	Definition
Variable	A letter or other symbol used in an expression to represent an unspecified number may have many values, one value, or no possible value depending on its use. In a polynomial, the variables correspond to the base symbols themselves, stripped of coefficients and any powers or products.
Vector	A quantity with magnitude and direction in the plane or in space, defined by an ordered pair or triple of real numbers.
Visual fraction model	A tape diagram, number line diagram, or area model.
Variable	A letter or other symbol used in an expression to represent an unspecified number may have many values, one value, or no possible value depending on its use. In a polynomial, the variables correspond to the base symbols themselves, stripped of coefficients and any powers or products.
Vector	A quantity with magnitude and direction in the plane or in space, defined by an ordered pair or triple of real numbers.
Visual fraction model	A tape diagram, number line diagram, or area model.
Variable	A letter or other symbol used in an expression to represent an unspecified number may have many values, one value, or no possible value depending on its use. In a polynomial, the variables correspond to the base symbols themselves, stripped of coefficients and any powers or products.
Vector	A quantity with magnitude and direction in the plane or in space, defined by an ordered pair or triple of real numbers.

W

Term	Definition
Whole numbers	The numbers 0, 1, 2, 3…

NOTES

[1]Adapted from Wisconsin Department of Public Instruction, http://dpi.wi.gov/standards/mathglos.html, accessed March 2, 2010.

[2]Many different methods for computing quartiles are in use. The method defined here is sometimes called the Moore and McCabe method. See Langford, E., “Quartiles in Elementary Statistics,” *Journal of Statistics Education* Volume 14, Number 3 (2006).

[3]Adapted from Wisconsin Department of Public Instruction, *op. cit*.

[4]To be more precise, this defines the *arithmetic mean*.

[5]Adapted from Wisconsin Department of Public Instruction, *op. cit*.

Additional Support

Appendix B: Tables

Common addition and subtraction situations.[4]

Table 1

Add To

Result Unknown	Change Unknown	Start Unknown
Two bunnies sat on the grass. Three more bunnies hopped there. How many bunnies are on the grass now? 2 + 3 = ?	Two bunnies were sitting on the grass. Some more bunnies hopped there. Then there were five bunnies. How many bunnies hopped over to the first two? 2 + ? = 5	Some bunnies were sitting on the grass. Three more bunnies hopped there. Then there were five bunnies. How many bunnies were on the grass before? ? + 3 = 5

Take From

Result Unknown	Change Unknown	Start Unknown
Five apples were on the table. I ate two apples. How many apples are on the table now? 5 – 2 = ?	Five apples were on the table. I ate some apples. Then there were three apples. How many apples did I eat? 5 – ? = 3	Some apples were on the table. I ate two apples. Then there were three apples. How many apples were on the table before? ? – 2 = 3

Put Together/Take Apart[2]

Total Unknown	Addend Unknown	Both Addends Unknown[1]
Three red apples and two green apples are on the table. How many apples are on the table? 3 + 2 = ?	Five apples are on the table. Three are red and the rest are green. How many apples are green? 3 + ? = 5, 5 – 3 = ?	Grandma has five flowers. How many can she put in her red vase and how many in her blue vase? 5 = 0 + 5, 5 = 5 + 0 5 = 1 + 4, 5 = 4 + 1 5 = 2 + 3, 5 = 3 + 2

Compare[3]

Difference Unknown	Bigger Unknown	Smaller Unknown
("How many more?" version): Lucy has two apples. Julie has five apples. How many more apples does Julie have than Lucy? ("How many fewer?" version): Lucy has two apples. Julie has five apples. How many fewer apples does Lucy have than Julie? 2 + ? = 5, 5 – 2 = ?	(Version with "more"): Julie has three more apples than Lucy. Lucy has two apples. How many apples does Julie have? (Version with "fewer"): Lucy has 3 fewer apples than Julie. Lucy has two apples. How many apples does Julie have? 2 + 3 = ?, 3 + 2 = ?	(Version with "more"): Julie has three more apples than Lucy. Julie has five apples. How many apples does Lucy have? (Version with "fewer"): Lucy has 3 fewer apples than Julie. Julie has five apples. How many apples does Lucy have? 5 – 3 = ?, ? + 3 = 5

NOTES

[1]These take apart situations can be used to show all the decompositions of a given number. The associated equations, which have the total on the left of the equal sign, help children understand that the = sign does not always mean makes or results in but always does mean is the same number as.

[2]Either addend can be unknown, so there are three variations of these problem situations. Both Addends Unknown is a productive extension of this basic situation, especially for small numbers less than or equal to 10.

[3]For the Bigger Unknown or Smaller Unknown situations, one version directs the correct operation (the version using more for the bigger unknown and using less for the smaller unknown). The other versions are more difficult.

