Archdiocese of Omaha

# K-12 Math Curriculum Standards

## 2023

Archdiocese of Omaha Catholic Schools

# Table of Contents

# Acknowledgements

We would like to thank the following individuals for their support and assistance in the writing of the Archdiocese of Omaha Math Standards, 2023.

**The Writing Team**

| | |
|---|---|
| Rachel Jenkinson | St. Francis School |
| Jenny Keller | St. Thomas More School |
| Tricia Gushard | Holy Name School |
| Kate Rezac | St. Margaret Mary School |
| Myah Brown | St. Stephen the Martyr School |
| Debbie Miller | St. Vincent de Paul School |
| Patty Daly | St. James/Seton School |
| Patricia Bauer | St. Mary School-O'Neill |
| Maria Mergens | Mercy High School |
| Jake Moore | Duchesne Academy |
| Jenne Gregor | Creighton Preparatory High School |
| Megan Fiedler | Facilitator of Curriculum & Assessment |
| Vickie Kauffold | Superintendent of Archdiocese of Omaha Schools |

**Special Acknowledgements**

The Archdiocese of Omaha Catholic Schools Office offers special appreciation to the Archdiocese of Denver Catholic Schools, Nebraska Department of Education, the Office of Catholic Schools in the Diocese of Columbus, and Saint James Catholic School in the Diocese of Arlington.

## Introduction

The purpose of these standards is to assist administrators and teachers of the Archdiocese of Omaha in teaching math in the Archdiocesan Catholic Schools. This guide contains clear expectations for math standards. It is intended that this material be used in the development of local math curriculum plans, evaluating, and choosing instructional materials, developing formative and summative assessments, and for the training of teachers in evidence-based instructional practices for math.

Administrators will use this curriculum to assist teachers in applying the math standards and assessments to the specific grade levels/courses.

Teachers will use the curriculum as the basis for planning their lessons for the year. Use of this curriculum will assist students in attaining the standards for which all are accountable. Teachers are required to spend 80% of their instructional time teaching curriculum directly connected to the standards with 20% of their time teaching concepts that enhance the curriculum.

## Archdiocese of Omaha Catholic Schools Mission Statement

The mission of the Catholic Schools in the Archdiocese of Omaha, Nebraska, in cooperation with the parents, is an extension of the four-fold educational mission of the Catholic Church:
To proclaim the message of faith and morals
To foster community
To encourage worship and prayer
To motivate to serve others

Each school is to foster in students a personal relationship with Jesus Christ educating them to become academically proficient and responsible, community-minded adults who will be active and loyal members of their Church and their country.

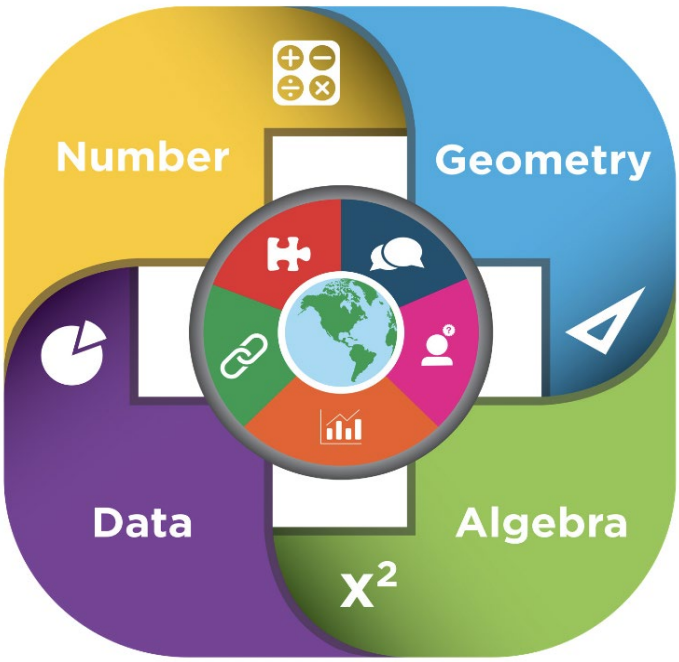
## Archdiocese of Omaha Catholic School Exit Standards

All graduates of Catholic Schools in the Archdiocese of Omaha demonstrate:
Knowledge of Catholic Church teachings of faith, morals and virtue
Knowledge of core disciplines and fine arts
Higher order thinking skills
Effective communication skills
Effective social interaction skills
Independent learning skills
Life-long learning with the ability to access and utilize resources
Knowledge of practices essential to:
Christ-centered families
Full participation in parish community life
Sound health in mind, body and spirit
Responsible stewardship
Mature, responsible, and sensible use of technology
Effective citizenship

## Math Program Mission Statement

The mission of mathematical education in the Archdiocese of Omaha is to empower all students to use their God-given abilities to solve problems confidently, think critically, and reason logically guided by the Catholic faith.

# Introduction to the Nebraska Math Standards and the Formation of a Catholic Identity in the Archdiocese of Omaha Standards




## College and Career Readiness

College and career readiness for Nebraska's K-12 students requires content area standards that are clearly defined and increasingly rigorous across grade levels. The standards are designed to ensure all students have access to grade-level mathematics content centered on deep learning of concepts while actively building new knowledge from their experiences. The revised mathematics standards encompass a wide range of essential skills across the strands of Number, Algebra, Geometry, and Data. The standards, both individually and as an integrated whole, describe not only expectations for college and career readiness, but the 21st century mathematical literacies for critical and innovative thinking and problem solving. The progression of skills within each strand are research and evidence-based and designed to prepare Nebraska's students for postsecondary and workforce demands.

The structure of Nebraska's College and Career Ready Standards for Mathematics includes:

Number

Ratios and Proportions [1]

Algebra

Geometry

Data

[1] Ratios and Proportions is a new content strand in Grades 6 and 7.

**Grade Level Content Focus**

In addition to the standards and indicators, this document includes information about content focus at the beginning of each grade level. Based on research and the progression of the disciplines, the information provides a snapshot of the "major work of the grade." This guidance leverages the structure and emphases of college- and career-ready mathematics standards. At every grade level, instruction should emphasize the development of the mathematical processes as the vehicle for content mastery.

**Nebraska Mathematical Processes**

The Nebraska Mathematical Processes reflect overarching processes that students should master as they work towards college and career readiness. As described by the National Research Council (2001), mathematical processes are integral to all mathematics teaching and learning. The Nebraska Mathematical Processes reflect the interaction of skills necessary for success in math coursework as well as the ability to apply math knowledge and processes within authentic contexts. The processes highlight the applied nature of math within the workforce and clarify the expectations held for the use of mathematics in and outside of the classroom. Additionally, the Fordham Institute (2018) states that high quality standards for mathematics "integrate and promote the 'math processes' or mathematical habits of mind that every student should possess." Mathematical processes activate the learning process while increasing the likelihood that students will become mathematically proficient (Van de Walle et al., 2018).

***To develop essential mathematical habits of mind, mathematically proficient students:***

**Make sense of problems and persevere in solving them.** Students make sense of problems and look for entry points to plan solution pathways. A variety of tools including, but not limited to, mental math, estimation, concrete and visual models, and appropriate technology may be selected to support problem solving. Students form conjectures or inferences based on patterns or sets of examples and nonexamples and monitor their progress. Perseverance includes working without knowing if a plan will succeed, trying other plans if an initial plan does not work, and checking if a solution is reasonable. **(PROBLEM SOLVING)**

**Reason quantitatively and abstractly and consider the reasoning of others.** Students make sense of quantities and their relationships using quantitative and abstract reasoning. Quantitative reasoning uses the properties of numbers, operations, and geometric objects. Abstract reasoning includes making sense of and manipulating representations in terms of the original context. Students can represent a problem using numbers and mathematical symbols, solve the problem and then make sense of the solution in context of the original situation. Students can analyze their own reasoning and the reasoning of others by comparing different approaches, recognizing correctness and efficiency, and finding counterexamples. **(REASONING)**

**Create and use representations to organize, record, and communicate mathematical ideas.** Students will understand that representations of mathematical ideas – physical, visual, symbolic, contextual, and verbal – are an essential part of learning, doing, and communicating mathematics. Students create, use, and evaluate the effectiveness of representations to clearly communicate mathematical ideas. **(REPRESENTATIONS)**

**Analyze mathematical relationships to connect mathematical ideas.** Students routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense. By modeling mathematics in authentic contexts, students make connections among and between different areas of mathematics and other disciplines. Students seek out and make connections among different approaches and representations, including those of other students. **(CONNECTIONS)**

**Explain and justify mathematical ideas using precise mathematical language in written or oral communication.** Students will communicate their solutions with displays, explanations, and justifications. Students make sense of the mathematics by asking helpful questions that clarify or deepen understanding. Students will use precise mathematical language when explaining and justifying their work in written or oral form. **(COMMUNICATION)**


## Key Instructional Shifts for the Nebraska Math Standards

Shifting instructional practice is central to improving teaching and learning. The 2022 revisions to *Nebraska's College and Career Ready Standards for Mathematics* require key shifts in practice and consideration of instructional materials to realize the vision for excellent instruction in mathematics. This document provides an overview of the instructional shifts and the roles that teachers, leaders, and students have in their implementation.

**Mathematics Shift 1: Focus** | The ability to focus on fewer concepts at a grade level allows for deeper engagement with concepts and topics. The revised standards reflect the emphasis of developmentally appropriate concepts at each grade level that are foundational to later proficiency. These shifts narrow and deepen learning experiences and focus on the "major work" of each grade.

| **Teachers…** | **School leaders…** | **Students…** |
|---|---|---|
| Establish clear learning goals for the mathematics students are learning and use the goals to make instructional decisions.<br><br>Design learning experiences using high-quality instructional materials that focus on the major work of the grade and promote positive dispositions toward the study of mathematics.<br><br>Facilitate meaningful discourse to build a shared understanding of mathematical ideas.<br><br>Provide students sufficient time working with engaging applications of mathematics while allowing students to think independently about problems. | Ensure instruction aligns with a district- wide, developed and shared vision for excellent teaching and learning of mathematics.<br><br>Support the procurement and implementation of high-quality, standards-aligned instructional materials.<br><br>Provide professional learning focused on the major work of each grade supported by high-quality instructional materials. | Use learning goals to focus on progress in improving their understanding of grade-level content and proficiency with using the mathematical processes.<br><br>Participate in grade-level content in classroom interactions and assignments.<br><br>Explain how they solved a problem and provide mathematical justification for their reasoning.<br><br>Discuss how different approaches to solving a problem are the same and how they are different.<br><br>Reflect on mistakes and misconceptions to improve their mathematical understanding. |

**Mathematics Shift 2: Coherence** | Mathematics represents a coherent body of knowledge that is made up of interconnected concepts and topics. The revised standards are designed as coherent progressions both within and across grade levels. The five mathematical processes (Problem solving, Reasoning, Representations, Connections, and Communications) support the interlinking within and across grades. Each standard is an extension of previous learning. All students should have the opportunity to exhibit mathematical processes while engaging in the content of the lesson.

| **Teachers…** | **School leaders…** | **Students…** |
|---|---|---|
| Prioritize the mathematical processes in all aspects of classroom practice including teaching, instructional materials, assessment, and the use of tools and technology.<br><br>Use high-quality instructional materials that address the major work of each grade and reflect the learning progressions.<br><br>Provide learning experiences that build on and extend the student's current mathematical understanding. | Develop and/or refine a coherent, district-wide scope and sequence based on the learning progressions.<br><br>Ensure the use of high-quality instructional materials that incorporate the mathematical processes.<br><br>Establish and maintain sustained professional learning across grade levels.<br><br>Observe lessons or engage in classroom walk-throughs, focusing on the mathematical processes. | Engage with the mathematical processes to apply and extend previous understandings.<br><br>Transfer mathematical skills and understandings across concepts and grade levels.<br><br>Make sense of tasks by drawing upon, and making connections to, prior understanding and ideas.<br><br>Use a variety of ways to demonstrate how previous learning supports their thinking with new topics and concepts. |

| **Mathematics Shift 3: Rigor \|** Rigor refers to the deep, authentic command of mathematical concepts and includes three aspects in the major work of each grade: conceptual understanding, procedural skills and fluency, and application. When these aspects are balanced in instruction and applied with equal intensity and through the use of high-quality questions and tasks, students are equipped to meet the standards at each grade level. | | |
|---|---|---|
| **Teachers…**<br><br>Use high-quality instructional materials that support the development of conceptual understanding of mathematics.<br><br>Provide work with grade-level, authentic problems to develop procedural skill and fluency.<br><br>Select tasks from high-quality instructional materials that promote multiple entry points using varied tools and representations.<br><br>Pose tasks and problems that require a high level of cognitive demand. | **School leaders…**<br><br>Design professional learning that deepens teachers' knowledge of the three aspects of rigor and the importance of balance among them.<br>Engage families and other stakeholders in the process of selecting high-quality instructional materials and the rigor expected from them.<br>Support the use of assessments that measure conceptual understanding, procedural skills, fluency, and application. | **Students…**<br><br>Build a foundation of conceptual understandings so that, over time, they become skillful in using procedures flexibly as they solve authentic mathematical problems.<br><br>Access concepts from a variety of perspectives.<br><br>Use tools and representations, as needed, to support their thinking and problem solving.<br><br>Persevere in exploring and reasoning through tasks. |

Archdiocese of Omaha

## The Formation of a Catholic Identity in the Math Standards

Mathematics is a great example of God's gift of the human mind for the betterment of all, regardless of heritage, language, aptitude, talents, needs or interests.

By growing in knowledge of problem-solving and understanding of Catholic beliefs, all students will be able to meet society's demands for well-informed citizens who can reason logically, think critically, solve problems creatively and resourcefully, and communicate effectively.

All students will attain skills across the strands of Number, Algebra, Geometry, and Data. The progression of skills is researched and evidence-based designed to prepare all students to function confidently in a mathematically sophisticated and increasingly complex world.

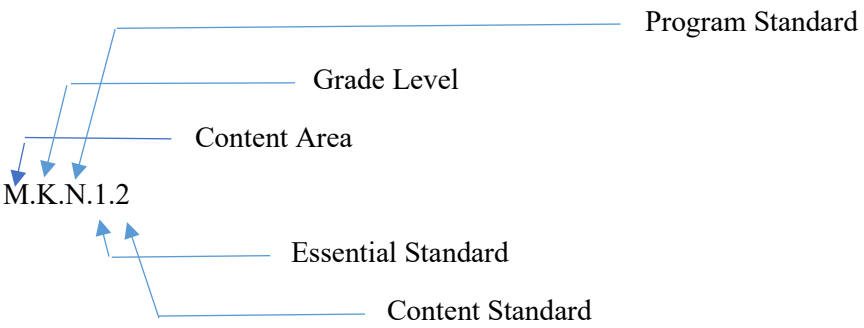
## Program Standards

Program and Essential Standards describe the knowledge and skills that students will learn. The *Program Standards* are the pillars of the content area. The *Essential Standards* are broad, overarching student expectations for learning. *Content Standards* identify what students will learn. These standards create a framework for teaching and learning to articulate a trajectory for knowledge and acquisition across all grade and course levels. This ensures that student learning builds on prior knowledge and becomes more advanced over time.

## K-12 Math Program Standards

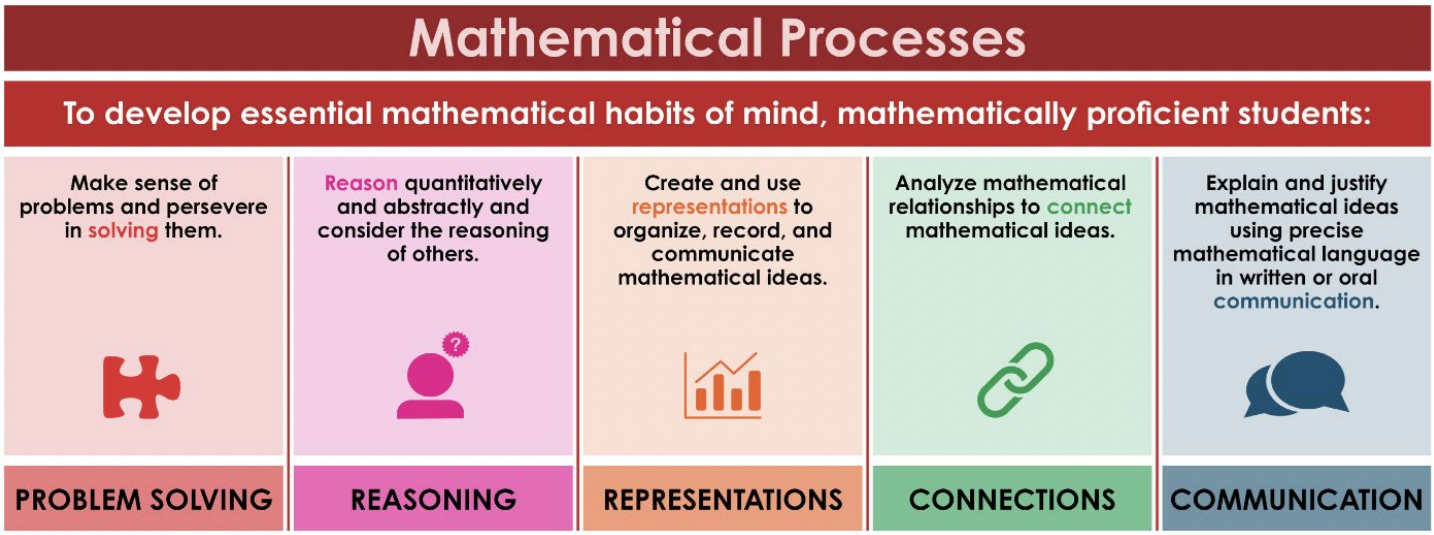
| **Program Standards** | **Description** |
|---|---|
| Number (N)<br>K-12 | Students will solve problems and reason with number concepts using multiple representations, make connections within math and across disciplines, and communicate their ideas. |
| Ratios and Proportion (R)<br>6-7 | Students will understand ratio concepts and use ratio reasoning to solve problems. |
| Algebra (A)<br>K-12 | Students will solve problems and reason with algebra using multiple representations, make connections within math and across disciplines, and communicate their ideas. |
| Geometry (G)<br>K-12 | Students will solve problems and reason with geometry using multiple representations, make connections within math and across disciplines, and communicate their ideas. |
| Data (D)<br>K-12 | Students will solve problems and reason with data/probability using multiple representations, make connections within math and across disciplines, and communicate their ideas. |

## Reading the Archdiocese Math Standards



Additionally, the Nebraska codes from the state standards are included in parathesis in order to better correlate student performance from current standardized tests and instructional materials, interventions, and assessments. When the Archdiocese math standards have additional information and/or revised the original state standard, the state standard in parentheses will be italicized.

# Kindergarten Math Standards




## Kindergarten Content Focus

During Kindergarten, instruction should value the use of God's gift of the human mind to develop understanding of mathematical processes. For all students to master grade-level content, instruction should focus on these critical areas:
Using numbers to represent quantities and to solve quantitative problems, such as quickly recognizing the number in a small set, counting objects in a set, producing sets of given sizes, and comparing and ordering sets or numerals.
Working with numbers 11-19 to gain foundations for place value.
Understanding addition as putting together and adding to and understanding subtraction as taking apart and taking from.
Identifying, naming, and describing two- and three-dimensional shapes that are presented in a variety of ways.

## Kindergarten Math Standards

**Number:** Students will solve problems and reason with number concepts using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Number (N)** | |
|---|---|
| **Essential Standard 1** | **Subitizing: Students will quantify briefly shown collections and verbally label the arrangements without counting. (K.N.1)** |
| M.K.N.1.1 (K.N.1.a) | Without counting, recognize and verbally label arrangements for briefly shown collections up to 10 (e.g., "I saw 5." "How did you know?" "I saw 3 and 2, that is 5." |
| **Essential Standard 2** | **Counting and Cardinality: Students will understand the relationship between numbers and quantities. (K.N.2)** |
| M.K.N.2.1 (K.N.2.a) | Use one-to-one correspondence when counting objects to show the relationship between numbers and quantities and understand the last number counted is a direct representation of the total objects in a given set. |
| M.K.N.2.2 (K.N.2.b) | Understand that each successive number name refers to a quantity that is one larger. |
| M.K.N.2.3 (K.N.2.c) | Count out the number of objects given a number from 1 to 20. |
| M.K.N.2.4 (K.N.2.d) | Count up to 20 objects arranged in a line, a rectangular array, or a circle, and count up to 10 objects in a scattered configuration. |
| M.K.N.2.5 (K.N.2.e) | Count verbally forward and backward from any given number within 20. |
| M.K.N.2.6 (K.N.2.f) | Count verbally in sequential order by ones and by tens to 100, making accurate decade transitions (e.g., 89 to 90). |
| M.K.N.2.7 (K.N.2.g) | Write and name numbers 0 to 20. Represent a number of objects with a written numeral 0 to 20. |
| M.K.N.2.8 (K.N.2.h) | Compare the number of objects in two groups, up to 20, using the words fewer than, more than, the same as. |
| **Essential Standard 3** | **Base Ten: Students will work with numbers 11 to 19 to gain a foundation for place value. (K.N.3)** |
| M.K.N.3.1 (K.N.3.a) | Compose and decompose numbers from 11 to 19 into a group of ten ones and some more ones using a model, drawing, or equation. |
| **Essential Standard 4** | **Number and Operations: Students will understand and demonstrate the meaning of addition and subtraction. (K.N.4)** |
| M.K.N.4.1 (K.N.4.a) | Represent and explain addition and subtraction as part-whole relationships, with addition as *putting together* and/or *adding to* and subtraction as *taking apart* and/or *taking from*, using objects, drawings, numbers, and equations. |

| | |
|---|---|
| M.K.N.4.2 (K.N.4.b) | Compose and decompose numbers less than or equal to 10 into pairs in more than one way using verbal explanations, objects, or drawings. |
| M.K.N.4.3 (K.N.4.c) | For any number from 1 to 9, find the number that makes 10 when added to the given number, sharing the answer with a model, drawing, or equation. |
| M.K.N.4.4 (K.N.4.d) | Efficiently, flexibly, and accurately add and subtract within 5. |
| M.K.N.4.5 (K.N.4.e) | Solve authentic problems that involve addition and subtraction within 10 (e.g., by using objects, drawings, and equations to represent the problem). |

**Algebra:** Students will solve problems and reason with algebra using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Algebra (A)** | |
|---|---|
| | **See number and operations in Number: Essential Standard 4, 1-5.** |

**Geometry**: Students will solve problems and reason with geometry using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Geometry (G)** | |
|---|---|
| **Essential Standard 1** | **Shapes and Their Attributes: Students will identify and represent the attributes of two-dimensional shapes and three-dimensional solids. (K.G.1)** |
| M.K.G.1.1 (K.G.1.a) | Identify and name two-dimensional shapes including circles, triangles, squares, and rectangles regardless of orientation or size. |
| M.K.G.1.2 (K.G.1.b) | Identify and name three-dimensional shapes including spheres, cubes, cylinders, and cones regardless of orientation or size. |
| M.K.G.1.3 (K.G.1.c) | Describe the relative positions of shapes in relation to other objects or shapes using terms such as above, below, in front of, behind, and next to. |
| M.K.G.1.4 (K.G.1.d) | Create shapes using given materials and describe one or more of the attributes such as number of sides/corners. |
| M.K.G.1.5 K.G.1.e) | Combine simple shapes to compose larger shapes. |
| **Essential Standard 2** | **Measurement: Students will describe and compare measurable attributes. (K.G.2)** |
| M.K.G.2.1 (K.G.2.a) | Describe measurable attributes of authentic objects including length, capacity, and weight. |
| M.K.G.2.2 (K.G.2.b) | Directly compare two objects with a measurable attribute in common to describe which object is longer/shorter, heavier/lighter, and has more/less-capacity. |

| **Essential Standard 3** | **Time and Money: Students will know coin names and values and tell time to the hour. (K.G.3)** |
|---|---|
| M.K.G.3.1 *(K.G.3.a)* | Identify the name and value of pennies, nickels, dimes, and quarters. |
| M.K.G.3.2 *(K.G.3.b)* | Identify the parts of digital and analog clocks. Tell and write time to the hour using digital and analog clocks. |

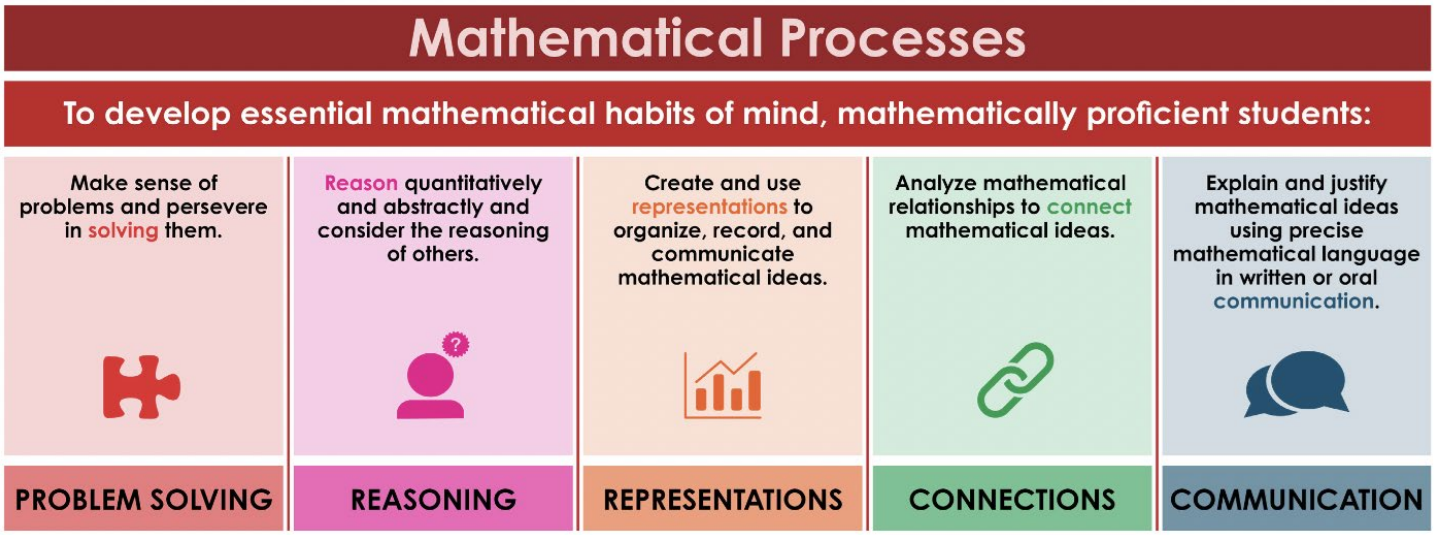
**Data:** Students will solve problems and reason with data/probability using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Data (D)** | |
|---|---|
| **Essential Standard 1** | **Classification: Students will sort and classify objects using one or more attributes. (K.D.1)** |
| M.K.D.1.1 (K.D.1.a) | Identify, sort, and classify objects by size, shape, color, and other attributes. |
| M.K.D.1.2 (K.D.1.b) | Identify objects that do not belong to a particular group and explain the reasoning used. |

## Kindergarten Math Glossary

| **Term** | **Definition** |
|---|---|
| analog clock | a clock in which hours, minutes, and sometimes seconds are indicated by hands on a dial |
| circle | all points in a plane equidistant from the center |
| compose | put together |
| decompose | take apart |
| making 10 | combinations of numbers that add up to ten |
| subitizing | to identify the number of things in a set by quickly looking at them, not by counting them |
| using 10 | use properties of place value (tens and ones) |

# 1st Grade Math Standards




## 1st Grade Content Focus

During Grade 1, instruction should value the use of God's gift of the human mind to develop understanding of mathematical processes. For all students to master grade-level content, instruction should focus on these critical areas:

Extending the counting sequence and strategies for solving quantitative questions.
Representing and solving problems involving addition and subtraction to include work with equations and the properties of the operations.
Developing understandings of addition and subtraction strategies for basic addition facts and related subtraction facts.
Developing an understanding of whole number relationships, including grouping in tens and ones.
Measuring lengths indirectly and by iterating length units.

# 1st Grade Math Standards

**Number:** Students will solve problems and reason with number concepts using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Number (N)** | |
|---|---|
| **Essential Standard 1** | **Subitizing: Students will quantify briefly shown collections and verbally label the arrangements without counting. (1.N.1)** |
| M.1.N.1.1 (1.N.1.a) | Without counting, recognize and verbally label arrangements for briefly shown collections up to 20 (e.g.," I saw 16." "How did you know?" "I saw 10 and 6, that is 16"). |
| **Essential Standard 2** | **Counting and Cardinality: Students will understand the relationship between numbers and quantities to extend the counting sequence. (1.N.2)** |
| M.1.N.2.1 (1.N.2.a) | Count verbally by ones and tens within 120 starting at any given number. |
| M.1.N.2.2 (1.N.2.b) | Count verbally by ones and tens within 120 starting at any given number. Understand that the given number is a direct representation of the total objects in a given set and counting on each successive number represents adding an additional object, and counting back each proceeding number represents removing an object. |
| M.1.N.2.3 (1.N.2.c) | Write numerals to match a representation of a given set of objects for numbers up to 120. |
| M.1.N.2.4 (1.N.2.d) | Understand patterns of skip counting by 2s, 5s, and 10s. |
| **Essential Standard 3** | **Base Ten: Students will represent and compare two-digit numbers to gain foundations for place value. (1.N.3)** |
| M.1.N.3.1 (1.N.3.a) | Understand 10 as a bundle, collection, or (more abstractly) composition of ten ones and that the two digits of a two-digit number represent a composition of some tens and some ones. |
| M.1.N.3.2 (1.N.3.b) | Compare two, two-digit numbers using words greater than, less than, equal to, and symbols <, >, =. Justify comparisons based on the number of tens and ones. |
| **Essential Standard 4** | **Number and Operations: Students will compute using addition and subtraction. (1.N.4)** |
| M.1.N.4.1 (1.N.4.a) | Add and subtract within 20, using flexible strategies such as counting on or counting back, making ten, using ten, and using doubles and near doubles. |
| M.1.N.4.2 (1.N.4.b) | Efficiently, flexibly, and accurately add and subtract within 10. |
| M.1.N.4.3 (1.N.4.c) | Find the difference between two numbers that are multiples of 10, ranging from 10 to 90 using concrete models, drawings, or strategies, and write the corresponding equation. |
| M.1.N.4.4 (1.N.4.d) | Mentally find 10 more or 10 less than a two-digit number (without having to count) and explain the reasoning used. |

| | |
|---|---|
| M.1.N.4.5 *(1.N.4.e)* | Add within 100, including adding a two-digit number and a one-digit number (e.g., 34 + 3), adding a two-digit number and a multiple of ten (e.g., 62 + 20), using concrete models, drawings, and strategies that reflect an understanding of place value, the relationship between addition and subtraction, and the properties of operations. Relate the strategy to a written method and explain the reasoning used to solve. |
| M.1.N.4.6 (1.N.4.f) | Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; sometimes it is necessary to compose a ten. |
| M.1.N.4.7 (1.N.4.g) | Subtract multiples of ten from two-digit numbers (positive or zero differences) using concrete models, drawings, and strategies that reflect an understanding of place value, the relationship between addition and subtraction, and the properties of operations. Relate the strategy to a written method and explain the reasoning used to solve. |
| **Essential Standard 5** | **Number and Algebraic Relationships: Students will understand and apply properties of operations and the relationship between addition and subtraction to solve problems. (1.N.5)** |
| M.1.N.5.1 (1.N.5.a) | Use the meaning of the equal sign to determine if equations are true and give examples of equations that are true (e.g., 4 = 4, 6 = 7 – 1, 6 + 3 = 3 + 6, 7 + 2 = 5 + 4). |
| M.1.N.5.2 (1.N.5.b) | Use the relationship of addition and subtraction to solve subtraction problems (e.g., find 12 – 9 = _, using the addition fact 9 + 3 = 12). |
| M.1.N.5.3 (1.N.5.c) | Determine the unknown whole number in an addition or subtraction equation (e.g., 7 + ? = 13). |
| M.1.N.5.4 (1.N.5.d) | Use the commutative property of addition to develop addition strategies and compose/decompose numbers to develop addition and subtraction strategies. (See other flexible strategies in M.1.N.4.1). |
| M.1.N.5.5 (1.N.5.e) | Solve problems that call for addition of three whole numbers whose sum is less than or equal to 20 using flexible strategies with objects, drawings, and/or equations. |
| M.1.N.5.6 (1.N.5.f) | Solve authentic problems involving addition and subtraction within 20 in situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all parts of the addition or subtraction problem by using objects, drawings, and/or equations with a symbol for the unknown number to represent the problem. |
| M.1.N.5.7 (1.N.5.g) | Create an authentic problem to represent a given equation involving addition and subtraction within 20. |

**Algebra:** Students will solve problems and reason with algebra using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Algebra (A)** | |
|---|---|
| | **See number and algebraic relationships in Number: Essential Standard 5, 1-7** |

**Geometry**: Students will solve problems and reason with geometry using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Geometry (G)** | |
|---|---|
| **Essential Standard 1** | **Shapes and Their Attributes: Students will represent and describe the attributes of two-dimensional shapes. (1.G.1)** |
| M.1.G.1.1 (1.G.1.a) | Determine geometric attributes of two-dimensional shapes regardless of orientation or size for rhombi, trapezoids, and hexagons (e.g., a hexagon is closed with six sides). |
| M.1.G.1.2 (1.G.1.b) | Determine geometric attributes of three-dimensional shapes including cones, cylinders, cubes, and rectangular prisms regardless of orientation or size. |
| M.1.G.1.3 (1.G.1.c) | Describe lines and sides of shapes as parallel or non-parallel. |
| M.1.G.1.4 (1.G.1.d) | Partition circles and rectangles into two and four equal parts using the language halves and fourths. |
| **Essential Standard 2** | **Measurement: Students will measure and compare lengths. (1.G.2)** |
| M.1.G.2.1 (1.G.2.a) | Measure the length of an object as a whole number of same-size, non-standard units by placing them end to end. |
| M.1.G.2.2 (1.G.2.b) | Order three objects by directly comparing their lengths or indirectly by using a third object. |
| **Essential Standard 3** | **Time and Money: Students will solve problems with coins and tell time to the half hour. (1.G.3)** |
| M.1.G.3.1 (1.G.3.a) | Understand the value of dimes and pennies (e.g., a dime is equal to ten pennies) relating to tens and ones and solve problems involving dimes and pennies using the ¢ symbol appropriately. |
| M.1.G.3.2 (1.G.3.b) | Count collections of like coins (penny, nickel, and dime) relating to patterns of counting by 1s, 5s, and 10s. |
| M.1.G.3.3 | Count collections of quarters up to one dollar. |
| M.1.G.3.4 (1.G.3.c) | Tell and write time to the half hour and hour using analog and digital clocks. |

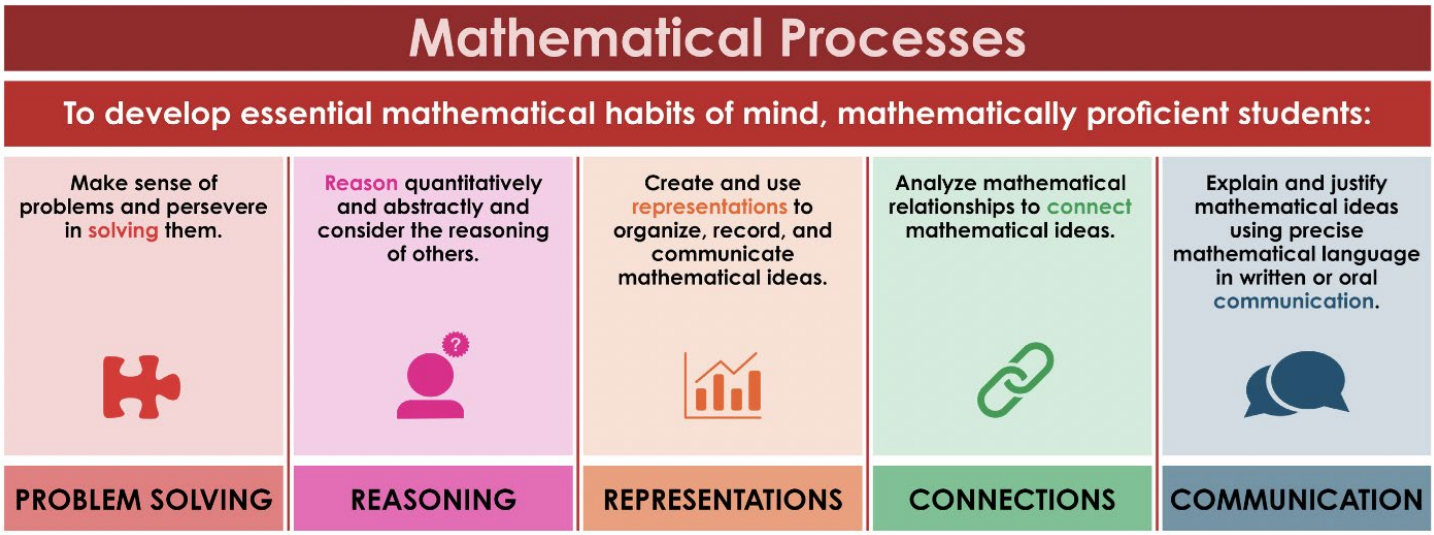
**Data:** Students will solve problems and reason with data/probability using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Data (D)** | |
|---|---|
| **Essential Standard 1** | **Data Collection: Students will formulate questions to collect, organize, and represent data. (1.D.1)** |
| M.1.D.1.1 (1.D.1.a) | Collect, organize, and represent a data set with up to three categories using a picture graph. |
| **Essential Standard 2** | **Analyze Data and Interpret Results: Students will analyze the data and interpret the results. (1.D.2)** |
| M.1.D.2.1 (1.D.2.a) | Ask and answer questions about the total number of data points, how many in each category, and compare categories by identifying how many more or less are in a particular category using a picture graph. |

## 1st Grade Math Glossary

| Term | Definition |
|---|---|
| analog clock | a clock in which hours, minutes, and sometimes seconds are indicated by hands on a dial |
| circle | all points in a plane equidistant from the center |
| compose | put together |
| concrete model | a real, physical object (e.g., counters) |
| counting back | start the counting sequence at any number and count down |
| decompose | take apart |
| operation | an action performed on some set of quantities (addition, subtraction, multiplication, division, raising to a power, and taking a root) |
| partition | splitting equally |
| subitizing | to identify the number of things in a set by quickly looking at them, not by counting them |
| using 10 | use properties of place value (tens and ones) |

# 2nd Grade Math Standards




## 2nd Grade Content Focus

During Grade 2, instruction should value the use of God's gift of the human mind to develop understanding of mathematical processes. For all students to master grade-level content, instruction should focus on these critical areas:

Building on base-ten numeration system and place-value concepts to demonstrate understanding of multi-digit numbers.
Applying properties of operations and the relationship between adding and subtracting.
Developing quick recall of addition facts and related subtraction facts.
Solving problems that involve time and/or money.
Extending understanding of linear measurement by measuring and estimating lengths and relating length to addition and subtraction.

## 2nd Grade Math Standards

**Number:** Students will solve problems and reason with number concepts using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Number (N)** | |
|---|---|
| **Essential Standard 1** | **Subitizing: Students will quantify briefly shown collections and verbally label the arrangements without counting. (2.N.1)** |
| M.2.N.1.1 (2.N.1.a) | Without counting, recognize and verbally label structured arrangements for briefly shown collections using groups, multiplicative thinking, and place value (e.g.," I saw 48." "How did you know?" "I saw 4 groups of 10 and 2 groups of 4 is 8...4 tens and 8 ones...48"). |
| **Essential Standard 2** | **Counting: Students will understand the relationship between numbers and quantities to extend the counting sequence. (2.N.2)** |
| M.2.N.2.1 (2.N.2.a) | Count within 1,000, including skip counting by 5s, 10s, and 100s starting at a variety of multiples of 5, 10, or 100. |
| **Essential Standard 3** | **Base Ten: Students will represent and compare three-digit numbers to apply concepts of place value. (2.N.3)** |
| M.2.N.3.1 (2.N.3.a) | Read and write numbers within the range of 0 to 1,000 using standard, word, and expanded forms. |
| M.2.N.3.2 (2.N.3.b) | Understand 100 as a bundle, collection, or (more abstractly) composition of ten tens and that the three digits of a three- digit number represent a composition of some hundreds, some tens, and some ones. |
| M.2.N.3.3 (2.N.3.c) | Compare two three-digit numbers by using symbols <, >, = and justify the comparison based on the value of the hundreds, tens, and ones. |
| **Essential Standard 4** | **Number and Operations: Students will compute using addition and subtraction. (2.N.4)** |
| M.2.N.4.1 (2.N.4.a) | Fluently add and subtract within 20. |
| M.2.N.4.2 (2.N.4.b) | Add and subtract within 100 using strategies based on place value including properties of operations, relationships between addition and subtraction, and algorithms. |
| M.2.N.4.3 (2.N.4.c) | Mentally add or subtract 10 or 100 to or from a given number 100 to 900. |
| M.2.N.4.4 (2.N.4.d) | Add up to three two-digit numbers using strategies based on place value and understanding of properties. |
| M.2.N.4.5 (2.N.4.e) | Add and subtract within 1,000 using concrete models, drawings, and strategies that reflect an understanding of place value and the properties of operations. |
| **Essential Standard 5** | **Number and Algebraic Relationships: Students will create and solve problems involving addition and subtraction and work with equal groups of objects to gain foundations for multiplication. (2.N.5)** |

| | |
|---|---|
| M.2.N.5.1 (2.N.5.a) | Solve authentic problems involving addition and subtraction within 100 in situations of addition and subtraction, including adding to, subtracting from, joining and separating, and comparing situations with unknowns in all positions using objects, models, drawings, verbal explanations, expressions, and equations. |
| M.2.N.5.2 (2.N.5.b) | Create authentic problems to represent one-step addition and subtraction within 100 with unknowns in all positions. |
| M.2.N.5.3 (2.N.5.c) | Use repeated addition to find the total number of objects arranged in an array no larger than five rows and five columns and write an equation to express the total. |
| M.2.N.5.4 (2.N.5.d) | Identify a group of objects from 0 to 20 as even or odd by counting by 2s or by showing even numbers as a sum of two equal parts. |

**Algebra:** Students will solve problems and reason with algebra using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Algebra (A)** | |
|---|---|
| | **See number and algebraic relationships in Number: Essential Standard 5, 1-4** |

**Geometry**: Students will solve problems and reason with geometry using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Geometry (G)** | |
|---|---|
| **Essential Standard 1** | **Shapes and Their Attributes: Students will recognize and represent the attributes of two-dimensional shapes and three-dimensional solids. (2.G.1)** |
| M.2.G.1.1 (2.G.1.a) | Recognize and describe all faces of three-dimensional shapes as two-dimensional shapes. Identify and count attributes of solid shapes including the edges, faces, and vertices. |
| M.2.G.1.2 (2.G.1.b) | Recognize and draw two-dimensional shapes having a specific number of sides, angles, and vertices including triangles, quadrilaterals, pentagons, and hexagons. |
| M.2.G.1.3 (2.G.1.c) | Partition a rectangle into rows and columns of equal-sized squares and count to find the total. |
| M.2.G.1.4 (2.G.1.d) | Divide circles and rectangles into two, three, or four equal parts and describe the parts using the language of halves, thirds, fourths, half of, a third of, and a fourth of. |
| M.2.G.1.5 (2.G.1.e) | Recognize that equal shares of identical wholes need not have the same shape. |
| **Essential Standard 2** | **Describe Measurable Attributes: Students will measure, estimate, and compare lengths to build meaning of the measurement process. (2.G.2)** |
| M.2.G.2.1 (2.G.2.a) | Measure the length of an object using two different length units and describe how the measurements relate to the size of the specific unit. |

| | |
|---|---|
| M.2.G.2.2 (2.G.2.b) | Compare the difference in length of objects using inches and feet or centimeters and meters. |
| **Essential Standard 3** | **Measurement: Students will use tools to measure and estimate length using standard units. (2.G.3)** |
| M.2.G.3.1 (2.G.3.a) | Identify and use appropriate tools for measuring length. |
| M.2.G.3.2 (2.G.3.b) | Measure and estimate lengths using whole numbers with inches, feet, centimeters, and meters. |
| **Essential Standard 4** | **Relate Addition and Subtraction to Measurement: Students will add or subtract to solve length problems. (2.G.4)** |
| M.2.G.4.1 (2.G.4.a) | Represent whole numbers as equally spaced lengths on a number line diagram. Use number lines to find sums and differences within 100. |
| M.2.G.4.2 (2.G.4.b) | Use addition and subtraction within 100 to solve problems using the same standard-length units. |
| **Essential Standard 5** | **Time and Money: Students will solve problems with dollar bills and coins and tell time to the nearest five-minute interval. (2.G.5)** |
| M.2.G.5.1 (2.G.5.a) | Solve problems involving dollar bills, quarters, dimes, nickels, and pennies using $ and ¢ symbols appropriately. |
| M.2.G.5.2 (2.G.5.b) | Identify and write time to five-minute intervals using analog and digital clocks and both a.m. and p.m. |

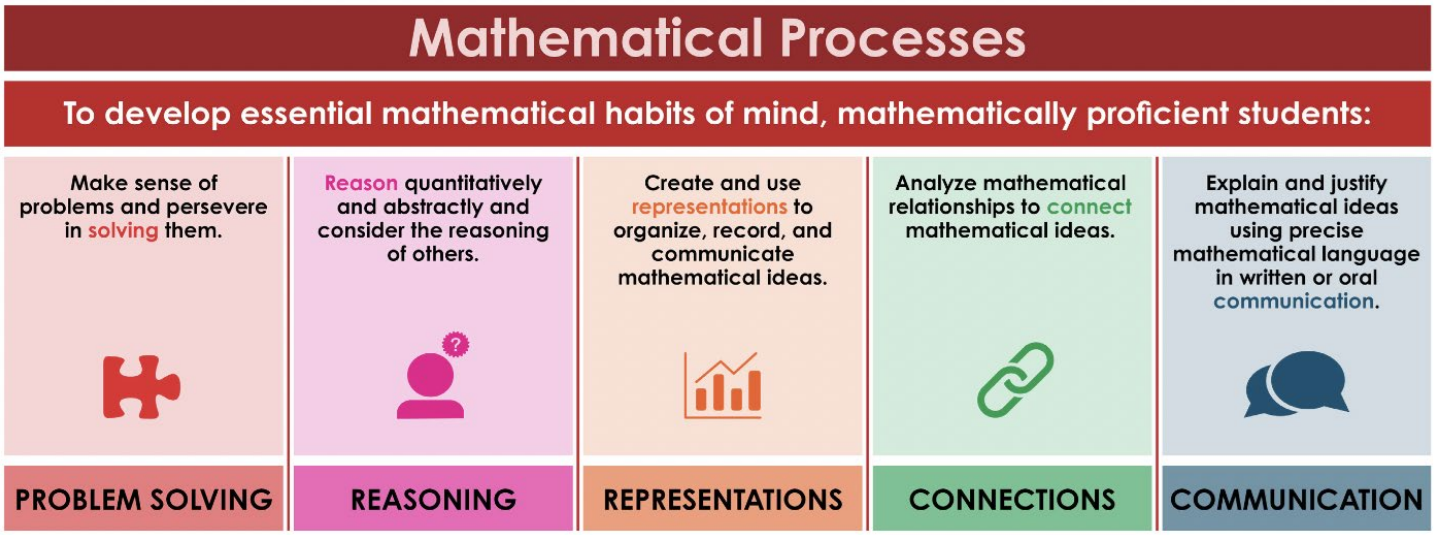
**Data:** Students will solve problems and reason with data/probability using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Data (D)** | |
|---|---|
| **Essential Standard 1** | **Data Collection: Students will formulate questions to collect, organize, and represent data. (2.D.1)** |
| M.2.D.1.1 (2.D.1.a) | Ask authentic questions to generate data and represent the data using scaled picture graphs with up to four categories. |
| M.2.D.1.2 (2.D.1.b) | Ask authentic questions to generate data and represent the data using bar graphs with up to four categories. |
| M.2.D.1.3 (2.D.1.c) | Create and represent a data set by making a line plot using whole numbers. |
| **Essential Standard 2** | **Analyze Data and Interpret Results: Students will analyze the data and interpret the results. (2.D.2)** |
| M.2.D.2.1 (2.D.2.a) | Analyze data using scaled picture graphs or bar graphs with up to four categories. Solve problems including one-step comparison problems, using information from the graphs. |

# 2nd Grade Math Glossary

| Term | Definition |
|---|---|
| analog clock | a clock in which hours, minutes, and sometimes seconds are indicated by hands on a dial |
| circle | all points in a plane equidistant from the center |
| compose | put together |
| concrete model | a real, physical object (e.g., counters) |
| decompose | take apart |
| generate data | collect or create data |
| line plot | a graph that displays data as points or check marks above a number line, showing the frequency of each value |
| number line | a line on which numbers are marked at intervals |
| operation | an action performed on some set of quantities (addition, subtraction, multiplication, division, raising to a power, and taking a root) |
| partition | splitting equally |
| repeated addition | the process of adding equal groups |
| scaled bar graphs | a bar graph that uses a scale of one or more |
| scaled picture graphs | a picture graph that uses a scale of one or more |
| subitizing | to identify the number of things in a set by quickly looking at them, not by counting them |
| using 10 | use properties of place value (tens and ones) |

# 3rd Grade Math Standards




## 3rd Grade Content Focus

During Grade 3, instruction should value the use of God's gift of the human mind to develop understanding of mathematical processes. For all students to master grade-level content, instruction should focus on these critical areas:

Building on additive reasoning to develop understanding of multiplication and division.
Exploring multiplication properties and strategies to multiply within 100 flexibly and efficiently.
Developing understanding of fractions as numbers by connecting prior work in partitioning shapes into equal areas to the relationship between numerator and denominator.
Solving problems using visual fraction models to compare and find equivalencies.
Reasoning with shapes and their attributes.
Recognizing area as an attribute of two-dimensional shapes and connecting understanding to multiplication.

## 3rd Grade Math Standards

**Number:** Students will solve problems and reason with number concepts using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Number (N)** | |
|---|---|
| **Essential Standard 1** | **Numeric Relationships: Students will demonstrate and represent multi-digit numbers using place value understanding within the base-ten number system. *(3.N.1)*** |
| M.3.N.1.1 (3.N.1.a) | Read, write, and demonstrate multiple equivalent representations for numbers up to 10,000 using objects or visual representations including standard form and expanded form. |
| M.3.N.1.2 (3.N.1.b) | Represent and justify comparisons of whole numbers up to 10,000 using number lines and reasoning strategies. |
| **Essential Standard 2** | **Fractions: Students will develop understanding of fractions as numbers. (3.N.2)** |
| M.3.N.2.1 (3.N.2.a) | Partition two-dimensional figures into equal areas and express the area of each part as a unit fraction of the whole. |
| M.3.N.2.2 (3.N.2.b) | Find parts of a whole using visual fraction models. |
| M.3.N.2.3 (3.N.2.c) | Represent and understand a fraction as a number on a number line. |
| M.3.N.2.4 (3.N.2.d) | Show and identify equivalent fractions using visual representations including pictures, manipulatives, and number lines. |
| M.3.N.2.5 (3.N.2.e) | Justify whole numbers as fractions and identify fractions that are equivalent to whole numbers. |
| M.3.N.2.6 (3.N.2.f) | Compare and order fractions having the same numerators or denominators by reasoning about their size. |

**Algebra:** Students will solve problems and reason with algebra using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Algebra (A)** | |
|---|---|
| **Essential Standard 1** | **Operations and Algebraic Thinking: Students will extend understanding of multiplication and apply operational properties to solve problems. (3.A.1)** |
| M.3.A.1.1 (3.A.1.a) | Add and subtract up to four-digit whole numbers with or without regrouping using strategies based on place value and algorithms. |
| M.3.A.1.2 (3.A.1.b) | Determine the reasonableness of whole number sums and differences using estimations and number sense. |

| | |
|---|---|
| M.3.A.1.3 (3.A.1.c) | Solve and write one-step whole number equations to represent authentic problems using the four operations including equations with an unknown start, unknown change, or unknown result. |
| M.3.A.1.4 (3.A.1.d) | Interpret and solve two-step authentic problems involving whole numbers and the four operations. |
| M.3.A.1.5 (3.A.1.e) | Apply commutative, associative, distributive, identity, and zero properties as strategies to multiply and divide. |
| M.3.A.1.6 (3.A.1.f) | Use drawings, words, arrays, symbols, repeated addition, equal groups, and number lines to interpret and explain the meaning of multiplication and division and their relationship. |
| M.3.A.1.7 (3.A.1.g) | Fluently multiply and divide within 100 using strategies based on understanding and properties of operations. |
| M.3.A.1.8 (3.A.1.h) | Multiply one-digit whole numbers by multiples of 10 in the range of 10 to 90 using strategies based on place value and properties of operations. |

**Geometry**: Students will solve problems and reason with geometry using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Geometry (G)** | |
|---|---|
| **Essential Standard 1** | **Shapes and Their Attributes: Students will recognize and represent the attributes of two-dimensional shapes. (3.G.1)** |
| M.3.G.1.1 *(3.G.1.a)* | Sort quadrilaterals into categories according to their attributes (e.g., presence or absence of specific angles, presence or absence of parallel and/or perpendicular lines). |
| **Essential Standard 2** | **Area and Perimeter: Students will recognize perimeter and area as attributes of plane figures and understand concepts of area measurement. (3.G.2)** |
| M.3.G.2.1 (3.G.2.a) | Solve authentic problems involving perimeters of polygons when given the side lengths or when given the perimeter and unknown side length(s). |
| M.3.G.2.2 (3.G.2.b) | Use concrete and pictorial models to measure areas in square units by counting square units. |
| M.3.G.2.3 (3.G.2.c) | Find the area of a rectangle with whole-number side lengths by modeling with unit squares; show that area can be additive and is the same as would be found by multiplying the side lengths. |
| **Essential Standard 3** | **Measurement: Students will use tools to solve measurement problems. (3.G.3)** |
| M.3.G.3.1 (3.G.3.a) | Identify and use the appropriate tools and units of measurement, both customary and metric, to solve authentic problems involving length, weight, mass, liquid volume, and capacity (within the same system and unit). |
| M.3.G.3.2 (3.G.3.b) | Estimate and measure length to the nearest half inch, fourth inch, and centimeter. |
| **Essential Standard 4** | **Time: Students will tell time to the nearest minute and find elapsed time. (3.G.4)** |
| M.3.G.4.1 (3.G.4.a) | Tell and write time to the minute using both analog and digital clocks. |

| | |
|---|---|
| M.3.G.4.2 (3.G.4.b) | Solve authentic problems involving addition and subtraction of time intervals and find elapsed time. |

**Data:** Students will solve problems and reason with data/probability using multiple representations, make connections within math and across disciplines, and communicate their ideas.