[4]Adapted from Box 2-4 of Mathematics Learning in Early Childhood, National Research Council (2009, pp. 32, 33).

Common multiplication and division situations.[7]

Table 2

Equal Groups

Unknown Product **3 x 6 = ?**	**Group Size Unknown** **("How many in each group?" Division)** **3 x ? = 18, and 18 ÷ 3 =?**	**Number of Groups Unknown** **("How many groups?" Division)** **? x 6 = 18, and 18 ÷ 6 =?**
There are 3 bags with 6 plums in each bag. How many plums are there in all? *Measurement example*. You need 3 lengths of string, each 6 inches long. How much string will you need altogether?	If 18 plums are shared equally into 3 bags, then how many plums will be in each bag? *Measurement example*. You have 18 inches of string, which you will cut into 3 equal pieces. How long will each piece of string be?	If 18 plums are to be packed 6 to a bag, then how many bags are needed? *Measurement example*. You have 18 inches of string, which you will cut into pieces that are 6 inches long. How many pieces of string will you have?

Arrays[5], Area[6]

Unknown Product **3 x 6 = ?**	**Group Size Unknown** **("How many in each group?" Division)** **3 x ? = 18, and 18 ÷ 3 =?**	**Number of Groups Unknown** **("How many groups?" Division)** **? x 6 = 18, and 18 ÷ 6 =?**
There are 3 rows of apples with 6 apples in each row. How many apples are there? *Area example*. What is the area of a 3 cm by 6 cm rectangle?	If 18 apples are arranged into 3 equal rows, how many apples will be in each row? *Area example*. A rectangle has area 18 square centimeters. If one side is 3 cm long, how long is a side next to it?	If 18 apples are arranged into equal rows of 6 apples, how many rows will there be? *Area example*. A rectangle has area 18 square centimeters. If one side is 6 cm long, how long is a side next to it?

Compare

Unknown Product 3 x 6 = ?	Group Size Unknown (“How many in each group?” Division) 3 x ? = 18, and 18 ÷ 3 =?	Number of Groups Unknown (“How many groups?” Division) ? x 6 = 18, and 18 ÷ 6 =?
A blue hat costs $6. A red hat costs 3 times as much as the blue hat. How much does the red hat cost? *Measurement example*. A rubber band is 6 cm long. How long will the rubber band be when it is stretched to be 3 times as long?	A red hat costs $18 and that is 3 times as much as a blue hat costs. How much does a blue hat cost? *Measurement example*. A rubber band is stretched to be 18 cm long and that is 3 times as long as it was at first. How long was the rubber band at first?	A red hat costs $18 and a blue hat costs $6. How many times as much does the red hat cost as the blue hat? *Measurement example*. A rubber band was 6 cm long at first. Now it is stretched to be 18 cm long. How many times as long is the rubber band now as it was at first?

General

Unknown Product 3 x 6 = ?	Group Size Unknown (“How many in each group?” Division) 3 x ? = 18, and 18 ÷ 3 =?	Number of Groups Unknown (“How many groups?” Division) ? x 6 = 18, and 18 ÷ 6 =?
$a \times b = ?$	$a \times ? = p$, and $p \div a = ?$	$? \times b = p$, and $p \div b = ?$

NOTES

[5]The language in the array examples shows the easiest form of array problems. A harder form is to use the terms rows and columns: The apples in the grocery window are in 3 rows and 6 columns. How many apples are in there? Both forms are valuable.

[6]Area involves arrays of squares that have been pushed together so that there are no gaps or overlaps, so array problems include these especially important measurement situations.

[7]The first examples in each cell are examples of discrete things. These are easier for students and should be given before the measurement examples.

Tables 3-5

Table 3

The Properties of Operations	
Here a, b and c stand for arbitrary numbers in a given number system. The properties of operations apply to the rational number system, the real number system, and the complex number system.	
Associative property of addition	$(a + b) + c = a + (b + c)$
Commutative property of addition	$a + b = b + a$
Additive identity property of 0	$a + 0 = 0 + a = a$
Existence of additive inverses	For every a there exists $–a$ so that $a + (–a) = (–a) + a = 0$.
Associative property of multiplication	$(a \times b) \times c = a \times (b \times c)$
Commutative property of multiplication	$a \times b = b \times a$
Multiplicative identity property of 1	$a \times 1 = 1 \times a = a$
Existence of multiplicative inverses	For every $a \neq 0$ there exists $\frac{1}{a}$ so that $a \times \frac{1}{a} = \frac{1}{a} \times a = 1$.
Distributive property of multiplication over addition	$a \times (b + c) = a \times b + a \times c$

Table 4

The Properties of Equality	
Here a, b and c stand for arbitrary numbers in the rational, real, or complex number systems.	
Reflexive property of equality	$a = a$
Symmetric property of equality	If $a = b$, then $b = a$.
Transitive property of equality	If $a = b$ and $b = c$, then $a = c$.
Addition property of equality	If $a = b$, then $a + c = b + c$.
Subtraction property of equality	If $a = b$, then $a – c = b – c$.
Multiplication property of equality	If $a = b$, then $a \times c = b \times c$.
Division property of equality	If $a = b$ and $c \neq 0$, then $a \div c = b \div c$.
Substitution property of equality	If $a = b$, then b may be substituted for a in any expression containing a.