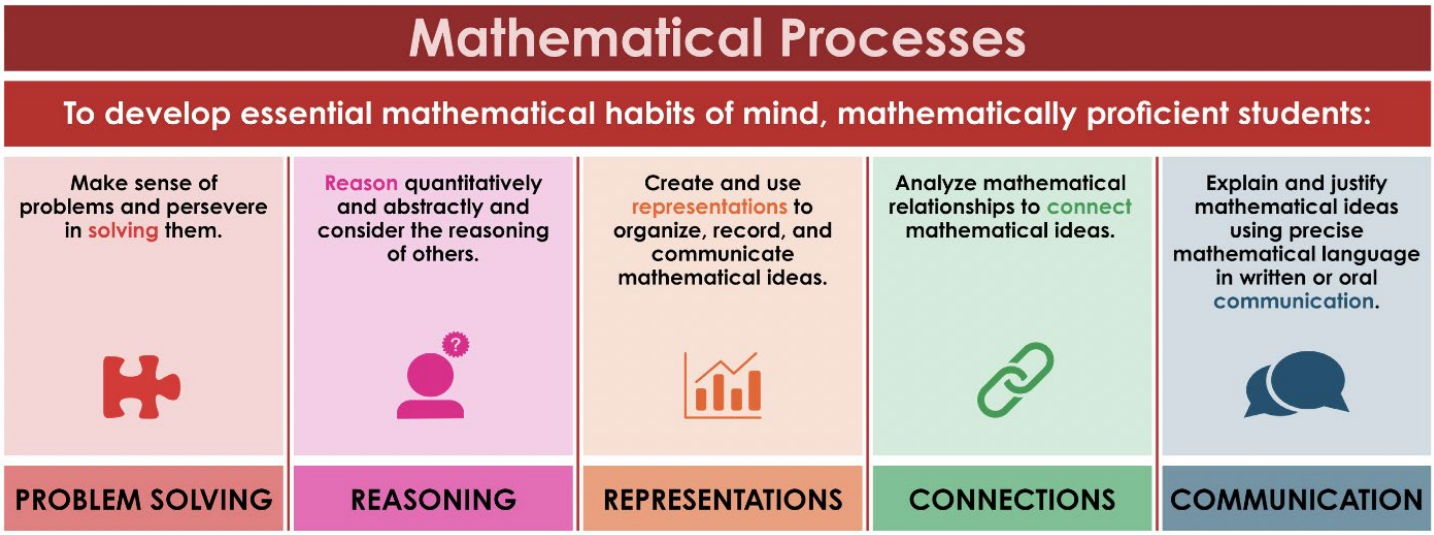
| **Data (D)** | |
|---|---|
| **Essential Standard 1** | **Data Collection: Students will formulate questions to collect, organize, and represent data. (3.D.1)** |
| M.3.D.1.1 (3.D.1.a) | Create scaled picture graphs and scaled bar graphs to represent a data set with more than four categories, including data collected through observations, surveys, and experiments. |
| **Essential Standard 2** | **Analyze Data and Interpret Results: Students will analyze the data and interpret the results. (3.D.2)** |
| M.3.D.2.1 (3.D.2.a) | Analyze data and make simple statements using information represented in picture graphs, line plots, and bar graphs. |
| M.3.D.2.2 | Represent data using bar graphs, circle graphs, line graphs and line plots. |
| M.3.D.2.3 | Find the range for a set of data. |

## 3rd Grade Math Glossary

| Term | Definition |
|---|---|
| analog clock | a clock in which hours, minutes, and sometimes seconds are indicated by hands on a dial |
| associative property of multiplication | the product stays the same when the grouping of factors is changed. (a*b)*c=a*(b*c), where a, b, and c stand for any real numbers, ex (6*4)*2=6*(4*2) |
| concrete model | a real, physical object |
| denominator | the number or expression written below the line in a fraction, tells the number of equal parts into which a whole is divided |
| distributive property | a*(b+c)=(a*b)+(a*c) and a*(b-c)=(a*b)-(a*c), where a, b, and c stand for any real numbers, ex. 6*(4+3)=(6*4)+(6*3) |
| horizontal | parallel to or in the plane of the horizon |
| identify property of multiplication | multiplying a number by 1 gives a product identical to the given number, ex. 8x1=8 and 1x8=8 |
| line plot | a graph that displays data as points or check marks above a number line, showing the frequency of each value |
| number line | a line on which numbers are marked at intervals |
| operation | an action performed on some set of quantities (addition, subtraction, multiplication, division, raising to a power, and taking a root) |
| partition | splitting equally |
| polygon | a closed, plane figure formed by line segments that meet only at their endpoints |

| | |
|---|---|
| repeated addition | the process of adding equal groups |
| scaled bar graphs | a bar graph that uses a scale of one or more |
| scaled picture graphs | a picture graph that uses a scale of one or more |
| zero property | The product of any number is 0 is 0, ex. 8*0=0 and 0*8=0 |

# 4th Grade Math Standards




## 4th Grade Content Focus

During Grade 4, instruction should value the use of God's gift of the human mind to develop understanding of mathematical processes. For all students to master grade-level content, instruction should focus on these critical areas:
Developing understanding and fluency with multi-digit multiplication through visual models and operational properties.
Developing understanding of division involving multi-digit dividends using place value models.
Extending understanding of fraction equivalence and operations with fractions by composing and decomposing, reasoning about relative size, and applying properties of operations.
Classifying two-dimensional shapes according to their attributes such as the presence or absence of lines or angles.
Developing understanding of an angle as a turn in a circle and justify the classification of angles as acute, obtuse, and right.

## 4th Grade Math Standards

**Number:** Students will solve problems and reason with number concepts using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Number (N)** | |
|---|---|
| **Essential Standard 1** | **Numeric Relationships: Students will demonstrate and represent multi-digit numbers using relationships with the base-ten number system. (4.N.1)** |
| M.4.N.1.1 (4.N.1.a) | Read, write, and demonstrate multiple equivalent representations for whole numbers up to 1,000,000 and decimals to the hundredths using visual representations, standard form, and expanded form. |
| M.4.N.1.2 (4.N.1.b) | Represent and justify comparisons of whole numbers up to 1,000,000 and decimals through the hundredths place using number lines and reasoning strategies. |
| M.4.N.1.3 (4.N.1.c) | Recognize a digit in one place represents ten times what it represents in the place to its right. |
| M.4.N.1.4 (4.N.1.d) | Use decimal notation for fractions with denominators of 10 or 100 (e.g., 43/100 = 0.43). |
| **Essential Standard 2** | **Fractions and Decimals: Students will extend understanding of fractions by equivalence and ordering and will develop an understanding of decimals. (4.N.2)** |
| M.4.N.2.1 *(4.N.2.a)* | Explain and demonstrate how a mixed number is equivalent to a fraction greater than one and how a fraction greater than one is equivalent to a mixed number using visual fraction models and reasoning strategies (e.g., 2 ¾ =11/4). |
| M.4.N.2.2 (4.N.2.b) | Explain and demonstrate how equivalent fractions are generated by multiplying by a fraction equivalent to 1 using visual fraction models and the Identity Property of Multiplication. |
| M.4.N.2.3 (4.N.2.c) | Compare and order fractions having unlike numerators or denominators using number lines, benchmarks, reasoning strategies, and/or equivalence. |
| **Essential Standard 3** | **Operations with Fractions: Students will understand and demonstrate fractional computation. (4.N.3)** |
| M.4.N.3.1 ((4.N.3.a) | Decompose a fraction into a sum of fractions with the same denominator in more than one way and record each decomposition with an equation and a visual representation. |
| M.4.N.3.2 (4.N.3.b) | Explain the meaning of addition and subtraction of fractions with like denominators using visual fraction models, properties of operations, and reasoning strategies. |
| M.4.N.3.3 (4.N.3.c) | Add and subtract fractions and mixed numbers with like denominators. |
| M.4.N.3.4 (4.N.3.d) | Solve authentic problems involving addition and subtraction of fractions and mixed numbers with like denominators. |
| M.4.N.3.5 (4.N.3.e) | Multiply a fraction by a whole number using visual fraction models and properties of operations. |
| | |

| **Essential Standard 4** | **Factors and Multiples: Students will find factors and multiples and classify numbers as prime or composite. (4.N.4)** |
|---|---|
| M.4.N.4.1 (4.N.4.a) | Determine whether a given whole number up to 100 is a multiple of a given one-digit number. |
| M.4.N.4.2 (4.N.4.b) | Determine factors of any whole number up to 100 and classify a number up to 100 as prime or composite. |

**Algebra:** Students will solve problems and reason with algebra using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Algebra (A)** | |
|---|---|
| **Essential Standard 1** | **Operations and Algebraic Thinking: Students will extend understanding of multiplication and division and apply operational properties to solve problems involving variables. (4.A.1)** |
| M.4.A.1.1 (4.A.1.a) | Add and subtract multi-digit numbers using an algorithm. |
| M.4.A.1.2 (4.A.1.b) | Multiply up to a four-digit whole number by a one-digit whole number and multiply a two-digit whole number by a two- digit whole number, using strategies based on place value, properties of operations, and algorithms. |
| M.4.A.1.3 (4.A.1.c) | Divide up to a four-digit whole number by a one-digit divisor with and without a remainder using strategies based on place value. |
| M.4.A.1.4 (4.A.1.d) | Determine the reasonableness of whole number products and quotients using estimations and number sense. |
| M.4.A.1.5 (4.A.1.e) | Create a simple algebraic expression or equation using a variable for an unknown number to represent an authentic mathematical situation (e.g., $3 + n = 15$, $81 \div n = 9$). |
| M.4.A.1.6 (4.A.1.f) | Solve one- and two-step authentic problems using the four operations including interpreting remainders and the use of a letter to represent the unknown quantity. |

**Geometry**: Students will solve problems and reason with geometry using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Geometry (G)** | |
|---|---|
| **Essential Standard 1** | **Shapes and Their Attributes: Students will draw and identify lines and angles and classify shapes by properties of their lines and angles. (4.G.1)** |
| M.4.G.1.1 (4.G.1.a) | Identify, create, and describe points, lines, line segments, rays, angles, parallel lines, perpendicular lines, and intersecting lines. |

| | |
|---|---|
| M.4.G.1.2 (4.G.1.b) | Justify the classification of angles as acute, obtuse, or right. |
| M.4.G.1.3 (4.G.1.c) | Justify the classification of two-dimensional shapes based on the presence or absence of parallel and perpendicular lines or the presence or absence of specific angles. |
| M.4.G.1.4 (4.G.1.d) | Recognize, draw, and justify lines of symmetry in two-dimensional shapes. |
| **Essential Standard 2** | **Measurement: Students will generate simple conversions from a larger unit to a smaller unit to solve authentic problems and measure angles. (4.G.2)** |
| M.4.G.2.1 (4.G.2.a) | Identify and use the appropriate tools, operations, and units of measurement, both customary and metric, to solve authentic problems involving time, length, weight, mass, and capacity. |
| M.4.G.2.2 (4.G.2.b) | Determine the reasonableness of measurements involving time, length, weight, mass, capacity, and angles. |
| M.4.G.2.3 (4.G.2.c) | Generate simple conversions from a larger unit to a smaller unit within the customary and metric systems of measurement. |
| M.4.G.2.4 (4.G.2.d) | Measure angles in whole number degrees using a protractor and relate benchmark angle measurements to their rotation through a circle (e.g., 180º = 1/2 of a circle). |
| M.4.G.2.5 (4.G.2.e) | Recognize angle measures as additive and solve problems involving addition and subtraction to find unknown angles on a diagram. |
| **Essential Standard 3** | **Area and Perimeter: Students will apply perimeter and area formulas for rectangles. (4.G.3)** |
| M.4.G.3.1 (4.G.3.a) | Apply perimeter and area formulas for rectangles to solve authentic problems. |

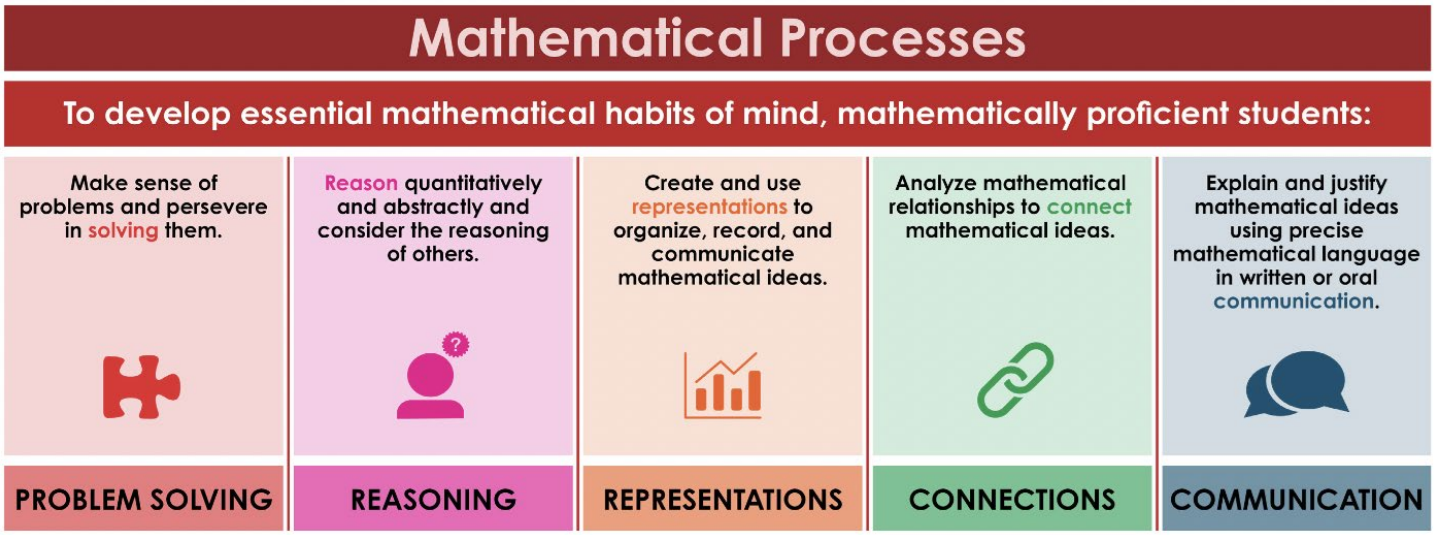
**Data:** Students will solve problems and reason with data/probability using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Data (D)** | |
|---|---|
| **Essential Standard 1** | **Data Collection: Students will formulate questions to collect, organize, and represent data. (4.D.1)** |
| M.4.D.1.1 | Create scaled picture graphs, bar graphs, line graphs, and dot plots to represent a data set with more than four categories, including data collected through observations, surveys, and experiments. |
| **Essential Standard 2** | **Analyze Data and Interpret Results: Students will analyze the data and interpret the results. (4.D.2)** |
| M.4.D.2.1 *(4.D.2.a)* | Solve authentic problems and analyze data presented in bar graphs, circle graphs, line graphs, and dot plots. |
| M.4.D.2.2 | Represent data using bar graphs, circle graphs, line graphs, and dot plots. |
| M.4.D.2.3 | Find and interpret the mean, median, mode, and range for a set of data. |

# 4th Grade Math Glossary

| Term | Definition |
|---|---|
| circle | all points in a plane equidistant from the center |
| concrete model | a real, physical object |
| conversion | the act or process of changing something into a different state or form |
| decimal | a number written using base ten and containing a decimal point |
| denominator | the number or expression written below the line in a fraction, tells the number of equal parts into which a whole is divided |
| dividend | a quantity to be divided |
| divisor | the quantity that divides a dividend |
| horizontal | parallel to or in the plane of the horizon |
| identify property of multiplication | multiplying a number by 1 gives a product identical to the given number, ex. 8x1=8 and 1x8=8 |
| line plot | a graph that displays data as points or check marks above a number line, showing the frequency of each value |
| mixed number | a number with an integer part and a fraction part |
| number line | a line on which numbers are marked at intervals |
| numerator | the number or expression written above the line in a fraction |
| operation | an action performed on some set of quantities (addition, subtraction, multiplication, division, raising to a power, and taking a root) |

# 5th Grade Math Standards




## 5th Grade Content Focus

During Grade 5, instruction should value the use of God's gift of the human mind to develop understanding of mathematical processes. For all students to master grade-level content, instruction should focus on these critical areas:

Extending previous understandings of multiplication and division to multiply and divide fractions and decimals.
Performing operations with multi-digit whole numbers and decimals to the hundredths in order to solve authentic problems following the order of operations.
Categorizing shapes using knowledge of their attributes.
Developing concepts of volume and relating volume to multiplication and addition.

## 5th Grade Math Standards

**Number:** Students will solve problems and reason with number concepts using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Number (N)** | |
|---|---|
| **Essential Standard 1** | **Numeric Relationships: Students will understand the place value system within the base-ten number system. *(5.N.1)*** |
| M.5.N.1.1 (5.N.1.a) | Read, write, and demonstrate multiple equivalent representations for multi-digit whole numbers and decimals through the thousandths place using standard form and expanded form. |
| M.5.N.1.2 (5.N.1.b) | Recognize a digit in one place represents 1/10 of what it represents in the place to its left. |
| M.5.N.1.3 (5.N.1.c) | Use whole number exponents to denote powers of 10. |
| **Essential Standard 2** | **Fractions and Decimals: Students will extend understanding of fraction and decimal equivalence and ordering. (5.N.2)** |
| M.5.N.2.1 (5.N.2.a) | Generate equivalent forms of commonly used fractions and decimals (e.g., halves, fourths, fifths, tenths). |
| M.5.N.2.2 (5.N.2.b) | Represent and justify comparisons of whole numbers, fractions, mixed numbers, and decimals through the thousandths place using number lines, reasoning strategies, and/or equivalence. |
| **Essential Standard 3** | **Operations with Fractions and Decimals: Students will apply and extend previous understandings of whole number operations to add, subtract, multiply and divide fractions and decimals. (5.N.3)** |
| M.5.N.3.1 (5.N.3.a) | Interpret a fraction as division of the numerator by the denominator. |
| M.5.N.3.2 (5.N.3.b) | Multiply a whole number by a fraction or a fraction by a fraction, including mixed numbers, using visual fraction models and properties of operations. |
| M.5.N.3.3 (5.N.3.c) | Divide a unit fraction by a whole number and a whole number by a unit fraction using visual fraction models and properties of operations. |
| M.5.N.3.4 (5.N.3.d) | Solve authentic problems involving addition, subtraction, and multiplication of fractions and mixed numbers with like and unlike denominators. |
| M.5.N.3.5 (5.N.3.e) | Add and subtract fractions and mixed numbers with unlike denominators without simplifying. |
| M.5.N.3.6 (5.N.3.f) | Solve authentic problems involving division of unit fractions by whole numbers and division of whole numbers by unit fractions. |
| M.5.N.3.7 (5.N.3.g) | Add and subtract decimals to hundredths using strategies based on place value, properties of operations, and/or algorithms. |

**Algebra:** Students will solve problems and reason with algebra using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Algebra (A)** | |
|---|---|
| **Essential Standard 1** | **Operations and Algebraic Thinking: Students will extend understanding of division and apply operational properties to solve problems involving order of operations. (5.A.1)** |
| M.5.A.1.1 (5.A.1.a) | Multiply multi-digit whole numbers using an algorithm. |
| M.5.A.1.2 (5.A.1.b) | Divide four-digit whole numbers by a two-digit divisor, with and without remainders, using strategies based on place value. |
| M.5.A.1.3 (5.A.1.c) | Justify the reasonableness of computations involving whole numbers, fractions, and decimals. |
| M.5.A.1.4 (5.A.1.d) | Simplify authentic numerical or algebraic expressions using order of operations (excluding exponents). |

**Geometry**: Students will solve problems and reason with geometry using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Geometry (G)** | |
|---|---|
| **Essential Standard 1** | **Shapes and Their Attributes: Students will classify two-dimensional and three-dimensional figures into categories based on their properties. *(5.G.1)*** |
| M.5.G.1.1 *(5.G.1.a)* | Identify and describe faces, edges, vertices, and angles of two and three-dimensional figures. |
| M.5.G.1.2 (5.G.1.b) | Recognize volume as an attribute of solid figures that is measured in cubic units. |
| M.5.G.1.3 *(5.G.1.c)* | Justify the classification of two and three-dimensional figures in a hierarchy based on their properties (e.g., by dimension, number sides, angles, vertices, parallel lines, etc.). |
| **Essential Standard 2** | **Coordinate Geometry: Students will graph points on the coordinate plane to solve authentic problems. (5.G.2)** |
| M.5.G.2.1 (5.G.2.a) | Identify the origin, x axis, and y axis of the coordinate plane. |
| M.5.G.2.2 (5.G.2.b) | Graph and name points in the first quadrant of the coordinate plane using ordered pairs of whole numbers. |
| M.5.G.2.3 (5.G.2.c) | Form ordered pairs from authentic problems involving rules or patterns, graph the ordered pairs in the first quadrant on a coordinate plane, and interpret coordinate values in the context of the situation. |
| **Essential Standard 3** | **Measurement: Students will generate conversions within the customary and metric systems of measurement to solve authentic problems. (5.G.3)** |

| | |
|---|---|
| M.5.G.3.1 (5.G.3.a) | Generate conversions in authentic mathematical situations from larger units to smaller units and smaller units to larger units, within the customary and metric systems of measurement. |
| **Essential Standard 4** | **Area and Volume: Students will extend area problems for rectangles to include fractions and build meaning for measuring volume. (5.G.4)** |
| M.5.G.4.1 (5.G.4.a) | Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the fraction side lengths and show that the area is the same as would be found by multiplying the side lengths. |
| M.5.G.4.2 (5.G.4.b) | Multiply fractional side lengths to find areas of rectangles and represent fraction products as rectangular areas. |
| M.5.G.4.3 (5.G.4.c) | Use concrete models to measure the volume of rectangular prisms by counting cubic units. |
| M.5.G.4.4 (5.G.4.d) | Find the volume of a rectangular prism with whole-number side lengths by modeling with unit cubes and show that the volume can be additive and is the same as would be found by multiplying the area of the base times height. |
| M.5.G.4.5 (5.G.4.e) | Solve authentic problems by applying the formulas $V = l \times w \times h$ and $V = B \times h$ for rectangular prisms to find volumes of rectangular prisms with whole number edge lengths. |

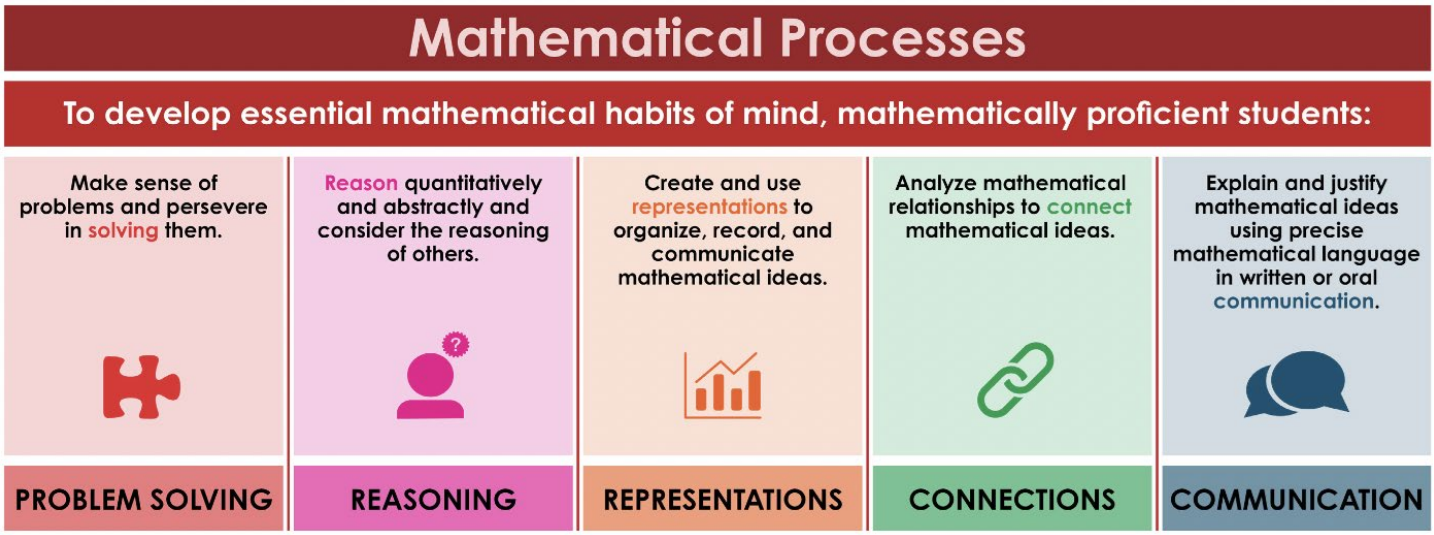
**Data:** Students will solve problems and reason with data/probability using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Data (D)** | |
|---|---|
| **Essential Standard 1** | **Data Collection: Students will formulate questions to collect, organize, and represent data. (5.D.1)** |
| | No new skills introduced at this level. |
| **Essential Standard 2** | **Analyze Data and Interpret Results: Students will analyze the data and interpret the results. (5.D.2)** |
| M.5.D.2.1 *(5.D.2.a)* | Represent, analyze, and solve authentic problems using information presented in one or more tables, plots, or graphs. |
| M.5.D.2.2 | Represent data using bar graphs, circle graphs, line graphs, line plots, and dot plots. |
| M.5.D.2.3 | Solve problems using information presented in bar graphs, circle graphs, line graphs, line plots, and dot plots. |
| M.5.D.2.4 | Find and interpret the mean, median, mode, and range for a set of data. |

# 5th Grade Math Glossary

| Term | Definition |
|---|---|
| concrete model | a real, physical object |
| conversion | the act or process of changing something into a different state or form |
| decimal | a number written using base ten and containing a decimal point |
| denominator | the number or expression written below the line in a fraction, tells the number of equal parts into which a whole is divided |
| dividend | a quantity to be divided |
| divisor | the quantity that divides a dividend |
| edge | the line segment where two faces of a solid figure meet |
| line plot | a graph that displays data as points or check marks above a number line, showing the frequency of each value |
| mixed number | a number with an integer part and a fraction part |
| number line | a line on which numbers are marked at intervals |
| numerator | the number or expression written above the line in a fraction |
| operation | an action performed on some set of quantities (addition, subtraction, multiplication, division, raising to a power, and taking a root) |
| origin | the intersection of the x- and y-axes in a coordinate plane, described by the ordered pair (0,0) |

# 6th Grade Math Standards




## 6th Grade Content Focus

During Grade 6, instruction should value the use of God's gift of the human mind to develop understanding of mathematical processes. For all students to master grade-level content, instruction should focus on these critical areas:

Connecting ratio and rate to whole number multiplication and division and using concepts of ratio and rate to solve problems.
Completing computational understanding with the division of fractions and moving towards efficiency by using the algorithm for each operation.
Extending understanding of the number line to include the entire system of rational numbers, which now includes negative numbers.
Writing and using expressions and equations
Representing data in multiple ways in order to analyze and interpret the results.

## 6th Grade Math Standards

**Number:** Students will solve problems and reason with number concepts using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Number (N)** | |
|---|---|
| **Essential Standard 1** | **Numeric Relationships: Students will demonstrate, represent, and show relationships among fractions, decimals, percents, and integers within the base-ten number system. (6.N.1)** |
| M.6.N.1.1 (6.N.1.a) | Determine common factors and common multiples. |
| M.6.N.1.2 (6.N.1.b) | Determine prime factorization of numbers with and without exponents. |
| M.6.N.1.3 (6.N.1.c) | Model integers using drawings, words, number lines, models, and symbols. |
| M.6.N.1.4 (6.N.1.d) | Determine absolute value of rational numbers. |
| M.6.N.1.5 *(6.N.1.e)* | Compare and order numbers including non-negative fractions and decimals, integers, and absolute values. |
| M.6.N.1.6 *(6.N.1.e)* | Locate non-negative fractions and decimals, integers, and absolute values on a number line. |
| **Essential Standard 2** | **Operations: Students will compute with fractions and decimals accurately. (6.N.2)** |
| M.6.N.2.1 *(6.N.2.a and 6.N.2.b)* | Add, subtract, multiply, and divide whole numbers, non-negative fractions/mixed numbers, and decimals. |
| M.6.N.2.2 (6.N.2.c) | Evaluate numerical expressions including absolute value and/or positive exponents with respect to order of operations. |

**Ratios and Proportions:** Students will understand ratio concepts and use ratio reasoning to solve problems.

| **Ratios and Proportions (R)** | |
|---|---|
| **Essential Standard 1** | **Ratios and Rates: Students will understand the concept of ratios and unit rates, use language to describe the relationship between two quantities, and use ratios and unit rates to solve authentic situations. (6. R.1)** |
| M.6.R.1.1 (6.R.1.a) | Determine ratios from concrete models, drawings, and/or words. |
| M.6.R.1.2 *(6.R.1.b)* | Explain and determine rates and unit rates. |

| | |
|---|---|
| M.6.R.1.3 *(6.R.1.c)* | Use a proportion to solve problems involving finding a missing part, whole, or percent. |
| M.6.R.1.4 (6.R.1.d) | Convert among fractions, decimals, and percents using multiple representations. |
| M.6.R.1.5 (6.R.1.e) | Solve authentic problems using ratios, rates, unit rates, and percentages. |
| M.6.R.1.6 *(6.R.1.f)* | Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities (e.g., miles per hour to feet per hour). |
| **Essential Standard 2** | **Represent: Students will represent ratios and rates on the coordinate plane and with tables. *(6.R.2)*** |
| M.6.R.2.1 (6.R.2.d) | Make tables of equivalent ratios relating quantities with whole number measurements. |
| M.6.R.2.2 (6.R.2.e) | Use the constant of proportionality to find the missing value in ratio tables. |
| M.6.R.2.3 (6.R.2.f) | Plot the pair of values from a ratio table on the coordinate plane. |
| M.6.R.2.4 (6.R.2.g) | Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation. |

**Algebra:** Students will solve problems and reason with algebra using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Algebra (A)** | |
|---|---|
| **Essential Standard 1** | **Algebraic Processes: Students will apply the operational properties when evaluating expressions and solving equations and inequalities. (6.A.1)** |
| M.6.A.1.1 (6.A.1.a) | Recognize and generate equivalent algebraic expressions involving the distributive property and combining like terms. |
| M.6.A.1.2 (6.A.1.b) | Given the value of the variable, evaluate algebraic expressions with non-negative rational numbers with respect to order of operations, which may include absolute value. |
| M.6.A.1.3 (6.A.1.c) | Use substitution to determine if a given value for a variable makes an equation or inequality true. |
| M.6.A.1.4 (6.A.1.d) | Solve one-step equations with non-negative rational numbers using addition, subtraction, multiplication, and division. |
| M.6.A.1.5 (6.A.1.e) | Solve one-step inequalities with whole numbers using addition, subtraction, multiplication, and division and represent solutions on a number line (e.g., graph $3x > 3$). |
| **Essential Standard 2** | **Applications: Students will solve authentic problems with algebraic expressions, equations, and inequalities. (6.A.2)** |
| M.6.A.2.1 (6.A.2.a) | Create algebraic expressions (e.g., one or more operations using one variable) from word phrases. |
| M.6.A.2.2 (6.A.2.b) | Write equations (e.g., one operation, one variable) to represent authentic situations involving non-negative rational numbers. |

| | |
|---|---|
| M.6.A.2.3 (6.A.2.c) | Write inequalities (e.g., one operation, one variable) to represent authentic situations involving whole numbers. |

**Geometry**: Students will solve problems and reason with geometry using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Geometry (G)** | |
|---|---|
| **Essential Standard 1** | **Attributes: Students will identify and describe geometric attributes of two-dimensional shapes. (6.G.1)** |
| M.6.G.1.1 (6.G.1.a) | Identify and create nets to represent two-dimensional drawings of prisms and pyramids. |
| **Essential Standard 2** | **Coordinate Geometry: Students will determine location, orientation, and relationships on the coordinate plane. (6.G.2)** |
| M.6.G.2.1 (6.R.2.a) | Identify the ordered pair of a given point in the coordinate plane. |
| M.6.G.2.2 (6.R.2.b) | Plot the location of an ordered pair in the coordinate plane. |
| M.6.G.2.3 (6.R.2.c) | Identify the location of a given point in the coordinate plane (e.g., axis, origin, quadrant). |
| **Essential Standard 3** | **Measurement: Students will identify geometric attributes that create two and three-dimensional shapes in order to perform measurements and apply formulas to find area and volume. (6.G.3)** |
| M.6.G.3.1 *(6.G.3.a)* | Determine the area of quadrilaterals (e.g., parallelograms and trapezoids) and triangles by composition and decomposition of these shapes (e.g., a rectangle can be represented as two triangles), as well as applications of properties and formulas. |
| M.6.G.3.2 (6.G.3.b) | Determine the surface area of rectangular and triangular prisms using nets as well as application of formulas. |
| M.6.G.3.3 (6.G.3.c) | Apply volume formulas for triangular prisms. |

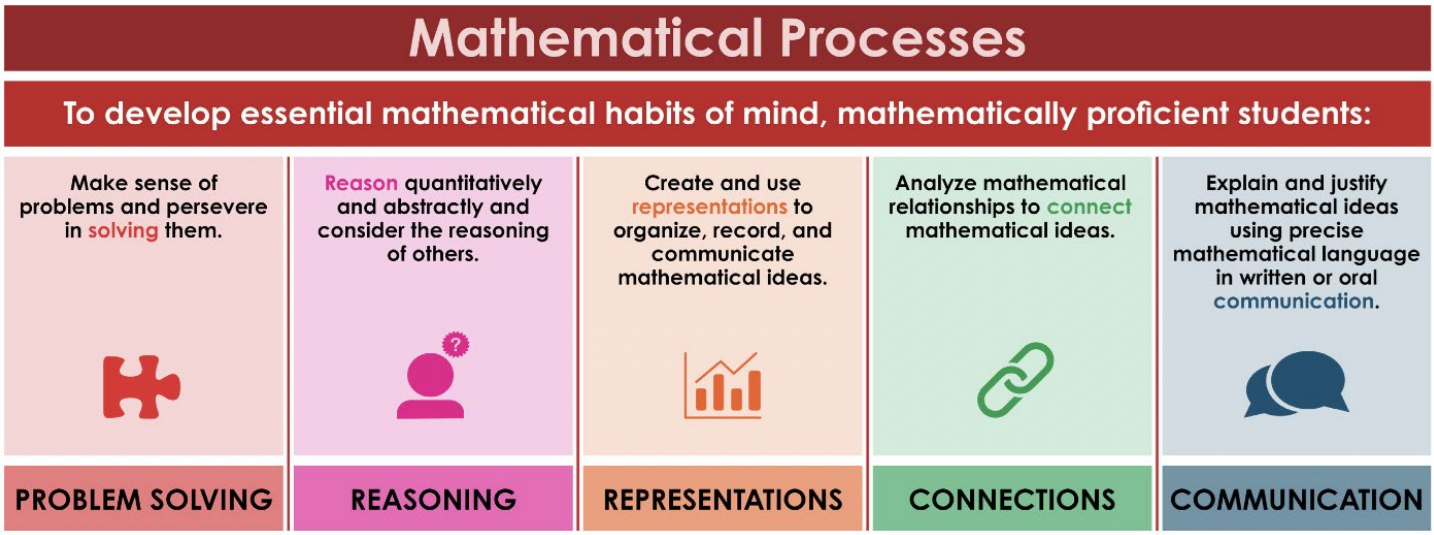
**Data:** Students will solve problems and reason with data/probability using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Data (D)** | |
|---|---|
| **Essential Standard 1** | **Data Collection and Statistical Methods: Students will formulate statistical investigative questions, collect data, and organize data. (6.D.1)** |
| | No new skills introduced at this level. |
| **Essential Standard 2** | **Analyze Data and Interpret Results: Students will represent and analyze the data and interpret the results. (6.D.2)** |
| M.6.D.2.1 *(6.D.2.a)* | Represent data using dot plots, box-and-whisker plots, stem-and-leaf plots, and histograms. |
| M.6.D.2.2 *(6.D.2.b)* | Solve problems using information presented in dot plots, box-and-whisker plots, stem-and-leaf plots, histograms, and circle graphs. |
| M.6.D.2.3 (6.D.2.c) | Find and interpret the mean, median, mode, and range for a set of data. |
| M.6.D.2.4 (6.D.2.d) | Compare the mean, median, mode, and range from two sets of data. |
| M.6.D.2.5 (6.D.2.e) | Compare and interpret data sets based upon their measures of central tendency and graphical representations (e.g., center, spread, shape). |
| **Essential Standard 3** | **Probability: Students will interpret and apply concepts of probability. (6.D.3)** |
| M.6.D.3.1 *(6.D.3.a)* | Identify a list of possible outcomes for a simple event (e.g., heads/tails). |
| M.6.D.3.2 (6.D.3.b) | Describe the theoretical and experimental probability of an event using a fraction, percentage, and decimal. |
| M.6.D.3.3 *(6.D.3.c)* | Express the degree of likelihood (impossible, less likely, equally likely, more likely, or certain) of simple events. |
| M.6.D.3.4 (6.D.3.d) | Compare and contrast theoretical and experimental probabilities. |

# 6th Grade Math Glossary

| Term | Definition |
|---|---|
| central tendency | a value intended to indicate the typical value in a collection of data (mean, median, mode) |
| certain event | an event that will definitely happen, has a probability of 1 |
| circle | all points in a plane equidistant from the center |
| concrete model | a real, physical object |
| constant of proportionality | the constant factor by which a proportion increases or decreases; in a direction proportion, y=kx, and in an indirect proportion, y=k/x, where k does not equal 0, k is the constant of proportionality (also called constant of variation) |
| decimal | a number written using base ten and containing a decimal point |
| distributive property | a*(b+c)=(a*b)+(a*c) and a*(b-c)=(a*b)-(a*c), where a, b, and c stand for any real numbers. 6*(4+3)=(6*4)+(6*3) |
| impossible event | an event with a probability of zero |
| mixed number | a number with an integer part and a fraction part |
| net | a two-dimensional pattern that can be folded to form a three-dimensional solid |
| number line | a line on which numbers are marked at intervals |
| operation | an action performed on some set of quantities (addition, subtraction, multiplication, division, raising to a power, and taking a root) |
| origin | the intersection of the x- and y-axes in a coordinate plane, described by the ordered pair (0,0) |
| percent (%) | a ratio that compares a number to 100; the word percent means per hundred or out of 100, ex. 59% of 100 is 59 and 59% of 200 is 118a ratio that compares a number to 100; the word percent means per hundred or out of 100, ex. 59% of 100 is 59 and 59% of 200 is 118 |
| percentage | a number that is a given percent of another number, ex. if 85% of 3000 is 2550, the percentage is 2550 |
| possible outcomes | all of the outcomes that can occur |
| simple event | an experimental outcome that cannot be broken down any further |
| substitution property of equality | for all real numbers a and b, if a=b, then a can be replaced by b in any equation or expression |
| surface area | the sum of the areas of the faces and any curved surfaces of a solid |
| unit rate | a rate in which the second part is one unit, ex. 60 miles per hour, or 60 miles:1 hour |

# 7th Grade Math Standards




## 7th Grade Content Focus

During Grade 7, instruction should value the use of God's gift of the human mind to develop understanding of mathematical processes. For all students to master grade-level content, instruction should focus on these critical areas:

Developing an understanding of proportional relationships.
Understanding operations with rational numbers.
Using expressions and linear equations to represent and solve problems.
Solving problems involving perimeter and area of two-dimensional figures as well as surface area and volume of three-dimensional figures.
Investigating probability concepts.

## 7th Grade Math Standards

**Number:** Students will solve problems and reason with number concepts using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Number (N)** | |
|---|---|
| **Essential Standard 1** | **Numeric Relationships: Students will demonstrate, represent, and show relationships among rational numbers within the base-ten number system. (7.N.1)** |
| M.7.N.1.1 | Determine subsets of numbers as natural, whole, integer, and rational based on the definitions of these numbers. |
| M.7.N.1.2 | Represent numbers with positive exponents and in scientific notation. |
| M.7.N.1.3 | Approximate, compare, and order rational numbers (positive and negative representations) on a number line. |
| **Essential Standard 2** | **Operations: Students will compute with rational numbers accurately. (7.N.2)** |
| M.7.N.2.1 (7.N.2.a) | Add, subtract, multiply, and divide rational numbers (e.g., positive and negative fractions, decimals, and integers). |
| M.7.N.2.2 (7.N.2.b) | Apply properties of operations (commutative, associative, distributive, identity, inverse, zero) as strategies for problem solving with rational numbers. |

**Ratios and Proportions:** Students will understand ratio concepts and use ratio reasoning to solve problems.

| **Ratios and Proportions (R)** | |
|---|---|
| **Essential Standard 1** | **Proportional Relationships: Students will understand the concept of proportions, use language to describe the relationship between two quantities, and use proportions to solve authentic situations. (7.R.1)** |
| M.7.R.1.1 (7.R.1.a) | Decide whether two quantities are in a proportional relationship (e.g., by testing for equivalent ratios in a table). |
| M.7.R.1.2 (7.R.1.b) | Represent and solve authentic problems with proportions. |
| M.7.R.1.3 (7.R.1.c) | Use proportional relationships to solve authentic percent problems (e.g., percent change, sales tax, mark-up, discount, tip). |
| M.7.R.1.4 (7.R.1.d) | Solve authentic problems involving scale drawings. |

**Algebra:** Students will solve problems and reason with algebra using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Algebra (A)** | |
|---|---|
| **Essential Standard 1** | **Algebraic Processes: Students will apply the operational properties when evaluating expressions and solving equations and inequalities. (7.A.1)** |
| M.7.A.1.1 (7.A.1.a) | Use factoring and properties of operations to create equivalent algebraic expressions [e.g., 2x + 6 = 2(x+ 3)]. |
| M.7.A.1.2 (7.A.1.b) | Given the value of the variable(s), evaluate algebraic expressions, which may include absolute value. |
| M.7.A.1.3 (7.A.1.c) | Solve one- and two-step equations involving rational numbers. |
| M.7.A.1.4 (7.A.1.d) | Solve equations using the distributive property and combining like terms. |
| M.7.A.1.5 (7.A.1.e) | Solve one- and two-step inequalities involving integers and represent solutions on a number line. |
| **Essential Standard 2** | **Applications: Students will solve authentic problems with algebraic expressions, equations, and inequalities. (7.A.2)** |
| M.7.A.2.1 (7.A.2.a) | Write one- and two-step equations involving rational numbers from words, tables, and authentic situations. |
| M.7.A.2.2 (7.A.2.b) | Write one- and two-step inequalities to represent authentic situations involving integers. |

**Geometry**: Students will solve problems and reason with geometry using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Geometry (G)** | |
|---|---|
| **Essential Standard 1** | **Attributes: Students will identify angle relationships and apply properties to determine angle measures. (7.G.1)** |
| M.7.G.1.1 (7.G.1.a) | Apply properties of adjacent, complementary, supplementary, linear pair, and vertical angles to find missing angle measures. |
| **Essential Standard 2** | **Coordinate Geometry: Students will determine location, orientation, and relationships on the coordinate plane. (7.G.2)** |
| M.7.G.2.1 (7.G.2.a) | Draw polygons in the coordinate plane given coordinates for the vertices. |
| M.7.G.2.2 (7.G.2.b) | Calculate vertical and horizontal distances in the coordinate plane to find perimeter and area of rectangles. |

| **Essential Standard 3** | **Measurement: Students will identify geometric attributes that create two- and three-dimensional shapes in order to perform measurements and apply formulas to find area and volume. (7.G.3)** |
|---|---|
| M.7.G.3.1 (7.G.3.a) | Solve authentic problems involving perimeter and area of composite shapes made from triangles and quadrilaterals. |
| M.7.G.3.2 (7.G.3.b) | Determine surface area and volume of composite rectangular and triangular prisms. |
| M.7.G.3.3 *(7.G.3.c*) | Determine the area and circumference of circles both on and off the coordinate plane using 3.14 as an approximation for the value of Pi. |

**Data:** Students will solve problems and reason with data/probability using multiple representations, make connections within math and across disciplines, and communicate their ideas.

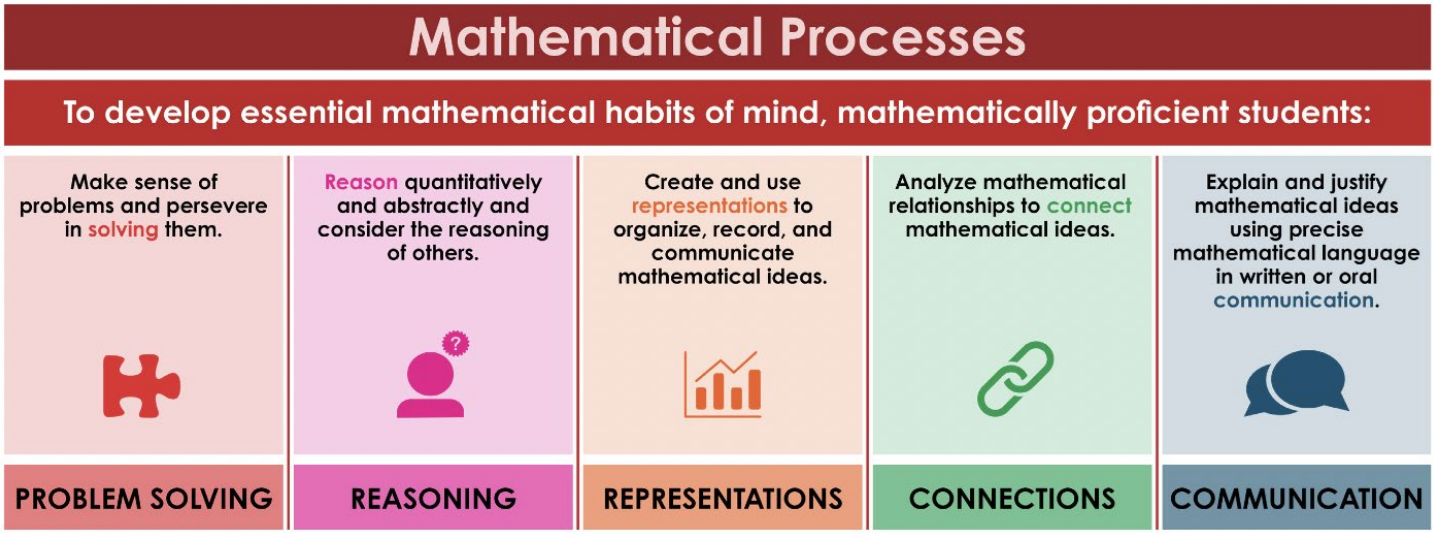
| **Data (D)** | |
|---|---|
| **Essential Standard 1** | **Data Collection and Statistical Methods: Students will formulate statistical investigative questions, collect data, and organize data. (7.D.1)** |
| M.7.D.1.1 (7.D.1.a) | Create an investigative question and collect data. |
| M.7.D.1.2 (7.D.1.b) | Generate conclusions about a population based on a random sample. |
| M.7.D.1.3 (7.D.1.c) | Identify and critique biases in various data representations. |
| **Essential Standard 2** | **Analyze Data and Interpret Results: Students will represent and analyze the data and interpret the results. *(7.D.2)*** |
| M.7.D.2.1 | Interpret and compare data using a variety of graphical representations for modes of central tendency and quantitative information. |
| **Essential Standard 3** | **Probability: Students will interpret and apply concepts of probability. (7.D.3)** |
| M.7.D.3.1 (*7.D.3.a*) | Find theoretical and experimental probabilities for compound independent (e.g., drawing multiple marbles from a bag with replacement) and dependent (e.g., drawing multiple marbles from a bag without replacement) events. |
| M.7.D.3.2 *(7.D.3.b)* | Identify complementary events (e.g., rolling a two on a die compared to not rolling a two) and calculate their probabilities. |

## 7th Grade Math Glossary

| Term | Definition |
|---|---|
| adjacent angles | any two non-overlapping angles with a side in common |

| | |
|---|---|
| associative property of addition | the sum stays the same when the grouping of addends is changed, (a+b)+c=a+(b+c), where a, b, and c stand for any real numbers, ex. (6+4)+2=6+(4+2) |
| associative property of multiplication | the product stays the same when the grouping of factors is changed, (a*b)*c=a*(b*c), where a, b, and c stand for any real numbers, ex. (6*4)*2=6*(4*2) |
| circle | all points in a plane equidistant from the center |
| complimentary angles | two angles with measures whose sum is 90 degrees |
| composite figure | a figure that can be decomposed into two or more figures |
| decimal | a number written using base ten and containing a decimal point |
| distributive property | a*(b+c)=(a*b)+(a*c) and a*(b-c)=(a*b)-(a*c), where a, b, and c stand for any real numbers. 6*(4+3)=(6*4)+(6*3) |
| horizontal | parallel to or in the plane of the horizon |
| identity property of multiplication | multiplying a number by 1 gives a product identical to the given number, 8x1=8 and 1x8=8 |
| inverse property of addition | for any real number, a+(-a)=0 and -a+a=0 |
| inverse property of multiplication | for any real number except 0, a*a/1=1 and 1/a*a=1 |
| linear pair | two adjacent angles whose noncommon sides are opposite rays |
| number line | a line on which numbers are marked at intervals |
| operation | an action performed on some set of quantities (addition, subtraction, multiplication, division, raising to a power, and taking a root) |
| percent (%) | a ratio that compares a number to 100; the word percent means per hundred or out of 100, ex. 59% of 100 is 59 and 59% of 200 is 118a ratio that compares a number to 100; the word percent means per hundred or out of 100, ex. 59% of 100 is 59 and 59% of 200 is 118 |
| percent change | a way to describe a change in a quantity by expressing it as a percent of the original quantity; percent change = amount of change/original amount x 100 |
| percent decrease | the absolute value of the percent change when an amount goes down; percent decrease = amount of decrease/original amount x 100 |
| percent increase | the percent change when an amount goes up; percent increase = amount of increase/original amount x 100 |
| pi | a constant representing the ratio of the circumference of a circle to its diameter, common approximations for pi are 22/7 and 3.14 |
| polygon | a closed, plane figure formed by line segments that meet only at their endpoints |
| random | by chance, with no outcome any more likely than another |
| supplementary angles | two angles with measures whose sum is 180 degrees |
| surface area | the sum of the areas of the faces and any curved surfaces of a solid |
| vertical | perpendicular to the horizon |
| vertical angles | the non-adjacent angles formed by intersecting lines, which are congruent, sometimes called opposite angles |
| zero property | the product of any number and 0 is 0, ex. 8*0=0 and 0*8=0 |

# 8th Grade Math Standards




## 8th Grade Content Focus

During Grade 8, instruction should value the use of God's gift of the human mind to develop understanding of mathematical processes. For all students to master grade-level content, instruction should focus on these critical areas:

Using linear equations to represent, analyze, and solve a variety of problems.
Developing an understanding of irrational numbers and integer exponents.
Analyzing two-dimensional figures and solving problems using understanding of distance, angle, similarity, and congruence.
Understanding and applying the Pythagorean Theorem.
Determining and describing rate of change and y-intercept for given situations.