Table 5

The Properties of Inequality
Here a, b and c stand for arbitrary numbers in the rational or real number systems.
Exactly one of the following is true: $a < b$, $a = b$, $a > b$.
If $a > b$ and $b > c$, then $a > c$.
If $a > b$ then $b < a$.
If $a > b$ then $-a < -b$.
If $a > b$, then $a \pm c > b \pm c$.
If $a > b$ and $c > 0$, *then* $a \times c > b \times c$.
If $a > b$ and $c < 0$, *then* $a \times c < b \times c$.
If $a > b$ and $c > 0$, *then* $a \div c > b \div c$.
If $a > b$ and $c < 0$, *then* $a \div c < b \div c$.

MS CCRS Widely Applicable as Prerequisites for a Range of College Majors, Postsecondary Programs and Careers. [8]

Table 6

High-School—Conceptual Category (N)

Number and Quantity
N-RN, Real Numbers: Both clusters in this domain contain widely applicable prerequisites.
N-Q*, Quantities: Every standard in this domain is a widely applicable prerequisite. Note, this domain is especially important in the high school content standards overall as a widely applicable prerequisite.

High-School—Conceptual Category (A)

Algebra
Every **domain** in this category contains widely applicable prerequisites.[10] Note, the **A-SSE** domain is especially important in the high school content standards overall as a widely applicable prerequisite.

High-School—Conceptual Category (F)

Functions
F-IF, Interpreting Functions: Every **cluster** in this domain contains widely applicable prerequisites.[10] Additionally, standards **F-BF.1** and **F-LE.1** are relatively important within this category as widely applicable prerequisites.

High-School—Conceptual Category (G)

Geometry
The following standards and clusters are relatively important within this category as widely applicable prerequisites: **G-CO.1, G-CO.9, G-CO.10, G-SRT.B, G-SRT.C** Note, the above standards in turn have learning prerequisites within the Geometry category, including: **G-CO.A, G-CO.B, G-SRT.A**

High-School—Conceptual Category (S)

Statistics and Probability
The following standards are relatively important within this category as widely applicable prerequisites: **S-ID.2, S-ID.7, S-IC.1** Note, the above standards in turn have learning prerequisites within 6-8.SP.

Applying Key Takeaways from Grades 6-8[9]

Middle Grades Content
Solving problems at a level of sophistication appropriate to high school by: • Applying ratios and proportional relationships. • Applying percentages and unit conversions, e.g., in the context of complicated measurement problems involving quantities with derived or compound units (such as $\frac{mg}{mL}, \frac{kg}{m^3}$ acre-feet, etc.). • Applying basic function concepts, e.g., by interpreting the features of a graph in the context of an applied problem. • Applying concepts and skills of geometric measurement e.g., when analyzing a diagram or schematic. • Applying concepts and skills of basic statistics and probability (see 6-8.SP). • Performing rational number arithmetic fluently.

NOTES

Letter codes (A, B, C) are used to denote cluster headings. For example, G-SRT.**B** refers to the ***second*** cluster heading in the domain G-SRT, *"Prove theorems using similarity"* (MS CCRS p. 191).

[8] Informed by postsecondary survey data in Conley et al. (2011), http://www.epiconline.org/publications/documents/ReachingtheGoal-FullReport.pdf.

[9] See MS CCRS, p. 85 "…some of the highest priority content for college and career readiness comes from Grades 6-8. This body of material includes powerfully useful proficiencies such as applying ratio reasoning in real-world and mathematical problems, computing fluently with positive and negative fractions and decimals, and solving real-world and mathematical problems involving angle measure, area, surface area, and volume."

* Modeling Standards (present in HS CCRS)

[10] Only the standards without a (+) sign are being cited here.

Additional Support

Appendix C: Supporting Resources

MS CCRS Navigator: Comprehensive Support for Instructional Preparation

PURPOSE

The primary purpose of the 2025 Mississippi College- and Career-Readiness Standards Navigator: Comprehensive Support for Instructional Preparation Document (MS CCRS Navigator), *formally known as the MS CCRS Scaffolding Document*, is to equip teachers with a deeper understanding of the Standards, enabling them to effectively prepare for classroom instruction. Grounded in the 2025 Mississippi College- and Career-Readiness Standards for Mathematics, this document provides a detailed analysis of what is required for student mastery in an effort to help teachers prepare to deliver high-quality, intentional instruction that aligns with the rigor of the Standards.