## 8th Grade Math Standards

**Number:** Students will solve problems and reason with number concepts using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Number (N)** | |
|---|---|
| **Essential Standard 1** | **Numeric Relationships: Students will demonstrate, represent, and show relationships among real numbers within the base-ten number system. (8.N.1)** |
| M.8.N.1.1 (8.N.1.a) | Determine subsets of numbers as natural, whole, integer, rational, irrational, or real based on the definitions of these sets of numbers. |
| M.8.N.1.2 (8.N.1.b) | Represent numbers with positive and negative exponents and in scientific notation. |
| M.8.N.1.3 (8.N.1.c) | Describe the difference between a rational and irrational number. |
| M.8.N.1.4 *(8.N.1.d)* | Approximate, compare, and order real numbers, both rational and irrational. |
| M.8.N.1.5 *(8.N.1.d)* | Locate real numbers, both rational and irrational, on a number line. |
| **Essential Standard 2** | **Operations: Students will compute with exponents and roots. (8.N.2)** |
| M.8.N.2.1 (8.N.2.a) | Evaluate the square roots of perfect squares less than or equal to 400 and cube roots of perfect cubes less than or equal to 125. |
| M.8.N.2.2 (8.N.2.b) | Simplify numerical expressions involving integer exponents, square roots, and cube roots (e.g., $4^{-2}$ is the same as 1/16). |
| M.8.N.2.3 (8.N.2.c) | Evaluate numerical expressions involving absolute value. |
| M.8.N.2.4 (8.N.2.d) | Multiply and divide numbers using scientific notation. |

**Algebra:** Students will solve problems and reason with algebra using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Algebra (A)** | |
|---|---|
| **Essential Standard 1** | **Algebraic Processes: Students will apply the operational properties when evaluating expressions and solving equations. (8.A.1)** |
| M.8.A.1.1 (8.A.1.a) | Describe single variable equations as having one solution, no solution, or infinitely many solutions. |
| M.8.A.1.2 (8.A.1.b) | Solve multi-step equations involving rational numbers with the same variable appearing on both sides of the equation. |

| | |
|---|---|
| M.8.A.1.3 (8.A.1.c) | Solve equations of the form $x^2 = k$ ($k \leq 400$) and $x^3 = k$ ($k \leq 125$), where k is a positive rational number, using square root and cube root symbols. |
| **Essential Standard 2** | **Applications: Students will solve authentic problems involving multi-step equations. (8.A.2)** |
| M.8.A.2.1 (8.A.2.a) | Write multi-step single variable equations from words, tables, and authentic situations. |
| M.8.A.2.2 (8.A.2.b) | Determine and describe the rate of change for given situations through the use of tables and graphs. |
| M.8.A.2.3 (8.A.2.c) | Graph proportional relationships and interpret the rate of change. |

**Geometry**: Students will solve problems and reason with geometry using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Geometry (G)** | |
|---|---|
| **Essential Standard 1** | **Attributes: Students will apply properties of angle relationships in triangles and with lines to determine angle measures. (8.G.1)** |
| M.8.G.1.1 (8.G.1.a) | Determine and use the relationships of the interior angles of a triangle to solve for missing measures. |
| M.8.G.1.2 *(8.G.1.b)* | Identify and apply geometric properties of parallel lines cut by a transversal and the resulting corresponding, same side/consecutive interior, same side exterior, alternate interior, and alternate exterior angles to find missing measures. |
| **Essential Standard 2** | **Coordinate Geometry: Students will determine location, orientation, and relationships on the coordinate plane. (8.G.2)** |
| M.8.G.2.1 (8.G.2.a) | Perform and describe positions and orientations of shapes under single transformations including rotations in multiples of 90 degrees about the origin, translations, reflections, and dilations on and off the coordinate plane. |
| M.8.G.2.2 (8.G.2.b) | Determine if two-dimensional figures are congruent or similar. |
| M.8.G.2.3 (8.G.2.c) | Perform and describe positions and orientations of shapes under a sequence of transformations on and off the coordinate plane |
| **Essential Standard 3** | **Measurement: Students will reason with formulas and context to determine and compare length, area, and volume. (8.G.3)** |
| M.8.G.3.1 (8.G.3.a) | Explain a model of the Pythagorean Theorem. |
| M.8.G.3.2 (8.G.3.b) | Apply the Pythagorean Theorem to find side lengths of triangles and to solve authentic problems. |
| M.8.G.3.3 (8.G.3.c) | Find the distance between any two points on the coordinate plane using the Pythagorean Theorem. |

| | |
|---|---|
| M.8.G.3.4 (8.G.3.d) | Determine the volume of cones, cylinders, and spheres and solve authentic problems using volumes. |

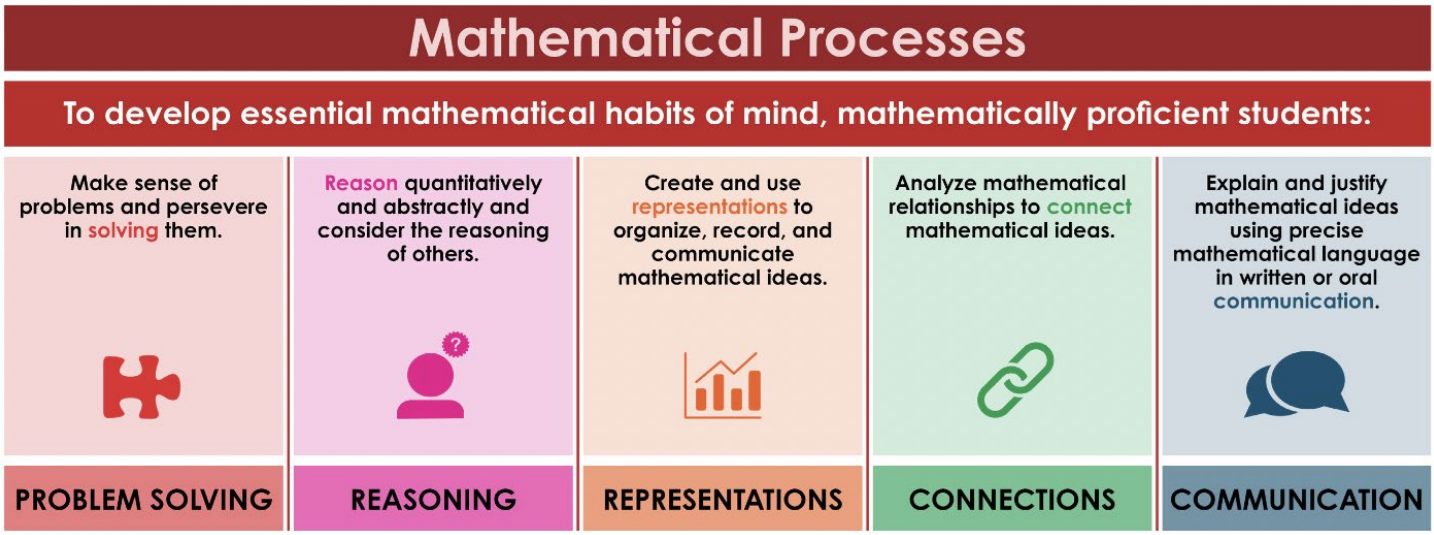
**Data:** Students will solve problems and reason with data/probability using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Data (D)** | |
|---|---|
| **Essential Standard 1** | **Data Collection and Statistical Methods: Students will formulate statistical investigative questions, collect data, and organize data. (8.D.1)** |
| | No new skills introduced at this level. |
| **Essential Standard 2** | **Analyze Data and Interpret Results: Students will represent and analyze the data and interpret the results. (8.D.2)** |
| M.8.D.2.1 (8.D.2a) | Represent and interpret bivariate data (e.g., ordered pairs) using scatter plots. |
| M.8.D.2.2 (8.D.2.b) | Describe patterns such as positive or negative association, linear or nonlinear association, clustering, and outliers when bivariate data is represented on a coordinate plane. |
| M.8.D.2.3 (8.D.2.c) | Draw an informal line of best fit based on the closeness of the data points to the line. |
| M.8.D.2.4 (8.D.2.d) | Use a linear model to make predictions and interpret the rate of change and y-intercept in context. |
| **Essential Standard 3** | **Probability: Students will interpret and apply concepts of probability. (8.D.3)** |
| | No new skills introduced at this level. |

## 8th Grade Math Glossary

| Term | Definition |
|---|---|
| alternate exterior angles | when a transversal intersects two lines, alternate interior angles are on opposite sides of the transversal and on the outside of the given lines |
| alternate interior angles | when a transversal intersects two lines, alternate interior angles are on opposite sides of the transversal and on the inside of the given lines |
| bivariate | a data set in which two variables are measured and recorded for each subject |
| corresponding angles | when a transversal intersects two lines, corresponding angles are on the same side of the transversal and on the same side of the given lines |
| cube root | a number whose cube is equal to a given number |
| number line | a line on which numbers are marked at intervals |
| operation | an action performed on some set of quantities (addition, subtraction, multiplication, division, raising to a power, and taking a root) |
| origin | the intersection of the x- and y-axes in a coordinate plane, described by the ordered pair (0,0) |
| transversal | a line that intersects two or more other lines at different points |

# High School Math Standards




## High School Content Focus

During high school, instruction should value the use of God's gift of the human mind to develop understanding of mathematical processes. For all students to master grade-level content, instruction should focus on these critical areas:

**NUMBER**: Instruction in Number should focus on these critical areas:
Working in authentic contexts, solutions involve quantities, numbers with units.
Using units, approximations, and estimations to check the reasonableness of their work.
Understanding how forms of approximation can accumulate errors when problem solving.
Understanding the four operations on real numbers applies to complex numbers.

**ALGEBRA**: Instruction in Algebra should focus on these critical areas:
Solving many authentic problems to best understand patterns, expressions, relations, and functions.
Using algebraic symbols and mathematical models to represent and demonstrate an understanding of quantitative relationships.
Analyzing change as it arises in various contexts such as physical and social as supported by algebraic reasoning and the concept of function.
Interpreting the functions in multiple representations, using their points of interest, and connecting across multiple representations to understand their mathematical equivalence instead of rote steps or procedures.

**GEOMETRY**: Instruction in Geometry should focus on these critical areas:
Using mathematics to define the spatial attributes of the world around us.
Exploring transformations (translations, reflections, rotations, and dilations) to build a foundation to understand congruence, similarity, and symmetry.
Formalizing geometric concepts using planar geometry, parallelism, congruence, similarity, and symmetry.
Connecting algebra and geometry via coordinate geometry, planar transformations, and trigonometry.
Developing skills of argumentation and proof by proving congruence, similarity, symmetry, and other concepts of plane geometry.

**DATA**: Instruction in Data should focus on these critical areas:
Using numbers in context (data) with the mathematical processes can result in better predictions and informed decisions.
Using tools to apply statistical methods to describe patterns and trends.
Understanding randomness, variability, and causality through data collection, data analysis, and interpretation of results.
Describing data using probability and sampling distributions to judge whether a result is unsurprising or rare.

## High School Math Standards

**Number:** Students will solve problems and reason with number concepts using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Number (N)** | |
|---|---|
| **Essential Standard 1** | **Estimation and Technology: Students will use estimation strategies and technology to reason, to solve problems, and to make connections within mathematics and across disciplines. (HS.N.1)** |
| M.HS.N.1.1 (HS.N.1.a) | Select, apply, and explain the method of computation when problem solving using real numbers (e.g., models, mental computation, paper-pencil, technology). |
| M.HS.N.1.2 (HS.N.1.b) | Determine if the context of a problem calls for an approximation or an exact value. |
| M.HS.N.1.3 (HS.N.1.c) | Determine the rounding convention to be used based on the context of a problem. |
| M.HS.N.1.4 (HS.N.1.d) | Estimate a value using the concept of betweenness by bounding above and below (e.g., since log (10) = 1 and log (1,000) = 3 we know log (500) is between 1 and 3). |
| M.HS.N.1.5 (HS.N.1.e) | Determine the tolerance interval and percent of error in measurement. |
| M.HS.N.1.6 (HS.N.1.f) | Convert equivalent rates (e.g., miles per hour to feet per second). |
| M.HS.N.1.7 (HS.N.1.g) | Determine whether extremely large or extremely small quantities can be reasonably represented by a calculator or graphing utility. |
| M.HS.N.1.8 (HS.N.1.h) | Use scientific notation to appropriately represent large and small quantities. |
| **Essential Standard 2** | **Sets and Operations: Students will use number sets and operations to reason and to solve problems. (HS.N.2)** |
| M.HS.N.2.1 *(HS.N.2.a)* | Extend the properties of exponents to rational numbers (e.g., $x^{\frac{1}{3}} \cdot x^{\frac{1}{2}} = x^{\frac{5}{6}}$). |
| M.HS.N.2.2 *(HS.N.2.b)* | Use properties of rational and irrational numbers to perform operations. |
| M.HS.N.2.3 (HS.N.2.c) | Demonstrate, represent, and show relationships among the subsets of real numbers and the complex number system. |
| M.HS.N.2.4 (HS.N.2.d) | Compute with subsets of the complex number system including imaginary, rational, irrational, integers, whole, and natural numbers. |

| **Essential Standard 3** | **Interpretation and Sense Making: Students will reason abstractly and quantitatively using units to solve problems and interpret results in context. (HS.N.3)** |
|---|---|
| M.HS.N.3.1 (HS.N.3.a) | Understand roundoff error and why roundoff error accumulates when rounding occurs prior to the last step in a computation. |
| M.HS.N.3.2 (HS.N.3.b) | Use estimation methods to check the reasonableness of real number computations and decide if the problem calls for an approximation (including appropriate rounding) or an exact number. |
| M.HS.N.3.3 (HS.N.3.c) | Use units to assess the validity of an answer in the context of a problem. |
| M.HS.N.3.4 (HS.N.3.d) | Communicate the meaning of an answer in the context of a problem. |

**Algebra:** Students will solve problems and reason with algebra using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Algebra (A)** | |
|---|---|
| **Essential Standard 1** | **Algebraic Relationships: Students will demonstrate and represent relationships with functions. (HS.A.1)** |
| M.HS.A.1.1 (HS.A.1.a) | Demonstrate that functions are a well mapped subdomain of relations. |
| M.HS.A.1.2 (HS.A.1.b) | Analyze a relation to determine if it is a function given mapping diagrams, function notation (e.g., $f(x)=x^2$), a table, or a graph. |
| M.HS.A.1.3 (HS.A.1.c) | Classify a function given its mapping diagram, function notation, table, or graph as a linear, quadratic, absolute value, exponential, or other function. |
| M.HS.A.1.4 (HS.A.1.d) | Analyze a function's domain and range to determine if it is one-to-one and has an inverse function both algebraically and graphically. |
| M.HS.A.1.5 *(HS.A.1.e)* | Define, interpret, and analyze linear, quadratic, absolute value, and exponential functions using the points of interest (e.g., intercepts and extrama) of the functions and graphing technology. |
| M.HS.A.1.6 (HS.A.1.f) | Identify, analyze, and apply transformations of existing functions (including translation and dilation). |
| M.HS.A.1.7 (HS.A.1.g) | Interpret logarithmic equations as exponential equations. |
| M.HS.A.1.8 (HS.A.1.h) | Describe arithmetic sequences using tables of values and functions in explicit and recursive forms. |
| M.HS.A.1.9 (HS.A.1.i) | Describe geometric sequences using tables of values and functions in explicit and recursive forms. |
| **Essential Standard 2** | **Algebraic Processes: Students will apply the operational properties when evaluating rational expressions and solving linear and quadratic equations, and inequalities. (HS.A.2)** |
| M.HS.A.2.1 (HS.A.2.a) | Analyze and explain the properties used in solving equations, inequalities, systems of linear equations, systems of linear inequalities, and literal equations. |

| | |
|---|---|
| M.HS.A.2.2 *(HS.A.2.b)* | Generate expressions in equivalent forms by using algebraic properties to make different characteristics or features visible (e.g., determine the vertex form of a quadratic equation given an alternate form). |
| M.HS.A.2.3 (HS.A.2.c) | Analyze equations and inequalities to determine and apply efficient methods to solve and use appropriate technology as needed. |
| M.HS.A.2.4 (HS.A.2.d) | Calculate the slope (rate of change) of a line given coordinate points, a graph, or a table of values. |
| M.HS.A.2.5 (HS.A.2.e) | Write and graph equations of functions (linear, absolute value, quadratic, and exponential) using the points of interest of the function. |
| M.HS.A.2.6 (HS.A.2.f) | Given a line, write the equation of a line that is parallel or perpendicular to it. |
| M.HS.A.2.7 (HS.A.2.g) | Perform and explain operations such as addition, subtraction, multiplication, division, and factoring on polynomials. |
| M.HS.A.2.8 (HS.A.2.h) | Explain the connection between the factors of a polynomial and the zeros of a polynomial. |
| M.HS.A.2.9 (HS.A.2.i) | Combine functions by composition and perform operations on functions. |
| **Essential Standard 3** | **Applications: Students will solve authentic problems using nonlinear functions. (HS.A.3)** |
| M.HS.A.3.1 (HS.A.3.a) | Analyze and model authentic situations using various representations and appropriate technology. |
| M.HS.A.3.2 (HS.A.3.b) | Identify, interpret, relate, and graph the factors, x-intercepts, roots, and zeros of polynomial functions using algebraic and graphing methods. |
| M.HS.A.3.3 (HS.A.3.c) | Identify and predict appropriate solutions to equations given context and domain/range (e.g., extraneous solutions, imaginary solutions, no solution, infinitely many solutions). |

**Geometry**: Students will solve problems and reason with geometry using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Geometry (G)** | |
|---|---|
| **Essential Standard 1** | **Attributes: Students will identify and describe geometric attributes, apply properties and theorems, and create two-dimensional shapes. (HS.G.1)** |
| M.HS.G.1.1 (HS.G.1.a) | Demonstrate that two figures are similar or congruent by using a sequence of rigid motions and dilations that map a figure onto the other in problems both with and without coordinates. |
| M.HS.G.1.2 (HS.G.1.b) | Describe symmetries of a figure in terms of rigid motions that map a figure onto itself and make inferences about symmetric figures (e.g., unknown side lengths or angle measures) in problems both with and without coordinates. |
| M.HS.G.1.3 (HS.G.1.c) | Explain how the criteria for triangle congruence and similarity (ASA, SAS, AAS, and SSS congruence; AA similarity criterion) follow from the definition of congruence and similarity in terms of corresponding parts. |

| | |
|---|---|
| M.HS.G.1.4 (HS.G.1.d) | Identify and apply right triangle relationships including converse of the Pythagorean Theorem. |
| M.HS.G.1.5 (HS.G.1.e) | Apply side and angle relationships of special right triangles (30 degree-60 degree-90 degree and 45 degree-45 degree-90 degree) to solve geometric problems. |
| M.HS.G.1.6 (HS.G.1.f) | Identify and apply right triangle relationships including sine, cosine, and tangent. |
| M.HS.G.1.7 (HS.G.1.g) | Apply interior and exterior angle formulas for n-gons and apply to authentic situations. |
| M.HS.G.1.8 (HS.G.1.h) | Compare/contrast the properties of quadrilaterals: parallelograms, rectangles, rhombi, squares, kites, trapezoids, and isosceles trapezoids. |
| M.HS.G.1.9 (HS.G.1.i) | Use slope and the distance formula to determine the type of quadrilateral. |
| M.HS.G.1.10 (HS.G.1.j) | Identify, describe, apply, and reason through properties of central angles, inscribed angles, angles formed by intersecting chords, secants, and/or tangents to find the measures of angles related to the circle, arc lengths, and areas of sectors. |
| **Essential Standard 2** | **Attributes: Students will identify and describe geometric attributes, apply properties and theorems and create three-dimensional shapes. (HS.G.2)** |
| M.HS.G.2.1 (HS.G.2.a) | Convert between various units of volume (e.g., cubic feet to cubic yards). |
| M.HS.G.2.2 (HS.G.2.b) | Apply the effect of a scale factor to determine the volume of similar three-dimensional shapes and solids. |
| M.HS.G.2.3 (HS.G.2.c) | Determine surface area and volume of pyramids, as well as solids that are composites of pyramids, prisms, spheres, cylinders, and cones, using formulas and appropriate units. |
| **Essential Standard 3** | **Coordinate Geometry and Transformations: Students will demonstrate and represent location, orientation, and relationships on the coordinate plane. (HS.G.3)** |
| M.HS.G.3.1 (HS.G.3.a) | Derive the midpoint formula using the concept of average and apply the midpoint formula to find coordinates. |
| M.HS.G.3.2 (HS.G.3.b) | Find the images and preimages of transformations of a point, shape, or a relation on the coordinate plane. Transformations include the following and their compositions: reflections across horizontal and vertical lines and the lines y=x and y=-x, rotations about the origin of 90 degrees, dilations about the origin by any positive scale factor, and any translation. |
| M.HS.G.3.3 (HS.G.3.c) | Find the equation of a circle given the radius and the center. |
| **Essential Standard 4** | **Logic and Proof: Students will use geometric definitions and theorems to reason abstractly and quantitatively. (HS.G.4)** |
| M.HS.G.4.1 (HS.G.4.a) | Know and use definitions to make deductions in mathematical argumentation (e.g., syllogism, detachment). |
| M.HS.G.4.2 (HS.G.4.b) | Evaluate the validity of conditional statements, including biconditional statements (e.g., conditional, converse, contrapositive, inverse). |
| M.HS.G.4.3 (HS.G.4.c) | Evaluate the validity of an argument communicated in different ways (e.g., a flow format, two-column, paragraph format). |

| | |
|---|---|
| M.HS.G.4.4 (HS.G.4.d) | Use coordinate geometry to prove triangles are right, acute, obtuse, isosceles, equilateral, or scalene. |
| M.HS.G.4.5 (HS.G.4.e) | Prove and apply geometric properties and theorems regarding triangles, congruence, and similarity using deductive reasoning. |
| M.HS.G.4.6 (HS.G.4.f) | Prove and apply geometric theorems about quadrilaterals using deductive reasoning. |

**Data:** Students will solve problems and reason with data/probability using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Data (D)** | |
|---|---|
| **Essential Standard 1** | **Data Collection and Statistical Methods: Students will formulate statistical investigative questions, collect data, and organize data. (HS.D.1)** |
| M.HS.D.1.1 (HS.D.1.a) | Formulate multi-variable statistical investigative questions and determine how data can be collected and analyzed to provide an answer. |
| M.HS.S.1.2 (HS.D.1.b) | Apply an appropriate data collection plan when collecting primary data for the statistical investigative question of interest. |
| M.HS.D.1.3 (HS.D.1.c) | Use appropriate technology, including spreadsheet-based logic, to organize data for analysis. |
| M.HS.D.1.4 (HS.D.1.d) | Distinguish between surveys, observational studies, and experiments. |
| M.HS.D.1.5 (HS.D.1.e) | Understand what constitutes good practice in designing a sample survey, an experiment, and an observational study. |
| M.HS.D.1.6 (HS.D.1.f) | Understand issues of bias and confounding variables in a study and their implications for interpretation. |
| **Essential Standard 2** | **Analyze Data and Interpret Results: Students will represent and analyze the data and interpret the results. (HS.D.2)** |
| M.HS.D.2.1 (HS.D.2.a) | Identify appropriate ways to summarize and then represent the distribution of univariate data and bivariate data through the construction of histograms, dot plots, stem plots, box plots, cumulative relative frequency graphs, time plots, circle graphs, stacked bar graphs, and mosaic bar graphs by hand or with technology. |
| M.HS.D.2.2 (HS.D.2.b) | Describe the shape, identify any outliers, and determine the spread of a data set. |
| M.HS.D.2.3 (HS.D.2.c) | Select and determine the appropriate measure of center based on the shape of a distribution and/or the presence of outliers. |
| M.HS.D.2.4 (HS.D.2.d) | Recognize when a data set can be reasonably said to be normally distributed and draw conclusions about the data from the associated normal distribution. |
| M.HS.D.2.5 (HS.D.2.e) | Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data and recognize possible associations and trends in the data. |

| | |
|---|---|
| M.HS.D.2.6 (HS.D.2.f) | Represent data on two quantitative variables on a scatter plot and describe how the variables are related. |
| M.HS.D.2.7 (HS.D.2.g) | Use technology to develop regression models for linear and non-linear data to predict unobserved outcomes. Interpret slope and y-intercept in the context of the problem. |
| M.HS.D.2.8 (HS.D.2.h) | Measure the strength of association using correlation coefficients for regression curves and interpret their meanings for the model. |
| M.HS.D.2.9 (HS.D.2.i) | Use residuals and residual plots to judge the quality of a regression model. |
| M.HS.D.2.10 (HS.D.2.j) | Recognize and explain when arguments based on data confuse correlation with causation. |
| M.HS.D.2.11 (HS.D.2.k) | Understand what constitutes statistical significance. Interpret statistical significance in the context of a situation and answer investigative questions appropriately. |
| M.HS.D.2.12 (HS.D.2.l) | Use probability as a tool for assessing risk and for informed decision making by interpreting P-values. |
| **Essential Standard 3** | **Probability: Students will interpret and apply concepts of probability. (HS.D.3)** |
| M.HS.D.3.1 (HS.D.3.a) | Describe events as subsets of a sample space using characteristics of the outcomes or as unions, intersections, or complements of other events. |
| M.HS.D.3.2 (HS.D.3.b) | Explain independent versus dependent probability of an event. |
| M.HS.D.3.3 (HS.D.3.c) | Determine when order in counting matters and use permutations and combinations to compute probabilities of events accordingly. |
| M.HS.D.3.4 (HS.D.3.d) | Recognize and explain the concepts of conditional probability in everyday language and everyday situations. |

## High School Advanced Topics Math Standards

**Number:** Students will solve problems and reason with number concepts using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Number (N)** | |
|---|---|
| **Essential Standard 1** | **Estimation and Technology: Students will use estimation strategies and technology to reason, to solve problems, and to make connections within mathematics and across disciplines. (AT.N.1)** |
| M.AT.N.1.1 (AT.N.1.a) | Use domain and range restrictions to apply an appropriate viewing window while using graphing technology. |
| M.AT.N.1.2 (AT.N.1.b) | Compare and contrast radians and degrees as measures of angles and the reason graphing utilities tend to use radians as the default setting. |
| **Essential Standard 2** | **Sets and Operations: Students will compare and contrast subsets and perform operations with subsets of the complex number system to reason and to solve problems. (AT.N.2)** |
| M.AT.N.2.1 (AT.N.2.a) | Perform arithmetic operations with complex numbers. |
| M.AT.N.2.2 (AT.N.2.b) | Represent complex numbers and their operations in the complex plane. |
| M.AT.N.2.3 (AT.N.2.c) | Use complex numbers in polynomial identities and equations. |
| M.AT.N.2.4 (AT.N.2.d) | Represent quantities using bases other than decimal such as binary (base 2) or hexadecimal (base 16) and convert numbers to and from base 10. |
| M.AT.N.2.5 (AT.N.2.e) | Explain modular arithmetic and its role in computer programming. |
| M.AT.N.2.6 (AT.N.2.f) | Represent and model vector quantities. |
| M.AT.N.2.7 (AT.N.2.g) | Perform operations on vectors. |
| M.AT.N.2.8 (AT.N.2.h) | Perform operations on matrices and use matrices in applications. |
| **Essential Standard 3** | **Interpretation and Sense Making: Students will reason abstractly and quantitatively using units to solve problems and interpret results in context. (AT.N.3)** |
| M.AT.N.3.1 (AT.N.3.a) | Use vectors to communicate the geometric relationships between complex numbers in the complex plane. |

**Algebra:** Students will solve problems and reason with algebra using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Algebra (A)** | |
|---|---|
| **Essential Standard 1** | **Algebraic Relationships: Students will demonstrate and represent relationships with functions. (AT.A.1)** |
| M.AT.A.1.1 (AT.A.1.a) | Analyze and graph nonlinear functions (trigonometric, rational, higher-order polynomials, logarithmic, and piecewise) and relations (conic sections) using their points of interest and graphing technology. |
| M.AT.A.1.2 (AT.A.1.b) | Use the unit circle to define the trigonometric functions on multiples of known angles (positive and negative multiples of 30 and 45 degrees or pi/6 and pi/4). |
| M.AT.A.1.3 (AT.A.1.c) | Given a function, list the sequence of algebraic transformations that changes a parent function to the given function. |
| M.AT.A.1.4 (AT.A.1.d) | Define the radian unit of measure and its relationship with degrees. |
| **Essential Standard 2** | **Algebraic Processes: Students will apply the operational properties when evaluating nonlinear expressions and solving nonlinear equations and inequalities. (AT.A.2)** |
| M.AT.A.2.1 (AT.A.2.a) | Explain symmetry of functions and determine whether a function is odd, even, or neither. |
| M.AT.A.2.2 (AT.A.2.b) | Represent, interpret, and analyze inverses of functions algebraically and graphically using domain restrictions when necessary. |
| M.AT.A.2.3 (AT.A.2.c) | Write equations of nonlinear functions (trigonometric, rational, higher-order polynomials, logarithmic and piecewise) using points of interest of the function. |
| M.AT.A.2.4 (AT.A.2.d) | Convert between radian and degree measures of an angle. |
| M.AT.A.2.5 (AT.A.2.e) | Use limits to describe the behavior of a function near its asymptotes and removable discontinuities. |
| **Essential Standard 3** | **Applications: Students will solve authentic problems using nonlinear functions and relations. (AT.A.3)** |
| M.AT.A.3.1 (AT.A.3.a) | Analyze and model authentic situations using various non-linear representations and relations with appropriate technology. |
| M.AT.A.3.2 (AT.A.3.b) | Analyze and model authentic application situations using various non-linear representations and relations with appropriate technology. |

**Geometry**: Students will solve problems and reason with geometry using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Geometry (G)** | |
|---|---|
| **Essential Standard 1** | **Attributes: Students will identify and describe geometric attributes, apply properties and theorems, and create two-dimensional shapes. (AT.G.1)** |
| M.AT.G.1.1 (AT.G.1.a) | Apply the Law of Sines and the Law of Cosines to find unknown measures in triangles. |
| **Essential Standard 2** | **Attributes: Students will identify and describe geometric attributes, apply properties and theorems, and create three-dimensional shapes. (AT.G.2)** |
| M.AT.G.2.1 (AT.G.2.a) | Determine the three-dimensional object created by rotating or revolving a two-dimensional object about an axis. |
| M.AT.G.2.2 (AT.G.2.b) | Determine the shape of a two-dimensional cross-section of a three-dimensional object. |
| M.AT.G.2.3 (AT.G.2.c) | Use Cavalieri's Principle to determine volume of three-dimensional figures. |
| **Essential Standard 3** | **Coordinate Geometry and Transformations: Students will demonstrate and represent location, orientation, and relationships on the coordinate plane. (AT.G.3)** |
| M.AT.G.3.1 (AT.G.3.a) | Identify symmetry properties of a function (e.g., axis of symmetry of a parabola) and know the connection between its symmetry properties and specific transformations. |
| M.AT.G.3.2 (AT.G.3.b) | Recognize that translations can be described in terms of vectors. |
| M.AT.G.3.3 (AT.G.3.c) | Find the images and preimages of transformations of a point, shape, or relation on the coordinate plane, where transformations include the following compositions: reflections about lines of any rational slope passing through the origins, delations about the origin by any positive scale factor, and translations. |
| M.AT.G.3.4 (AT.G.3.d) | Explain the focus-directrix construction of a parabola and derive the equation of a parabola from focus and directrix for a parabola whose axis of symmetry is a coordinate axis. |
| **Essential Standard 4** | **Logic and Proof: Students will use geometric definitions and theorems to reason abstractly and quantitatively. (AT.G.4)** |
| M.AT.G.4.1 (AT.G.4.a) | Use known definitions and results in informal argumentation to construct logical arguments. |
| M.AT.G.4.2 (AT.G.4.b) | Distinguish between empirical reasoning, examples, and deductive reasoning, as well as informal and formal reasoning. |
| M.AT.G.4.3 (AT.G.4.c) | Evaluate the deductive consequences of alternative definitions of known objects (e.g., whether a trapezoid is defined as a quadrilateral with exactly one pair of parallel sides or defined as at least one pair of parallel sides). |

**Data:** Students will solve problems and reason with data/probability using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| **Data (D)** | |
|---|---|
| **Essential Standard 1** | **Data Collection and Statistical Methods: Students will formulate statistical investigative questions, collect data, and organize data. (AT.D.1)** |
| M.AT.D.1.1 (AT.D.1.a) | Explain what constitutes good practice in designing a sample survey, an experiment, and an observational study. |
| M.AT.S.1.2 (AT.D.1.b) | Explain the use of randomization to reduce the influence of confounding or lurking variables. |
| M.AT.D.1.3 (AT.D.1.c) | Explain issues of bias and confounding variables in a study and their implications for interpretation. |
| M.AT.D.1.4 (AT.D.1.d) | Demonstrate knowledge of the role sampling distributions play in the estimation of an unknown population parameter through the use of appropriate sampling techniques. |
| **Essential Standard 2** | **Analyze Data and Interpret Results: Students will represent and analyze the data and interpret the results. (AT.D.2)** |
| M.AT.D.2.1 (AT.D.2.a) | Determine when a data set can be reasonably said to be normally distributed and draw conclusions about the data from the associated normal distribution. |
| M.AT.D.2.2 (AT.D.2.b) | Use technology to develop regression models for linear and non-linear data to predict unobserved outcomes. Apply algebraic transformations to non-linear data to generate a linearized data set and employ linear regression techniques to analyze the non-linear data set. |
| **Essential Standard 3** | **Probability: Students will interpret and apply concepts of probability. (AT.D.3)** |
| M.AT.D.3.1 (AT.D.3.a) | Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. Interpret the expected value as the mean of a probability distribution. |
| M.AT.D.3.2 (AT.D.3.b) | Communicate what constitutes statistical significance. Interpret statistical significance in the context of a situation and answer investigative questions appropriately. |
| M.AT.D.3.3 (AT.D.3.c) | Use data to compare two groups, describe sample variability, and decide if differences between parameters are significant based on the statistics. |
| M.AT.D.3.4 (AT.D.3.d) | Use probability as a tool for assessing risk and for informed decision making by computing and interpreting P-values. |
| M.AT.D.3.5 (AT.D.3.e) | Use confidence intervals to estimate an unknown population parameter. |

# High School Math Glossary

| Algebra | |
|---|---|
| **Term** | **Definition** |
| asymptote | a line to which the graph of a curve gets increasingly closer but never touches or crosses |
| circle | all points in a plane equidistant from the center |
| continuity | *see continuous graph* |
| continuous graph | a graph in which there are not gaps, jumps or holes |
| extraneous solutions | solutions to a transformed equation that are not solutions to the original equation or problem |
| limit | a number such that the value of a given function remains arbitrarily close to this number when the independent variable is sufficiently close to a specified point or is sufficiently large |
| logarithm | an exponent, the number of times a factor is used to produce another number |
| operation | an action performed on some set of quantities (addition, subtraction, multiplication, division, raising to a power, and taking a root) |
| origin | the intersection of the x- and y-axes in a coordinate plane, described by the ordered pair (0,0) |
| pi | a constant representing the ratio of the circumference of a circle to its diameter, common approximations are 22/7 and 3.14 |
| piece-wise | denoting that a function has a specified property, as smoothness or continuity, on each of a finite number of pieces into which its domain is divided |
| random | by chance, with no outcome more likely than another |

| Geometry | |
|---|---|
| **Term** | **Definition** |
| acute triangle | a triangle whose interior angles each measure less than 90 degrees |
| arc | a continuous part of a circle; the measure of an arc is the measure of the angle formed by two radii with endpoints at the endpoints of the arc (arc AB is the shorter of the two curves connecting point A with point B) |
| arc length | the length of an arc, or portion of a circle |
| biconditional statement | a logical statement containing the phrase If and only if; both the statement and its converse are true (p if and only if q) |
| center | the point that is equidistant from all points on a circle |
| central angle | an angle whose vertex is the center of a circle and whose sides are radii of the circle |
| chord | a segment whose endpoints are on a circle |
| circle | all points in a plane equidistant from the center |
| composition of transformations | the combination of two or more transformations resulting in the creation of a single image, ex. glide reflection is the result of a translation and a reflection |
| conditional | *see conditional statement* |
| conditional statement | a logical statement consisting of two parts, an hypothesis and a conclusion (if p, then q) |
| contrapositive | when the hypothesis and conclusion are both reversed and negated, has the same truth value as the conditional statement (if p then q becomes if not q, then not p) |
| converse | when the hypothesis and conclusion are reversed (if p, then q becomes if q, then p) |
| cosine (cos) | in a right triangle, the ratio of the length of the leg adjacent to the reference angle to the length of the hypotenuse |

| | |
|---|---|
| deductive reasoning | applying a general rule to a specific case |
| detachment | *see law of detachment* |
| directrix | a fixed line used in the description of a curve or surface |
| distance | the absolute value of the difference of the coordinates of two points on a number line |
| equilateral | all sides having the same length |
| exterior angle | an angle formed by a side of a polygon and an extension of an adjacent side; at each vertex, there are two congruent exterior angles |
| flow chart proof | a type of proof in which a flow chart is used to show the progression of a logical argument |
| flow format | *see flow chart proof* |
| focus | the point at which the axis of a double napped right cone intersects a figure formed when a plane slices the double napped cone |
| horizontal | parallel to or in the plane of the horizon |
| inscribed angle | an angle whose vertex is on a circle and whose sides are chords of the circle |
| interior angle | an angle on the inside of a polygon, formed by the sides of the polygon |
| inverse statement | in the inverse of a conditional statement, both the hypothesis and the conclusion are negated (if p, then q becomes, if not p, then not q) |
| isosceles trapezoid | a trapezoid with congruent legs |
| isosceles triangle | a triangle with two congruent sides |
| kite | a quadrilateral with two distinct pairs of adjacent congruent sides |
| law of detachment | if a statement is true, and the hypothesis is true, then the conclusion has to be true (if p then q is true and p is true, then q is true) |
| law of syllogism | if p then q is true, and if q then r is true, then if p then r is true |
| logic | a formal structure for reasoning |
| logical argument | an argument tying together an hypothesis or set of hypotheses and a conclusion |
| midpoint | the point on a line segment that divides it into two congruent segments |
| obtuse triangle | a triangle with exactly one interior angle that measures more than 90 degrees |
| origin | the intersection of the x- and y-axes in a coordinate plane, described by the ordered pair (0,0) |
| paragraph format | *see paragraph proof* |
| paragraph proof | a type of proof written in paragraph form |
| point | an exact location in space |
| preimage | the original figure in a transformation |
| proof | a logical argument that shows why a statement must be true |
| radius | a segment or distance from the center of a circle to a point on the circle |
| rectangle | a parallelogram with four right angles |
| rhombus | a parallelogram with four congruent sides |
| right triangle | a right triangle has one interior angle that measures exactly 90 degrees |
| scalene triangle | a triangle that has no congruent sides |
| secant | a line that intersects a circle in two points |
| sector of a circle | the region bounded by two radii of the circle and the arc they intersect |
| sine (sin) | in a right triangle, the ratio of the length of the leg opposite the reference angle to the length of the hypotenuse |
| square | a parallelogram with four congruent sides and four right angles |
| surface area | the sum of the areas of the faces and any curved surfaces of a solid. |

| | |
|---|---|
| syllogism | *see law of syllogism* |
| tangent (tan) | in a right triangle, the ratio of the length of the leg opposite the reference angle to the length of the leg adjacent to the given angle |
| theorem | a mathematical statement that can be shown to be true based on postulates, definition, or other proven theorems |
| triangle | a polygon with three sides |
| two-column proof | a type of proof consisting of ordered statements in one column and the corresponding reasons in the other column |
| vertical | perpendicular to the horizon |

| **Number** | |
|---|---|
| **Term** | **Definition** |
| matrix | a rectangular arrangement (array) of numbers |
| modular arithmetic | arithmetic in which numbers that are congruent modulo a given number are treated as the same |
| radians | real number angle measure (180 degrees = pi radians) |
| roundoff | round the last calculation to one more decimal place than the original data |
| vector | a quantity with both magnitude and direction |

| **Data** | |
|---|---|
| **Term** | **Definition** |
| bias | a biased sample is one that is not representative of the population from which it is drawn |
| bivariate | a data set in which two variables are measured and recorded for each subject |
| circle | all points in a plane equidistant from the center |
| confidence interval | *see level of confidence* |
| confounding variable | occurs when an experimenter cannot tell the difference between the effects of different factors on the variable |
| intersect | to meet or cross |
| intersections | *see intersect* |
| level of confidence | the level of confidence is the probability that the interval estimate contains the population parameter, assuming that the estimation process is repeated a large number of times |
| p-values | the probability of obtaining a sample statistic with a value as extreme or more extreme than the one determined from the sample data |
| parameter | a measured characteristic of a population |
| possible outcomes | all of the outcomes that can occur |
| random | by chance, with no outcome any more likely than another |
| residuals | represents the difference between the observed y-value and the predicted y-value for a given x-value |
| statistic | a measured characteristic of a sample |
| subsets | a set consisting of elements of a given set that can be the same as the given set or smaller |
| unions | the union of two sets is the set of all elements in each set or both sets |
| univariate | a data set in which one variable is measured and recorded for each subject (experimental unit) |

# Appendix

## Professional and State Organizations:

National Council of Teachers of Mathematics
National Council of Supervisors of Mathematics
Nebraska Association of Teachers of Mathematics
Nebraska Math Education

## Catholic Identity in Math:

*Integrating Faith and Math*, and example from the Diocese of Superior: https://catholicdos.org/math-curriculum-integrating-faith

*29 Great Catholic Mathematicians You Should Know*: https://www.ncregister.com/blog/great-catholic-mathematicians

*The Symbolism of Numbers in the Bible*: https://catholic-resources.org/Bible/Numbers.htm
https://religiousedacrosscurriculum.wordpress.com/math/

*Educating for Eternity: A Teacher's Companion for Making Every Class Catholic*
Book by Brett Salkeld, Ph.D.

## NCTM Instructional Strategies:

NCTM identifies eight effective teaching practices that provide a research and evidence-based framework for mathematics instruction. These practices guide and strengthen the teaching and learning of mathematics.

| Mathematics Teaching Practices |
|---|
| **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. |
| **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. |
| **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. |
| **Facilitate meaningful mathematical discourse.** Effective teaching of mathematics facilitates discourse among students to build shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments. |
| **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. |
| **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. |
| **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. |
| **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. |

**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.

**Research Says:**
• Learning progressions or trajectories describe how students make transitions from prior knowledge to more sophisticated understandings
• Both teachers and students need to be able to answer these crucial questions:
• What mathematics is being learned?
• Why is this important?
• How does it relate to what has already been learned?
• Where are these mathematical ideas going?
• Situating learning goals within the mathematical landscape supports opportunities to:
• Build explicit connections
• See how ideas build and relate to one another
• Develop a coherent and connected view of the discipline

| **Establish mathematics goals to focus learning**<br>Teacher and student actions | |
|---|---|
| **What are *teachers* doing?** | **What are *students* doing?** |
| Establishing clear goals that articulate the mathematics that students are learning as a result of instruction in a lesson, over a series of lessons, or throughout a unit.<br><br>Identifying how the goals fit within a mathematics learning progression.<br><br>Discussing and referring to the mathematical purpose and goal of a lesson during instruction to ensure that students understand how the current work contributes to their learning.<br><br>Using the mathematics goals to guide lesson planning and reflection and to make in-the-moment decisions during instruction. | Engaging in discussions of the mathematical purpose and goals related to their current work in the mathematics classroom (e.g., What are we learning? Why are we learning it?)<br><br>Using the learning goals to stay focused on their progress in improving their understanding of mathematics content and proficiency in using mathematical practices.<br><br>Connecting their current work with the mathematics that they studied previously and seeing where the mathematics is going.<br><br>Assessing and monitoring their own understanding and progress toward the mathematics learning goals. |

**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.

**Research Says:**
• Effective math teaching and learning uses carefully selected tasks as one way to motivate student learning and build new knowledge.
• Research on math tasks over the past two decades has found:
• Not all tasks provide the same opportunities for student thinking and learning.
• Student learning is the greatest in classrooms where tasks consistently encourage high-level student thinking and the least in classrooms where tasks are routinely procedural in nature.

• Tasks with high cognitive demands are the most difficult to implement well and are often transformed into less demanding tasks.
• To ensure that students have the opportunity to engage in high-level thinking, teachers must regularly select and implement tasks the promote reasoning and problem solving.

| **Implement tasks that promote reasoning and problem solving**<br>**Teacher and student actions** | |
|---|---|
| **What are *teachers* doing?** | **What are *students* doing?** |
| Motivating students' learning of mathematics through opportunities for exploring and solving problems that build on and extend their current mathematical understanding.<br><br>Selecting tasks that provide multiple entry points through the use of varied tools and representations.<br><br>Posing tasks on a regular basis that require a high level of cognitive demand.<br><br>Supporting students in exploring tasks without taking over student thinking.<br><br>Encouraging students to use varied approaches and strategies to make sense of and solve tasks. | Persevering in exploring and reasoning through tasks.<br><br>Taking responsibility for making sense of tasks by drawing on and making connections with their prior understanding and ideas.<br><br>Using tools and representations as needed to support their thinking and problem solving.<br><br>Accepting and expecting that their classmates will use a variety of solution approaches and that they will discuss and justify their strategies to one another. |

**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.

**Research Says:**
• Effective mathematics teaching includes a strong focus on using varied mathematical representations.
• Using a variety of representations helps students examine a concept through more than one lens. Selected representations could include:
• Visual representations
• Physical representations
• Symbolic representations
• Contextual representations
• Verbal representations
• When students learn to represent, discuss, and make connections among mathematical ideas in multiple forms, they demonstrate deeper mathematical understanding and enhanced problem-solving skills.
(Fuson, Kalchman, & Bransford, 2005; Lesh, Post, and Behr, 1987)

| Use and connect mathematical representations<br>Teacher and student actions | |
|---|---|
| **What are *teachers* doing?** | **What are *students* doing?** |
| Selecting tasks that allow students to decide which representations to use in making sense of the problems.<br><br>Allocating substantial instructional time for students to use, discuss, and make connections among representations.<br><br>Introducing forms of representations that can be useful to students.<br><br>Asking students to make math drawings or use other visual supports to explain and justify their reasoning.<br><br>Focusing students' attention on the structure or essential features of mathematical ideas that appear, regardless of the representation.<br><br>Designing ways to elicit and assess students' abilities to use representations meaningfully to solve problems. | Using multiple forms of representations to make sense of and understand mathematics.<br><br>Describing and justifying their mathematical understanding and reasoning with drawings, diagrams, and other representations.<br><br>Making choices about which forms of representations to use as tools for solving problems.<br><br>Sketching diagrams to make sense of problem situations.<br><br>Contextualizing mathematical ideas by connecting them to real-world situations.<br><br>Considering the advantages or suitability of using various representations when solving problems. |

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

**Research Says:**
• Effective mathematics teaching engages students in discourse to advance the mathematical learning of the whole class.
• Smith and Stein (2011) describe five practices for effectively using student responses in class discussions:
• Anticipating student responses prior to the lesson
• Monitoring students' work on engagement with tasks
• Selecting particular students to present their mathematical work
• Sequencing students' responses in specific order for discussion
• Connecting different students' responses and connecting responses to key mathematical ideas
• Students must have opportunities to talk with, respond to, and question one another as part of the discourse community, in ways that support the mathematics learning for all students in class.

| Facilitate meaningful mathematical discourse<br>Teacher and student actions | |
|---|---|
| **What are *teachers* doing?** | **What are *students* doing?** |
| Engaging students in purposeful sharing of mathematical ideas, reasoning, and approaches, using varied representations.<br><br>Selecting and sequencing student approaches and solution strategies for whole-class analysis and discussion.<br><br>Facilitating discourse among students by positioning them as authors of ideas, who explain and defend their approaches.<br><br>Ensuring progress toward mathematical goals by making explicit connections to student approaches and reasoning. | Presenting and explaining ideas, reasoning, and representations to one another in pair, small-group, and whole-class discourse.<br><br>Listening carefully to and critiquing the reasoning of peers, using examples to support or counterexamples to refute arguments.<br><br>Seeking to understand the approaches used by peers by asking clarifying questions, trying out others' strategies, and describing the approaches used by others.<br><br>Identifying how different approaches to solving a task are the same and how they are different. |

**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.

**Research Says:**
• Effective mathematics teaching relies on questions that encourage students to explain and reflect on their thinking as an essential component of meaningful discourse.
• Commonalities exist across a number of questioning frameworks. Key cross-cutting aspects of these questioning frameworks include:
• Gathering information
• Students recall facts, definitions, or procedures
• Probing thinking
• Students explain, elaborate, or clarify their thinking, including articulating the steps in solution methods or the completing of a task
• Making the mathematics visible
• Students discuss mathematical structures and make connections among mathematical ideas and relationships
• Encouraging reflection and justification
• Students reveal deeper understanding of their reasoning and actions, including making an argument for the validity of their work.

| Pose purposeful questions<br>Teacher and student actions | |
|---|---|
| **What are *teachers* doing?** | **What are *students* doing?** |
| Advancing student understanding by asking questions that build on, but do not take over or funnel, student thinking.<br><br>Making certain to ask questions that go beyond gathering information to probing thinking and requiring explanation and justification.<br><br>Asking intentional questions that make the mathematics more visible and accessible for student examination and discussion.<br><br>Allowing sufficient wait time so that more students can formulate and offer responses. | Expecting to be asked to explain, clarify, and elaborate on their thinking.<br><br>Thinking carefully about how to present their responses to questions clearly, without rushing to respond quickly.<br><br>Reflecting on and justifying their reasoning, not simply providing answers.<br><br>Listening to, commenting on, and questioning the contributions of their classmates. |

**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.

**Research Says:**
• Effective mathematics teaching focuses on the development of both conceptual understanding and procedural fluency.
• Both NCTM and CCSS-M emphasize that procedural fluency follows and builds on a foundation of conceptual understanding, strategic reasoning, and problem solving.
• Students who use math effectively do much more than carry out procedures. Such students must also know:
• Which procedure is appropriate and most productive for a given situation,
• What a given procedure accomplishes, and
• What kind of results to expect
• "Mechanical execution of procedures without understanding their conceptual basis often leads to bizarre results" (Martin, (2009), p.165)

| Build procedural fluency from conceptual understanding<br>Teacher and student actions | |
|---|---|
| **What are *teachers* doing?** | **What are *students* doing?** |
| Providing students with opportunities to use their own reasoning strategies and methods for solving problems.<br><br>Asking students to discuss and explain why the procedures that they are using work to solve particular problems.<br><br>Connecting student-generated strategies and methods to more efficient procedures as appropriate. | Making sure that they understand and can explain the mathematical basis for the procedures that they are using.<br><br>Demonstrating flexible use of strategies and methods while reflecting on which procedures seem to work best for specific types of problems.<br><br>Determining whether specific approaches generalize to a broad class of 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.

**Research Says:**
• Effective mathematics instruction supports students in struggling *productively* as they learn mathematics.
• Teacher actions to support students in productive struggle include:
• Students engage in problems that take time to solve
• Teachers select tasks that promote reasoning and problem solving; explicitly encouraging students to persevere; finding ways to support students without removing challenges in a task.
• Students explain and discuss how they thought about and solved tasks
• Teachers ask students to explain and justify how they solved a task, and value the quality of the explanation as much as the final solution.
• Students have a responsibility and obligation to make sense of the math
• Teachers give students the opportunity to discuss and determine the validity and appropriateness of strategies and solutions.
• Students use important tools in making sense of the task
• Teachers give students access to tools that will support their thinking process.
• Students communicate one's thinking during a task
• Teachers ask students to explain their thinking and pose questions based on students' reasoning, rather than on the way the teacher is think about the task.

| Support productive struggle in learning mathematics<br>Teacher and student actions | |
|---|---|
| **What are *teachers* doing?** | **What are *students* doing?** |
| Anticipating what students might struggle with during a lesson and being prepared to support them productively through the struggle.<br><br>Giving students time to struggle with tasks, and asking questions that scaffold students' thinking without stepping in to do the work for them.<br><br>Helping students realize that confusion and errors are a natural part of learning, by facilitating discussions on mistakes, misconceptions, and struggles.<br><br>Praising students for their efforts in making sense of mathematical ideas and perseverance in reasoning through problems. | Struggling at times with mathematics tasks but knowing that breakthroughs often emerge from confusion and struggle.<br><br>Asking questions that are related to the sources of their struggles and will help them make progress in understanding and solving tasks.<br><br>Persevering in solving problems and realizing that is acceptable to say, "I don't know how to proceed here," but it is not acceptable to give up.<br><br>Helping one another without telling their classmates what the answer is or how to solve the problem. |

**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.

**Research Says:**
• Effective mathematics teaching elicits evidence of student's current mathematical understanding and uses it as the basis for making instructional decisions.
• A focus on evidence includes:
• Identifying indicators of what is important to notice in students' mathematical thinking
• Planning for ways to elicit that information
• Interpreting what the evidence means with respect to students' learning
• Deciding how to respond on the basis of students' understanding
• Using assessment *for* learning means that:
• Students are revealing their mathematical understanding, reasoning, and methods in classroom discourse and written work.
• Students reflect on mistakes and misconceptions to improve their understanding
• Students ask questions, responding to, and giving suggestions to support the learning of their classmates
• Students assess and monitor their own progress towards math learning goals, and identify areas they can improve.

| Elicit and use evidence of student thinking<br>Teacher and student actions | |
|---|---|
| **What are *teachers* doing?** | **What are *students* doing?** |
| Identifying what counts as evidence of student progress toward mathematics learning goals.<br><br>Eliciting and gathering evidence of student understanding at strategic points during instruction.<br><br>Interpreting student thinking to assess mathematical understanding, reasoning, and methods.<br><br>Making in-the-moment decisions on how to respond to students with questions and prompts that probe, scaffold, and extend.<br><br>Reflecting on evidence of student learning to inform the planning of next instructional steps. | Revealing their mathematical understanding, reasoning, and methods in written work and classroom discourse.<br><br>Reflecting on mistakes and misconceptions to improve their mathematical understanding.<br><br>Asking questions, responding to, and giving suggestions to support the learning of their classmates.<br><br>Assessing and monitoring their own progress toward mathematics learning goals and identifying areas in which they need to improve. |

## Resource Books:

*Taking Action: Implementing Effective Mathematics Teaching Practices in K–Grade 5*
DeAnn Huinker and Victoria Bill; Margaret S. Smith, *Series Editor*

*Taking Action: Implementing Effective Mathematics Teaching Practices in Grades 6-8*
Margaret Smith, Michael Steele, Mary Lynn Raith

*Taking Action: Implementing Effective Mathematics Teaching Practices in Grades 9-12*
Melissa Boston, Frederick Dillon, Margaret Smith, and Stephen Miller

## Understanding Trip Steps in Math:

Certain skills are found to be disproportionately difficult for students to master. This will require a longer time period for instruction. https://www.renaissance.com/2021/09/24/blog-the-critical-role-of-trip-steps-in-math-recovery/

## Coherence Map: A Tool to Help Plan Pre- and Post-Requisite Skills in Math:

https://tools.achievethecore.org/coherence-map/

## Instructional Planning Resources:

Open Middle (K-12)

Teacher Desmos (K-12)

Math Warehouse (K-12)

Math Hints (K-12)

Venn Diagram Activities (6-12)

Math Medic (9-12)

Stats Medic (9-12)

Calc Medic (9-12)

## Skill Development and Practice:

Funbrain (Pre-K-8 math games)

Math Aids (K-10 worksheets)

Get the Math (6-12 real world math activities based on careers)

Math TV (6-12)

Prodigy (adaptive learning games)

Math Drills (worksheets)

Khan Academy

Freckle

First in Math (game-based activities)

IXL Math

BrainPOP

Illuminations (interactive lessons)

Figure This! (math challenges)

That Quiz (quiz creator)

Math Warehouse (activities and resources)

## Math Tools:

Articles:

*How Math Manipulatives Can Help Kids Learn*

*Why Manipulatives?*

Online Math Tools:

Desmos Graphing Calculator (8-12)

GeoGebra (8-12)

Virtual Manipulatives (K-8)

Polypad

Dice

Protractor

Chart Tool

## Math Enrichment Resources:

Books:

*Challenge Math* – A series by Edward Zaccaro that offers material that goes beyond calculation skills for those children who already know basic concepts.