ORGANIZATION

The 2025 MS CCRS Navigator is divided by grade level. Within each grade level, the MS CCRS Navigator is color-coded by mathematical domains (Grades K-8) or high school conceptual categories (Grades 9-12). Each standard is divided into three categories to guide instructional preparation:

(1) **Prerequisite Knowledge**: This column outlines the skills students should have previously mastered to engage with and work toward mastery of the grade-specific standard. It clarifies what students need to KNOW to build a strong foundation for learning.

(2) **Conceptual Understanding**: This column explains the deeper understanding of concepts—not just actions or skills—required for mastery. It details what students need to UNDERSTAND to fully grasp the grade-specific standard.

(3) **Evidence of Knowledge**: This column describes how student mastery is demonstrated, including the work students produce to exhibit understanding. It specifies what students need to DO to show they have achieved mastery.

To further support instructional preparation, the document includes suggested Standards for Mathematical Practice (SMPs) and key academic vocabulary for each standard. The MS Navigator is located at www.mdek12.org/secondaryeducation/mathematics.

2016 and 2025 Standards Comparison Guide

Mississippi College- and Career-Readiness Standards:
Kindergarten

Identifier	2016 MS CCR Standard	2025 MS CCR Standard
K.CC.1	Count to 100 by ones and by tens.	**New/Split Standard** K.CC.1a- Count to 100 by ones. K.CC.1b- Count to 100 by tens.
K.OA.5	***Fluently*** add and subtract within 5.	**New/Split Standard** K.OA.5a- ***Fluently*** add within 5. K.OA.5b- ***Fluently*** subtract within 5.

Mississippi College- and Career-Readiness Standards:
Grade 1

Identifier	2016 MS CCR Standard	2025 MS CCR Standard
1.MD.3b	Identify the days of the week, the number of days in a week, and the number of weeks in each month.	**New/Split Standard** 1.MD.3b Identify the days of the week and the number of days in a week. 1.MD.3c Identify the months of the year, number of months in a year, and the number of weeks in a month.

Mississippi College- and Career-Readiness Standards:
Grade 4

Identifier	2016 MS CCR Standard	2025 MS CCR Standard
4.G.2	Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles.	Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. ~~Recognize right triangles as a category, and identify right triangles.~~ Categorize triangles by sides and angles (equilateral, isosceles, right, and scalene).

Mississippi College- and Career-Readiness Standards:
Grade 5

Identifier	2016 MS CCR Standard	2025 MS CCR Standard
5.MD.5b	Apply the formulas V = l ×w×h and V = b ×h for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real-world and mathematical problems.	Apply the formulas V = l ×w×h and V = ~~b~~B ×h for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real-world and mathematical problems.

Mississippi College- and Career-Readiness Standards:
Grade 6

Identifier	2016 MS CCR Standard	2025 MS CCR Standard
6.EE.5	Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.	~~Understand solving~~ Solve an equation or inequality ~~as a~~ and understand the process ~~of~~ by answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.
6.G.2	Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas V = lwh and V = bh to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.	Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas V = lwh and V = ~~b~~Bh to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.

Mississippi College- and Career-Readiness Standards:

Grade 7

Identifier	2016 MS CCR Standard	2025 MS CCR Standard
7.G.6	Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.	Solve real-world and mathematical problems involving area, volume, and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, and polygons, including cubes, and right prisms, and pyramids.

Mississippi College- and Career-Readiness Standards:

Algebra I

Identifier	2016 MS CCR Standard	2025 MS CCR Standard
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. *	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-REI.6	Solve systems of linear equations algebraically, exactly, and graphically while focusing on pairs of linear equations in two variables.	Solve systems of linear equations exactly using algebraic processes and approximately (e.g. graphically) while focusing on pairs of linear equations in two variables.
F-IF.3	Recognize that sequences are functions whose domain is a subset of the integers.	Use the fact that sequences are functions whose domain is a subset of the integers to identify sequences and generate their explicit formulas.
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;	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; and end behavior; and periodicity.*

	symmetries; end behavior; and periodicity.*	
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.	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.~~

Mississippi College- and Career-Readiness Standards:
Geometry

Identifier	2016 MS CCR Standard	2025 MS CCR Standard
G-SRT.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.*	G.SRT.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems and rewrite expressions involving radicals to simplify and interpret solutions.*

Mississippi College- and Career-Readiness Standards:
Algebra II

Identifier	2016 MS CCR Standard	2025 MS CCR Standard
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.	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.

NOTE
* Modeling Standard