*Mind Benders* – Deductive thinking puzzles that develop logic, reading comprehension, and mental organizational skills.

Online Resources:

The NRICH Project; University of Cambridge https://nrich.maths.org

Figure This! Math Challenges, NCTM

The Infinite Pickle

Edutopia

## Tier 2 and Tier 3 Interventions:

IRIS Center

Intensive Intervention

Intervention Central

Intervention Express

Math Intervention Programs

RTI Action Network and Math

Understood: Math

What Works Clearinghouse

## Standardized Test Prep (High School):

Book:
*500 ACT Math Questions to Know by Test Day*, 3rd Edition, McGraw Hill, 2022

Online Resources:

ACT College and Career Readiness Standards

ACT Mathematics Curriculum Review Worksheet

ACT Mathematics Reporting Category Descriptions

College Board SAT Suite

Khan Academy SAT Prep Course

## Family Engagement:

National Association for Family, School, and Community Engagement

*7 Tips for Helping Your Child with Math at Home*

*Family Math*

*Everyday Math Activities Kids Can Do at Home*

*Family Engagement: The Math Manipulatives Hiding in a Junk Drawer*

## K-12 Math State Standards-Horizontal View:

2022-Math-Standards-Horizontal-41923 (1).xlsx

## K-12 Math Standards-Vertical View:

| K-12 Number (N) | |
|---|---|
| Students will solve problems and reason with number concepts using multiple representations, make connections within math and across disciplines, and communicate their ideas. | |
| **Essential Standard: Subitizing** | |
| K-2: Students will quantify briefly shown collections and verbally label the arrangements without counting. | |
| **Grade** | **Content Standard(s) and Indicator(s)** |
| **K** | **M.K.N.1.1 (K.N.1.a)** Without counting, recognize and verbally label arrangements for briefly shown collections up to 10 (e.g., "I saw 5." "How did you know?" "I saw 3 and 2, that is 5." |
| **1** | **M.1.N.1.1 (1.N.1.a)** Without counting, recognize and verbally label arrangements for briefly shown collections up to 20 (e.g.," I saw 16." "How did you know?" "I saw 10 and 6, that is 16"). |
| **2** | **M.2.N.1.1 (2.N.1.a)** Without counting, recognize and verbally label structured arrangements for briefly shown collections using groups, multiplicative thinking, and place value (e.g.," I saw 48." "How did you know?" "I saw 4 groups of 10 and 2 groups of 4 is 8...4 tens and 8 ones...48"). |

## Essential Standard: Counting and Cardinality

K-1: Students will understand the relationship between numbers and quantities.

2: Students will understand the relationship between numbers and quantities to extend the counting sequence.

| Grade | Content Standard(s) and Indicator(s) |
|---|---|
| **K** | **M.K.N.2.1 (K.N.2.a)** Use one-to-one correspondence when counting objects to show the relationship between numbers and quantities and understand the last number counted is a direct representation of the total objects in a given set.<br><br>**M.K.N.2.2 (2.N.2.b)** Understand that each successive number name refers to a quantity that is one larger.<br><br>**M.K.N.2.3 (K.N.2.c)** Count out the number of objects given a number from 1 to 20.<br><br>**M.K.N.2.4 (K.N.2.d)** Count up to 20 objects arranged in a line, a rectangular array, or a circle, and count up to 10 objects in a scattered configuration.<br><br>**M.K.N.2.5 (K.N.2.3)** Count verbally forward and backward from any given number within 20.<br><br>**M.K.N.2.6 (K.N.2.f)** Count verbally in sequential order by ones and by tens to 100, making accurate decade transitions (e.g., 89 to 90).<br><br>**M.K.N.2.7 (K.N.2.g)** Write and name numbers 0 to 20. Represent a number of objects with a written numeral 0 to 20.<br><br>**M.K.N.2.8 (K.N.2.h)** Compare the number of objects in two groups, up to 20, using the words fewer than, more than, the same as. |
| **1** | **M.1.N.2.1 (1.N.2.a)** Count verbally by ones and tens within 120 starting at any given number.<br><br>**M.1.N.2.2 (1.N.2.b)** Count verbally by ones and tens within 120 starting at any given number. Understand that the given number is a direct representation of the total objects in a given set and counting on each successive number represents adding an additional object, and counting back each proceeding number represents removing an object.<br><br>**M.1.N.2.3 (1.N.2.c)** Write numerals to match a representation of a given set of objects for numbers up to 120.<br><br>**M.1.N.2.4 (1.N.2.d)** Understand patterns of skip counting by 2s, 5s, and 10s. |
| **2** | **M.2.N.2.1 (2.N.2.a)** Count within 1,000, including skip counting by 5s, 10s, and 100s starting at a variety of multiples of 5, 10, or 100. |

## Essential Standard: Base 10

K: Students will work with numbers 11 to 19 to gain a foundation for place value.

1: Students will represent and compare two-digit numbers to gain foundations for place value.

2: Students will represent and compare three-digit numbers to apply concepts of place value.

| Grade | Content Standard(s) and Indicator(s) |
|---|---|
| **K** | **M.K.N.3.1 (K.N.3.a)** Compose and decompose numbers from 11 to 19 into a group of ten ones and some more ones using a model, drawing, or equation. |

| | |
|---|---|
| **1** | **M.1.N.3.1 (1.N.3.a)** Understand 10 as a bundle, collection, or (more abstractly) composition of ten ones and that the two digits of a two-digit number represent a composition of some tens and some ones.<br><br>**M.1.N.3.2 (3.N.3.b)** Compare two, two-digit numbers using words greater than, less than, equal to, and symbols <, >, =. Justify comparisons based on the number of tens and ones. |
| **2** | **M.2.N.3.1 (2.N.3.a)** Read and write numbers within the range of 0 to 1,000 using standard, word, and expanded forms.<br><br>**M.2.N.3.2 (2.N.3.b)** Understand 100 as a bundle, collection, or (more abstractly) composition of ten tens and that the three digits of a three- digit number represent a composition of some hundreds, some tens, and some ones.<br><br>**M.2.N.3.2 (2.N.3.c)** Compare two three-digit numbers by using symbols <, >, = and justify the comparison based on the value of the hundreds, tens, and ones. |

## Essential Standard: Number and Operations

K: Students will understand and demonstrate the meaning of addition and subtraction.

1-2: Students will compute using addition and subtraction.

| Grade | Content Standard(s) and Indicator(s) |
|---|---|
| **K** | **M.K.N.4.1 (K.N.4.a)** Represent and explain addition and subtraction as part-whole relationships, with addition as *putting together* and/or *adding to* and subtraction as *taking apart* and/or *taking from*, using objects, drawings, numbers, and equations.<br><br>**M.K.N.4.2 (K.N.4.b)** Compose and decompose numbers less than or equal to 10 into pairs in more than one way using verbal explanations, objects, or drawings.<br><br>**M.K.N.4.3 (K.N.4.c)** For any number from 1 to 9, find the number that makes 10 when added to the given number, sharing the answer with a model, drawing, or equation.<br><br>**M.K.N.4.4 (K.N.4.d)** Efficiently, flexibly, and accurately add and subtract within 5.<br><br>**M.K.N.4.5 (K.N.4.e)** Solve authentic problems that involve addition and subtraction within 10 (e.g., by using objects, drawings, and equations to represent the problem). |
| **1** | **M.1.N.4.1 (1.N.4.a)** Add and subtract within 20, using flexible strategies such as counting on or counting back, making ten, using ten, and using doubles and near doubles.<br><br>**M.1.N.4.2 (1.N.4.b)** Efficiently, flexibly, and accurately add and subtract within 10.<br><br>**M.1.N.4.3 (1.N.4.c)** Find the difference between two numbers that are multiples of 10, ranging from 10 to 90 using concrete models, drawings, or strategies, and write the corresponding equation.<br><br>**M.1.N.4.4 (1.N.4.d)** Mentally find 10 more or 10 less than a two-digit number (without having to count) and explain the reasoning used.<br><br>**M.1.N.4.5** ***(1.N.4.e)*** Add within 100, including adding a two-digit number and a one-digit number (e.g., 34 + 3), adding a two-digit number and a multiple of ten (e.g., 62 + 20), using concrete models, drawings, and strategies that reflect an understanding of place value, the relationship between addition and subtraction, and the properties of operations. Relate the strategy to a written method and explain the reasoning used to solve. |

| | |
|---|---|
| | **M.1.N.4.6 (1.N.4.f)** Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; sometimes it is necessary to compose a ten.<br><br>**M.1.N.4.7 (1.N.4.g)** Subtract multiples of ten from two-digit numbers (positive or zero differences) using concrete models, drawings, and strategies that reflect an understanding of place value, the relationship between addition and subtraction, and the properties of operations. Relate the strategy to a written method and explain the reasoning used to solve. |
| **2** | **M.2.N.4.1 (2.N.4.a)** Fluently add and subtract within 20.<br><br>**M.2.N.4.2 (2.N.4.b)** Add and subtract within 100 using strategies based on place value including properties of operations, relationships between addition and subtraction, and algorithms.<br><br>**M.2.N.4.3 (2.N.4.c)** Mentally add or subtract 10 or 100 to or from a given number 100 to 900.<br><br>**M.2.N.4.4 (2.N.4.d)** Add up to three two-digit numbers using strategies based on place value and understanding of properties.<br><br>**M.2.N.4.5 (2.N.4.e)** Add and subtract within 1,000 using concrete models, drawings, and strategies that reflect an understanding of place value and the properties of operations. |

## Essential Standard: Number and Algebraic Relationships

1: Students will understand and apply properties of operations and the relationship between addition and subtraction to solve problems.

2: Students will create and solve problems involving addition and subtraction and work with equal groups of objects to gain foundations for multiplication.

| Grade | Content Standard(s) and Indicator(s) |
|---|---|
| **1** | **M.1.N.5.1 (1.N.5.a)** Use the meaning of the equal sign to determine if equations are true and give examples of equations that are true (e.g., 4 = 4, 6 = 7 – 1, 6 + 3 = 3 + 6, 7 + 2 = 5 + 4).<br><br>**M.1.N.5.2 (1.N.5.b)** Use the relationship of addition and subtraction to solve subtraction problems (e.g., find 12 – 9 = ___, using the addition fact 9 + 3 = 12).<br><br>**M.1.N.5.3 (1.N.5.c)** Determine the unknown whole number in an addition or subtraction equation (e.g., 7 +? = 13).<br><br>**M.1.N.5.4 (1.N.5.d)** Use the commutative property of addition to develop addition strategies and compose/decompose numbers to develop addition and subtraction strategies. (See other flexible strategies in M.1.N.4.1).<br><br>**M.1.N.5.5 (1.N.5.e)** Solve problems that call for addition of three whole numbers whose sum is less than or equal to 20 using flexible strategies with objects, drawings, and/or equations.<br><br>**M.1.N.5.6 (1.N.5.f)** Solve authentic problems involving addition and subtraction within 20 in situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all parts of the addition or subtraction problem by using objects, drawings, and/or equations with a symbol for the unknown number to represent the problem.<br><br>**M.1.N.5.7 (1.N.5.g)** Create an authentic problem to represent a given equation involving addition and subtraction within 20. |

| | |
|---|---|
| **2** | **M.2.N.5.1 (2.N.5.a)** Solve authentic problems involving addition and subtraction within 100 in situations of addition and subtraction, including adding to, subtracting from, joining and separating, and comparing situations with unknowns in all positions using objects, models, drawings, verbal explanations, expressions, and equations.<br><br>**M.2.N.5.2 (2.N.5.b)** Create authentic problems to represent one-step addition and subtraction within 100 with unknowns in all positions.<br><br>**M.2.N.5.3 (2.N.5.c)** Use repeated addition to find the total number of objects arranged in an array no larger than five rows and five columns and write an equation to express the total.<br><br>**M.2.N.5.4 (2.N.5.d)** Identify a group of objects from 0 to 20 as even or odd by counting by 2s or by showing even numbers as a sum of two equal parts. |

## Essential Standard: Numeric Relationships

3: Students will demonstrate and represent multi-digit numbers using place value understanding within the base-ten number system.

4: Students will demonstrate and represent multi-digit numbers using relationships with the base-ten number system.

5: Students will understand the place value system within the base-ten number system.

6: Students will demonstrate, represent, and show relationships among fractions, decimals, percents, and integers within the base-ten number system.

7: Students will demonstrate, represent, and show relationships among rational numbers within the base-ten number system.

8: Students will demonstrate, represent, and show relationships among real numbers within the base-ten number system.

| Grade | Content Standard(s) and Indicator(s) |
|---|---|
| **3** | **M.3.N.1.1 (3.N.1.a)** Read, write, and demonstrate multiple equivalent representations for numbers up to 10,000 using objects or visual representations including standard form and expanded form.<br><br>**M.3.N.1.2 (3.N.1.b)** Represent and justify comparisons of whole numbers up to 10,000 using number lines and reasoning strategies. |
| **4** | **M.4.N.1.1 (4.N.1.a)** Read, write, and demonstrate multiple equivalent representations for whole numbers up to 1,000,000 and decimals to the hundredths using visual representations, standard form, and expanded form.<br><br>**M.4.N.1.2 (4.N.1.b)** Represent and justify comparisons of whole numbers up to 1,000,000 and decimals through the hundredths place using number lines and reasoning strategies.<br><br>**M.4.N.1.3 (4.N.1.c)** Recognize a digit in one place represents ten times what it represents in the place to its right.<br><br>**M.4.N.1.4 (4.N.1.d)** Use decimal notation for fractions with denominators of 10 or 100 (e.g., 43/100 = 0.43). |

| | |
|---|---|
| **5** | **M.5.N.1.1 (5.N.1.a)** Read, write, and demonstrate multiple equivalent representations for multi-digit whole numbers and decimals through the thousandths place using standard form and expanded form.<br><br>**M.5.N.1.2 (5.N.1.b)** Recognize a digit in one place represents 1/10 of what it represents in the place to its left.<br><br>**M.5.N.1.3 (5.N.1.c)** Use whole number exponents to denote powers of 10. |
| **6** | **M.6.N.1.1 (6.N.1.a)** Determine common factors and common multiples.<br><br>**M.6.N.1.2 (6.N.1.b)** Determine prime factorization of numbers with and without exponents.<br><br>**M.6.N.1.3 (6.N.1.c)** Model integers using drawings, words, number lines, models, and symbols.<br><br>**M.6.N.1.4 (6.N.1.d)** Determine absolute value of rational numbers.<br><br>**M.6.N.1.5** ***(6.N.1.e)*** Compare and order numbers including non-negative fractions and decimals, integers, and absolute values.<br><br>**M.6.N.1.6** ***(6.N.1.e)*** Locate non-negative fractions and decimals, integers, and absolute values on a number line. |
| **7** | **M.7.N.1.1 (7.N.1.a)** Determine subsets of numbers as natural, whole, integer, and rational based on the definitions of these numbers.<br><br>**M.7.N.1.2 (7.N.1.b)** Represent numbers with positive exponents and in scientific notation.<br><br>**M.7.N.1.3 (7.N.1.c)** Approximate, compare, and order rational numbers (positive and negative representations) on a number line. |
| **8** | **M.8.N.1.1 (8.N.1.a)** Determine subsets of numbers as natural, whole, integer, rational, irrational, or real based on the definitions of these sets of numbers.<br><br>**M.8.N.1.2 (8.N.1.b)** Represent numbers with positive and negative exponents and in scientific notation.<br><br>**M.8.N.1.3 (8.N.1.c)** Describe the difference between a rational and irrational number.<br><br>**M.8.N.1.4** ***(8.N.1.d)*** Approximate, compare, and order real numbers, both rational and irrational.<br><br>**M.8.N.1.5** ***(8.N.1.d)*** Locate real numbers, both rational and irrational, on a number line. |

## Essential Standard: Operations with Numbers

3: Students will develop understanding of fractions as numbers.

4: Students will extend understanding of fractions by equivalence and ordering and will develop an understanding of decimals. Students will understand and demonstrate fractional computation. Students will find factors and multiples and classify numbers as prime or composite.

5: Students will extend understanding of fraction and decimal equivalence and ordering. Students will apply and extend previous understandings of whole number operations to add, subtract, multiply and divide fractions and decimals.

6: Students will compute with fractions and decimals accurately.

7: Students will compute with rational numbers accurately.
8: Students will compute with exponents and roots.

HS: Students will use number sets and operations to reason and to solve problems.

HS Advanced Topics: Students will compare and contrast subsets and perform operations with subsets of the complex number system to reason and to solve problems.

| Grade | Content Standard(s) and Indicator(s) |
|---|---|
| **3** | **M.3.N.2.1 (3.N.2.a)** Partition two-dimensional figures into equal areas and express the area of each part as a unit fraction of the whole.<br><br>**M.3.N.2.2 (3.N.2.b)** Find parts of a whole using visual fraction models.<br><br>**M.3.N.2.3 (3.N.2.c)** Represent and understand a fraction as a number on a number line.<br><br>**M.3.N.2.4 (3.N.2.d)** Show and identify equivalent fractions using visual representations including pictures, manipulatives, and number lines.<br><br>**M.3.N.2.5 (3.N.2.e)** Justify whole numbers as fractions and identify fractions that are equivalent to whole numbers.<br><br>**M.3.N.2.6 (3.N.2.f)** Compare and order fractions having the same numerators or denominators by reasoning about their size. |
| **4** | **M.4.N.2.1** ***(4.N.2.a)*** Explain and demonstrate how a mixed number is equivalent to a fraction greater than one and how a fraction greater than one is equivalent to a mixed number using visual fraction models and reasoning strategies (e.g., 2 ¾ =11/4).<br><br>**M.4.N.2.2 (4.N.2.b)** Explain and demonstrate how equivalent fractions are generated by multiplying by a fraction equivalent to 1 using visual fraction models and the Identity Property of Multiplication.<br><br>**M.4.N.2.3 (4.N.2.c)** Compare and order fractions having unlike numerators or denominators using number lines, benchmarks, reasoning strategies, and/or equivalence.<br><br>**M.4.N.3.1 (4.N.3.a)** Decompose a fraction into a sum of fractions with the same denominator in more than one way and record each decomposition with an equation and a visual representation.<br><br>**M.4.N.3.2 (4.N.3.b)** Explain the meaning of addition and subtraction of fractions with like denominators using visual fraction models, properties of operations, and reasoning strategies.<br><br>**M.4.N.3.3 (4.N.3.c)** Add and subtract fractions and mixed numbers with like denominators.<br><br>**M.4.N.3.4 (4.N.3.d)** Solve authentic problems involving addition and subtraction of fractions and mixed numbers with like denominators.<br><br>**M.4.N.3.5 (4.N.3.e)** Multiply a fraction by a whole number using visual fraction models and properties of operations. |

| | |
|---|---|
| | **M.4.N.4.1 (4.N.4.a)** Determine whether a given whole number up to 100 is a multiple of a given one-digit number.<br><br>**M.4.N.4.2 (4.N.4.b)** Determine factors of any whole number up to 100 and classify a number up to 100 as prime or composite. |
| **5** | **M.5.N.2.1 (5.N.2.a)** Generate equivalent forms of commonly used fractions and decimals (e.g., halves, fourths, fifths, tenths).<br><br>**M.5.N.2.2 (5.N.2.b)** Represent and justify comparisons of whole numbers, fractions, mixed numbers, and decimals through the thousandths place using number lines, reasoning strategies, and/or equivalence.<br><br>**M.5.N.3.1 (5.N.3.a)** Interpret a fraction as division of the numerator by the denominator.<br><br>**M.5.N.3.2 (5.N.3.b)** Multiply a whole number by a fraction or a fraction by a fraction, including mixed numbers, using visual fraction models and properties of operations.<br><br>**M.5.N.3.3 (5.N.3.c)** Divide a unit fraction by a whole number and a whole number by a unit fraction using visual fraction models and properties of operations.<br><br>**M.5.N.3.4 (5.N.3.d)** Solve authentic problems involving addition, subtraction, and multiplication of fractions and mixed numbers with like and unlike denominators.<br><br>**M.5.N.3.5 (5.N.3.e)** Add and subtract fractions and mixed numbers with unlike denominators without simplifying.<br><br>**M.5.N.3.6 (5.N.3.f)** Solve authentic problems involving division of unit fractions by whole numbers and division of whole numbers by unit fractions.<br><br>**M.5.N.3.7 (5.N.3.g)** Add and subtract decimals to hundredths using strategies based on place value, properties of operations, and/or algorithms. |
| **6** | **M.6.N.2.1** ***(6.N.2.a and 6.N.2.b)*** Add, subtract, multiply, and divide whole numbers, non-negative fractions/mixed numbers, and decimals.<br><br>**M.6.N.2.2 (6.N.2.c)** Evaluate numerical expressions including absolute value and/or positive exponents with respect to order of operations. |
| **7** | **M.7.N.2.1 (7.N.2.a)** Add, subtract, multiply, and divide rational numbers (e.g., positive and negative fractions, decimals, and integers).<br><br>**M.7.N.2.2 (7.N.2.b)** Apply properties of operations (commutative, associative, distributive, identity, inverse, zero) as strategies for problem solving with rational numbers. |
| **8** | **M.8.N.2.1 (8.N.2.a)** Evaluate the square roots of perfect squares less than or equal to 400 and cube roots of perfect cubes less than or equal to 125.<br><br>**M.8.N.2.2 (8.N.2.b)** Simplify numerical expressions involving integer exponents, square roots, and cube roots (e.g., $4^{-2}$ is the same as 1/16).<br><br>**M.8.N.2.3 (8.N.2.c)** Evaluate numerical expressions involving absolute value.<br><br>**M.8.N.2.4 (8.N.2.d)** Multiply and divide numbers using scientific notation. |
| **HS** | **M.HS.N.2.1** ***(HS.N.2.a)*** Extend the properties of exponents to rational numbers (e.g., $x^{\frac{1}{3}} \cdot x^{\frac{1}{2}} = x^{\frac{5}{6}}$). |

| | |
|---|---|
| | **M.HS.N.2.2** ***(HS.N.2.b)*** Use properties of rational and irrational numbers to perform operations.<br><br>**M.HS.N.2.3 (HS.N.2.c)** Demonstrate, represent, and show relationships among the subsets of real numbers and the complex number system.<br><br>**M.HS.N.2.4 (HS.N.2.d)** Compute with subsets of the complex number system including imaginary, rational, irrational, integers, whole, and natural numbers. |
| **HS Advanced Topics** | **M.AT.N.2.1 (AT.N.2.a)** Perform arithmetic operations with complex numbers.<br><br>**M.AT.N.2.2 (AT.N.2.b)** Represent complex numbers and their operations in the complex plane.<br><br>**M.AT.N.2.3 (AT.N.2.c)** Use complex numbers in polynomial identities and equations.<br><br>**M.AT.N.2.4 (AT.N.2.d)** Represent quantities using bases other than decimal such as binary (base 2) or hexadecimal (base 16) and convert numbers to and from base 10.<br><br>**M.AT.N.2.5 (AT.N.2.e)** Explain modular arithmetic and its role in computer programming.<br><br>**M.AT.N.2.6 (AT.N.2.f)** Represent and model vector quantities.<br><br>**M.AT.N.2.7 (AT.N.2.g)** Perform operations on vectors.<br><br>**M.AT.N.2.8 (AT.N.2.h)** Perform operations on matrices and use matrices in applications. |
| **Essential Standard: Estimation and Technology** | |
| HS-HS Advanced Topics: Students will use estimation strategies and technology to reason, to solve problems, and to make connections within mathematics and across disciplines. | |
| **Grade** | **Content Standard(s) and Indicator(s)** |
| **HS** | **M.HS.N.1.1 (HS.N.1.a)** Select, apply, and explain the method of computation when problem solving using real numbers (e.g., models, mental computation, paper-pencil, technology).<br><br>**M.HS.N.1.2 (HS.N.1.b)** Determine if the context of a problem calls for an approximation or an exact value.<br><br>**M.HS.N.1.3 (HS.N.1.c)** Determine the rounding convention to be used based on the context of a problem.<br><br>**M.HS.N.1.4 (HS.N.1.d)** Estimate a value using the concept of betweenness by bounding above and below (e.g., since log (10) = 1 and log (1,000) = 3 we know log (500) is between 1 and 3).<br><br>**M.HS.N.1.5 (HS.N.1.e)** Determine the tolerance interval and percent of error in measurement.<br><br>**M.HS.N.1.6 (HS.N.1.f)** Convert equivalent rates (e.g., miles per hour to feet per second).<br><br>**M.HS.N.1.7 (HS.N.1.g)** Determine whether extremely large or extremely small quantities can be reasonably represented by a calculator or graphing utility.<br><br>**M.HS.N.1.8 (HS.N.1.h)** Use scientific notation to appropriately represent large and small quantities. |

| | |
|---|---|
| **HS Advanced Topics** | **M.AT.N.1.1 (AT.N.1.a)** Use domain and range restrictions to apply an appropriate viewing window while using graphing technology.<br><br>**M.AT.N.1.2 (AT.N.1.b)** Compare and contrast radians and degrees as measures of angles and the reason graphing utilities tend to use radians as the default setting. |
| **Essential Standard: Interpretation and Sense Making** | |
| HS-HS Advanced Topics: Students will reason abstractly and quantitatively using units to solve problems and interpret results in context. | |
| **Grade** | **Content Standard(s) and Indicator(s)** |
| **HS** | **M.HS.N.3.1 (HS.N.3.a)** Understand roundoff error and why roundoff error accumulates when rounding occurs prior to the last step in a computation.<br><br>**M.HS.N.3.2 (HS.N.3.b)** Use estimation methods to check the reasonableness of real number computations and decide if the problem calls for an approximation (including appropriate rounding) or an exact number.<br><br>**M.HS.N.3.3 (HS.N.3.c)** Use units to assess the validity of an answer in the context of a problem.<br><br>**M.HS.N.3.4 (HS.N.3.d)** Communicate the meaning of an answer in the context of a problem. |
| **HS Advanced Topics** | **M.AT.N.3.1 (AT.N.3.a)** Use vectors to communicate the geometric relationships between complex numbers in the complex plane. |

# 6-7 Ratios and Proportion (R)

Students will understand ratio concepts and use ratio reasoning to solve problems.

## Essential Standard: Ratios and Rates

6: Students will understand the concept of ratios and unit rates, use language to describe the relationship between two quantities, and use ratios and unit rates to solve authentic situations.

| Grade | Content Standard(s) and Indicator(s) |
|---|---|
| **6** | **M.6.R.1.1 (6.R.1.a)** Determine ratios from concrete models, drawings, and/or words.<br><br>**M.6.R.1.2** ***(6.R.1.b)*** Explain and determine rates and unit rates.<br><br>**M.6.R.1.3** ***(6.R.1.c)*** Use a proportion to solve problems involving finding a missing part, whole, or percent.<br><br>**M.6.R.1.4 (6.R.1.d)** Convert among fractions, decimals, and percents using multiple representations.<br><br>**M.6.R.1.5 (6.R.1.e)** Solve authentic problems using ratios, rates, unit rates, and percentages.<br><br>**M.6.R.1.6** ***(6.R.1.f)*** Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities (e.g., miles per hour to feet per hour). |

## Essential Standard: Represent

6: Students will represent ratios and rates on the coordinate plane and with tables.

| Grade | Content Standard(s) and Indicator(s) |
|---|---|
| **6** | **M.6.R.2.1 (6.R.2.d)** Make tables of equivalent ratios relating quantities with whole number measurements. |

| | |
|---|---|
| | **M.6.R.2.2 (6.R.2.e)** Use the constant of proportionality to find the missing value in ratio tables.<br><br>**M.6.R.2.3 (6.R.2.f)** Plot the pair of values from a ratio table on the coordinate plane.<br><br>**M.6.R.2.4 (6.R.2.g)** Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation. |
| **Essential Standard: Proportional Relationship** | |
| 7: Students will understand the concept of proportions, use language to describe the relationship between two quantities, and use proportions to solve authentic situations. | |
| **Grade** | **Content Standard(s) and Indicator(s)** |
| **7** | **M.7.R.1.1 (7.R.1.a)** Decide whether two quantities are proportional (e.g., by testing for equivalent ratios in a table).<br><br>**M.7.R.1.2 (7.R.1.b)** Represent and solve authentic problems with proportions.<br><br>**M.7.R.1.3 (7.R.1.c)** Use proportional relationships to solve authentic percent problems (e.g., percent change, sales tax, mark-up, discount, tip).<br><br>**M.7.R.1.4 (7.R.1.d)** Solve authentic problems involving scale drawings. |

# K-12 Algebra (A)

Students will solve problems and reason with algebra using multiple representations, make connections within math and across disciplines, and communicate their ideas.

| Grade | Content Standard(s) and Indicator(s) |
|---|---|
| **K** | See Number: Essential Standard 4, 1-5 |
| **1** | See Number: Essential Standard 5, 1-7 |
| **2** | See Number: Essential Standard 5, 1-4 |
| **Essential Standard: Operations and Algebraic Thinking** | |
| 3: Students will extend understanding of multiplication and apply operational properties to solve problems.<br><br>4: Students will extend understanding of multiplication and division and apply operational properties to solve problems involving variables.<br><br>5: Students will extend understanding of division and apply operational properties to solve problems involving order of operations. | |
| **Grade** | **Content Standard(s) and Indicator(s)** |
| **3** | **M.3.A.1.1 (3.A.1.a)** Add and subtract up to four-digit whole numbers with or without regrouping using strategies based on place value and algorithms.<br><br>**M.3.A.1.2 (3.A.1.b)** Determine the reasonableness of whole number sums and differences using estimations and number sense.<br><br>**M.3.A.1.3 (3.A.1.c)** Solve and write one-step whole number equations to represent authentic problems using the four operations including equations with an unknown start, unknown change, or unknown result. |

| | |
|---|---|
| | **M.3.A.1.4 (3.A.1.d)** Interpret and solve two-step authentic problems involving whole numbers and the four operations.<br><br>**M.3.A.1.5 (3.A.1.e)** Apply commutative, associative, distributive, identity, and zero properties as strategies to multiply and divide.<br><br>**M.3.A.1.6 (3.A.1.f)** Use drawings, words, arrays, symbols, repeated addition, equal groups, and number lines to interpret and explain the meaning of multiplication and division and their relationship.<br><br>**M.3.A.1.7 (3.A.1.g)** Fluently multiply and divide within 100 using strategies based on understanding and properties of operations.<br><br>**M.3.A.1.8 (3.A.1.h)** Multiply one-digit whole numbers by multiples of 10 in the range of 10 to 90 using strategies based on place value and properties of operations. |
| **4** | **M.4.A.1.1 (4.A.1.a)** Add and subtract multi-digit numbers using an algorithm.<br><br>**M.4.A.1.2 (4.A.1.b)** Multiply up to a four-digit whole number by a one-digit whole number and multiply a two-digit whole number by a two- digit whole number, using strategies based on place value, properties of operations, and algorithms.<br><br>**M.4.A.1.3 (4.A.1.c)** Divide up to a four-digit whole number by a one-digit divisor with and without a remainder using strategies based on place value.<br><br>**M.4.A.1.4 (4.A.1.d)** Determine the reasonableness of whole number products and quotients using estimations and number sense.<br><br>**M.4.A.1.5 (4.A.1.e)** Create a simple algebraic expression or equation using a variable for an unknown number to represent an authentic mathematical situation (e.g., $3 + n = 15$, $81 \div n = 9$).<br><br>**M.4.A.1.6 (4.A.1.f)** Solve one- and two-step authentic problems using the four operations including interpreting remainders and the use of a letter to represent the unknown quantity. |
| **5** | **M.5.A.1.1 (5.A.1.a)** Multiply multi-digit whole numbers using an algorithm.<br><br>**M.5.A.1.2 (5.A.1.b)** Divide four-digit whole numbers by a two-digit divisor, with and without remainders, using strategies based on place value.<br><br>**M.5.A.1.3 (5.A.1.c)** Justify the reasonableness of computations involving whole numbers, fractions, and decimals.<br><br>**M.5.A.1.4 (5.A.1.d)** Simplify authentic numerical or algebraic expressions using order of operations (excluding exponents). |
| **Essential Standard: Algebraic Processes** | |
| 6-7: Students will apply the operational properties when evaluating expressions and solving equations and inequalities.<br><br>8: Students will apply the operational properties when evaluating expressions and solving equations.<br><br>HS: Students will apply the operational properties when evaluating rational expressions and solving linear and quadratic equations, and inequalities. | |

| HS Advanced Topics: Students will apply the operational properties when evaluating nonlinear expressions and solving nonlinear equations and inequalities. | |
|---|---|
| **Grade** | **Content Standard(s) and Indicator(s)** |
| **6** | **M.6.A.1.1 (6.A.1.a)** Recognize and generate equivalent algebraic expressions involving the distributive property and combining like terms.<br><br>**M.6.A.1.2 (6.A.1.b)** Given the value of the variable, evaluate algebraic expressions with non-negative rational numbers with respect to order of operations, which may include absolute value.<br><br>**M.6.A.1.3 (6.A.1.c)** Use substitution to determine if a given value for a variable makes an equation or inequality true.<br><br>**M.6.A.1.4 (6.A.1.d)** Solve one-step equations with non-negative rational numbers using addition, subtraction, multiplication, and division.<br><br>**M.6.A.1.5 (6.A.1.e)** Solve one-step inequalities with whole numbers using addition, subtraction, multiplication, and division and represent solutions on a number line (e.g., graph $3x > 3$). |
| **7** | **M.7.A.1.1 (7.A.1.a)** Use factoring and properties of operations to create equivalent algebraic expressions [e.g., $2x + 6 = 2(x+ 3)$].<br><br>**M.7.A.1.2 (7.A.1.b)** Given the value of the variable(s), evaluate algebraic expressions, which may include absolute value.<br><br>**M.7.A.1.3 (7.A.1.c)** Solve one- and two-step equations involving rational numbers.<br><br>**M.7.A.1.4 (7.A.1.d)** Solve equations using the distributive property and combining like terms.<br><br>**M.7.A.1.5 (7.A.1.e)** Solve one- and two-step inequalities involving integers and represent solutions on a number line. |
| **8** | **M.8.A.1.1 (8.A.1.a)** Describe single variable equations as having one solution, no solution, or infinitely many solutions.<br><br>**M.8.A.1.2 (8.A.1.b)** Solve multi-step equations involving rational numbers with the same variable appearing on both sides of the equation.<br><br>**M.8.A.1.3 (8.A.1.c)** Solve equations of the form $x^2 = k$ ($k \leq 400$) and $x^3 = k$ ($k \leq 125$), where k is a positive rational number, using square root and cube root symbols. |
| **HS** | **M.HS.A.2.1 (HS.A.2.a)** Analyze and explain the properties used in solving equations, inequalities, systems of linear equations, systems of linear inequalities, and literal equations.<br><br>**M.HS.A.2.2** ***(HS.A.2.b)*** Generate expressions in equivalent forms by using algebraic properties to make different characteristics or features visible (e.g., determine the vertex form of a quadratic equation given an alternate form).<br><br>**M.HS.A.2.3 (HS.A.2.c)** Analyze equations and inequalities to determine and apply efficient methods to solve and use appropriate technology as needed.<br><br>**M.HS.A.2.4 (HS.A.2.d)** Calculate the slope (rate of change) of a line given coordinate points, a graph, or a table of values. |

| | |
|---|---|
| | **M.HS.A.2.5 (HS.A.2.e)** Write and graph equations of functions (linear, absolute value, quadratic, and exponential) using the points of interest of the function.<br><br>**M.HS.A.2.6 (HS.A.2.f)** Given a line, write the equation of a line that is parallel or perpendicular to it.<br><br>**M.HS.A.2.7 (HS.A.2.g)** Perform and explain operations such as addition, subtraction, multiplication, division, and factoring on polynomials.<br><br>**M.HS.A.2.8 (HS.A.2.h)** Explain the connection between the factors of a polynomial and the zeros of a polynomial.<br><br>**M.HS.A.2.9 (HS.A.2.i)** Combine functions by composition and perform operations on functions. |
| **HS Advanced Topics** | **M.AT.2.1 (AT.A.2.a)** Explain symmetry of functions and determine whether a function is odd, even, or neither.<br><br>**M.AT.2.2 (AT.A.2.b)** Represent, interpret, and analyze inverses of functions algebraically and graphically using domain restrictions when necessary.<br><br>**M.AT.2.3 (AT.A.2.c)** Write equations of nonlinear functions (trigonometric, rational, higher-order polynomials, logarithmic and piecewise) using points of interest of the function.<br><br>**M.AT.2.4 (AT.A.2.d)** Convert between radian and degree measures of an angle.<br><br>**M.AT.2.5 (AT.A.2.e)** Use limits to describe the behavior of a function near its asymptotes and removable discontinuities. |

## Essential Standard: Applications

6-7: Students will solve authentic problems with algebraic expressions, equations, and inequalities.

8: Students will solve authentic problems involving multi-step equations.

HS: Students will solve authentic problems using nonlinear functions.

HS Advanced Topics: Students will solve authentic problems using nonlinear functions and relations.

| Grade | Content Standard(s) and Indicator(s) |
|---|---|
| **6** | **M.6.A.2.1 (6.A.2.a)** Create algebraic expressions (e.g., one or more operations using one variable) from word phrases.<br><br>**M.6.A.2.2 (6.A.2.b)** Write equations (e.g., one operation, one variable) to represent authentic situations involving non- negative rational numbers.<br><br>**M.6.A.2.3 (6.A.2.c)** Write inequalities (e.g., one operation, one variable) to represent authentic situations involving whole numbers. |
| **7** | **M.7.A.2.1 (6.A.2.a)** Write one- and two-step equations involving rational numbers from words, tables, and authentic situations.<br><br>**M.7.A.2.2 (6.A.2.b)** Write one- and two-step inequalities to represent authentic situations involving integers. |

| | |
|---|---|
| **8** | **M.8.A.2.1 (8.A.2.a)** Write multi-step single variable equations from words, tables, and authentic situations.<br><br>**M.8.A.2.2 (8.A.2.b)** Determine and describe the rate of change for given situations through the use of tables and graphs.<br><br>**M.8.A.2.3 (8.A.2.c)** Graph proportional relationships and interpret the rate of change. |
| **HS** | **M.HS.A.3.1 (HS.A.3.a)** Analyze and model authentic situations using various representations and appropriate technology.<br><br>**M.HS.A.3.2 (HS.A.3.b)** Identify, interpret, relate, and graph the factors, x-intercepts, roots, and zeros of polynomial functions using algebraic and graphing methods.<br><br>**M.HS.A.3.3 (HS.A.3.c)** Identify and predict appropriate solutions to equations given context and domain/range (e.g., extraneous solutions, imaginary solutions, no solution, infinitely many solutions). |
| **HS Advanced Topics** | **M.AT.A.3.1 (AT.A.3.a)** Analyze and model authentic situations using various non-linear representations and relations with appropriate technology.<br><br>**M.AT.A.3.2 (AT.A.3.b)** Analyze and model authentic application situations using various non-linear representations and relations with appropriate technology. |
| **Essential Standard: Algebraic Relationships** | |
| HS-HS Advanced Topics: Students will demonstrate and represent relationships with functions. | |
| **Grade** | **Content Standard(s) and Indicator(s)** |
| **HS** | **M.HS.A.1.1 (HS.A.1.a)** Demonstrate that functions are a well mapped subdomain of relations.<br><br>**M.HS.A.1.2 (HS.A.1.b)** Analyze a relation to determine if it is a function given mapping diagrams, function notation (e.g., $f(x)=x^2$), a table, or a graph.<br><br>**M.HS.A.1.3 (HS.A.1.c)** Classify a function given its mapping diagram, function notation, table, or graph as a linear, quadratic, absolute value, exponential, or other function.<br><br>**M.HS.A.1.4 (HS.A.1.d)** Analyze a function's domain and range to determine if it is one-to-one and has an inverse function both algebraically and graphically.<br><br>**M.HS.A.1.5** ***(HS.A.1.e)*** Define, interpret, and analyze linear, quadratic, absolute value, and exponential functions using the points of interest (e.g., intercepts and extrama) of the functions and graphing technology.<br><br>**M.HS.A.1.6 (HS.A.1.f)** Identify, analyze, and apply transformations of existing functions (including translation and dilation).<br><br>**M.HS.A.1.7 (HS.A.1.g)** Interpret logarithmic equations as exponential equations.<br><br>**M.HS.A.1.8 (HS.A.1.h)** Describe arithmetic sequences using tables of values and functions in explicit and recursive forms.<br><br>**M.HS.A.1.9 (HS.A.1.i)**Describe geometric sequences using tables of values and functions in explicit and recursive forms. |

| | |
|---|---|
| **HS Advanced Topics** | **M.AT.A.1.1 (AT.A.1.a)** Analyze and graph nonlinear functions (trigonometric, rational, higher-order polynomials, logarithmic, and piecewise) and relations (conic sections) using their points of interest and graphing technology.<br><br>**M.AT.A.1.2 (AT.A.1.b)** Use the unit circle to define the trigonometric functions on multiples of known angles (positive and negative multiples of 30 and 45 degrees or pi/6 and pi/4).<br><br>**M.AT.A.1.3 (AT.A.1.c)** Given a function, list the sequence of algebraic transformations that changes a parent function to the given function.<br><br>**M.AT.A.1.4 (AT.A.1.d)** Define the radian unit of measure and its relationship with degrees. |

# K-12 Geometry (G)

Students will solve problems and reason with geometry using multiple representations, make connections within math and across disciplines, and communicate their ideas.

## Essential Standard: Shapes and Their Attributes

K: Students will identify and represent the attributes of two-dimensional shapes and three-dimensional solids.

1: Students will represent and describe the attributes of two-dimensional shapes.

2: Students will recognize and represent the attributes of two-dimensional shapes and three-dimensional solids.

3: Students will recognize and represent the attributes of two-dimensional shapes.

4: Students will draw and identify lines and angles and classify shapes by properties of their lines and angles.

5: Students will classify two-dimensional and three-dimensional figures into categories based on their properties.

6: Students will identify and describe geometric attributes of two-dimensional shapes.

7: Students will identify angle relationships and apply properties to determine angle measures.

8: Students will apply properties of angle relationships in triangles and with lines to determine angle measures.

HS-HS Advanced Topics: Students will identify and describe geometric attributes, apply properties and theorems, and create two and three-dimensional shapes.

| Grade | Content Standard(s) and Indicator(s) |
|---|---|
| **K** | **M.K.G.1.1 (K.G.1.a)** Identify and name two-dimensional shapes including circles, triangles, squares, and rectangles regardless of orientation or size.<br><br>**M.K.G.1.2 (K.G.1.b)** Identify and name three-dimensional shapes including spheres, cubes, cylinders, and cones regardless of orientation or size. |

| | |
|---|---|
| | **M.K.G.1.3 (K.G.1.c)** Describe the relative positions of shapes in relation to other objects or shapes using terms such as above, below, in front of, behind, and next to.<br><br>**M.K.G.1.4 (K.G.1.d)** Create shapes using given materials and describe one or more of the attributes such as number of sides/corners.<br><br>**M.K.G.1.5 (K.G.1.e)** Combine simple shapes to compose larger shapes. |
| **1** | **M.1.G.1.1 (1.G.1.a)** Determine geometric attributes of two-dimensional shapes regardless of orientation or size for rhombi, trapezoids, and hexagons (e.g., a hexagon is closed with six sides).<br><br>**M.1.G.1.2 (1.G.1.b)** Determine geometric attributes of three-dimensional shapes including cones, cylinders, cubes, and rectangular prisms regardless of orientation or size.<br><br>**M.1.G.1.3 (1.G.1.c)** Describe lines and sides of shapes as parallel or non-parallel.<br><br>**M.1.G.1.4 (1.G.1.d)** Partition circles and rectangles into two and four equal parts using the language halves and fourths. |
| **2** | **M.2.G.1.1 (2.G.1.a)** Recognize and describe all faces of three-dimensional shapes as two-dimensional shapes. Identify and count attributes of solid shapes including the edges, faces, and vertices.<br><br>**M.2.G.1.2 (2.G.1.b)** Recognize and draw two-dimensional shapes having a specific number of sides, angles, and vertices including triangles, quadrilaterals, pentagons, and hexagons.<br><br>**M.2.G.1.3 (2.G.1.c)** Partition a rectangle into rows and columns of equal-sized squares and count to find the total.<br><br>**M.2.G.1.4 (2.G.1.d)** Divide circles and rectangles into two, three, or four equal parts and describe the parts using the language of halves, thirds, fourths, half of, a third of, and a fourth of.<br><br>**M.2.G.1.5 (2.G.1.e)** Recognize that equal shares of identical wholes need not have the same shape. |
| **3** | **M.3.G.1.1** ***(3.G.1.a)*** Sort quadrilaterals into categories according to their attributes (e.g., presence or absence of specific angles, presence or absence of parallel and/or perpendicular lines). |
| **4** | **M.4.G.1.1 (4.G.1.a)** Identify, create, and describe points, lines, line segments, rays, angles, parallel lines, perpendicular lines, and intersecting lines.<br><br>**M.4.G.1.2 (4.G.1.b)** Justify the classification of angles as acute, obtuse, or right.<br><br>**M.4.G.1.3 (4.G.1.c)** Justify the classification of two-dimensional shapes based on the presence or absence of parallel and perpendicular lines or the presence or absence of specific angles.<br><br>**M.4.G.1.4 (4.G.1.d)** Recognize, draw, and justify lines of symmetry in two-dimensional shapes. |
| **5** | **M.5.G.1.1** ***(5.G.1.a)*** Identify and describe faces, edges, vertices, and angles of two and three-dimensional figures.<br><br>**M.5.G.1.2 (5.G.1.b)** Recognize volume as an attribute of solid figures that is measured in cubic units. |

| | |
|---|---|
| | **M.5.G.1.3** ***(5.G.1.c)*** Justify the classification of two and three-dimensional figures in a hierarchy based on their properties (e.g., by dimension, number sides, angles, vertices, parallel lines, etc.). |
| **6** | **M.6.G.1.1 (6.G.1.a)** Identify and create nets to represent two-dimensional drawings of prisms and pyramids. |
| **7** | **M.7.G.1.1 (7.G.1.a)** Apply properties of adjacent, complementary, supplementary, linear pair, and vertical angles to find missing angle measures. |
| **8** | **M.8.G.1.1 (8.G.1.a)** Determine and use the relationships of the interior angles of a triangle to solve for missing measures.<br><br>**M.8.G.1.2** ***(8.G.1.b)*** Identify and apply geometric properties of parallel lines cut by a transversal and the resulting corresponding, same side/consecutive interior, same side exterior, alternate interior, and alternate exterior angles to find missing measures. |
| **HS** | **M.HS.G.1.1 (HS.G.1.a)** Demonstrate that two figures are similar or congruent by using a sequence of rigid motions and dilations that map a figure onto the other in problems both with and without coordinates.<br><br>**M.HS.G.1.2 (HS.G.1.b)** Describe symmetries of a figure in terms of rigid motions that map a figure onto itself and make inferences about symmetric figures (e.g., unknown side lengths or angle measures) in problems both with and without coordinates.<br><br>**M.HS.G.1.3 (HS.G.1.c)** Explain how the criteria for triangle congruence and similarity (ASA, SAS, AAS, and SSS congruence; AA similarity criterion) follow from the definition of congruence and similarity in terms of corresponding parts.<br><br>**M.HS.G.1.4 (HS.G.1.d)** Identify and apply right triangle relationships including converse of the Pythagorean Theorem.<br><br>**M.HS.G.1.5 (HS.G.1.e)** Apply side and angle relationships of special right triangles (30 degree-60 degree-90 degree and 45 degree-45 degree-90 degree) to solve geometric problems.<br><br>**M.HS.G.1.6 (HS.g.1.f)** Identify and apply right triangle relationships including sine, cosine, and tangent.<br><br>**M.HS.G.1.7 (HS.G.1.g)** Apply interior and exterior angle formulas for n-gons and apply to authentic situations.<br><br>**M.HS.G.1.8 (HS.G.1.h)** Compare/contrast the properties of quadrilaterals: parallelograms, rectangles, rhombi, squares, kites, trapezoids, and isosceles trapezoids.<br><br>**M.HS.G.1.9 (HS.G.1.i)** Use slope and the distance formula to determine the type of quadrilateral.<br><br>**M.HS.G.1.10 (HS.G.1.j)** Identify, describe, apply, and reason through properties of central angles, inscribed angles, angles formed by intersecting chords, secants, and/or tangents to find the measures of angles related to the circle, arc lengths, and areas of sectors.<br><br>**M.HS.G.2.1 (HS.G.2.a)** Convert between various units of volume (e.g., cubic feet to cubic yards).<br><br>**M.HS.G.2.2 (HS.G.2.b)** Apply the effect of a scale factor to determine the volume of similar three-dimensional shapes and solids. |

| | |
|---|---|
| | **M.HS.G.2.3 (HS.G.2.c)** Determine surface area and volume of pyramids, as well as solids that are composites of pyramids, prisms, spheres, cylinders, and cones, using formulas and appropriate units. |
| **HS Advanced Topics** | **M.AT.G.1.1 (AT.G.1.a)** Apply the Law of Sines and the Law of Cosines to find unknown measures in triangles.<br><br>**M.AT.G.2.1 (AT.G.2.a)** Determine the three-dimensional object created by rotating or revolving a two-dimensional object about an axis.<br><br>**M.AT.G.2.2 (AT.G.2.b)** Determine the shape of a two-dimensional cross-section of a three-dimensional object.<br><br>**M.AT.G.2.3 (AT.G.2.c)** Use Cavalieri's Principle to determine volume of three-dimensional figures. |

## Essential Standard: Measurement

K: Students will describe and compare measurable attributes.

1: Students will measure and compare lengths.

2: Students will measure, estimate, and compare lengths to build meaning of the measurement process. Students will use tools to measure and estimate length using standard units. Students will add or subtract to solve length problems.

3: Students will recognize perimeter and area as attributes of plane figures and understand concepts of area measurement. Students will use tools to solve measurement problems.

4: Students will generate simple conversions from a larger unit to a smaller unit to solve authentic problems and measure angles. Students will apply perimeter and area formulas for rectangles.

5: Students will generate conversions within the customary and metric system of measurement to solve authentic problems. Students will extend area problems for rectangles to include fractions and build meaning for measuring volume.

6-7: Students will identify geometric attributes that create two and three-dimensional shapes in order to perform measurements and apply formulas to find area and volume.

8: Students will reason with formulas and context to determine and compare length, area, and volume.

| Grade | Content Standard(s) and Indicator(s) |
|---|---|
| **K** | **M.K.G.2.1 (K.G.2.a)** Describe measurable attributes of authentic objects including length, capacity, and weight.<br><br>**M.K.G.2.2 (K.G.2.b)** Directly compare two objects with a measurable attribute in common to describe which object is longer/shorter, heavier/lighter, and has more/less-capacity. |
| **1** | **M.1.G.2.1 (1.G.2.a)** Measure the length of an object as a whole number of same-size, non-standard units by placing them end to end.<br><br>**M.1.G.2.2 (1.G.2.b)** Order three objects by directly comparing their lengths or indirectly by using a third object. |
| **2** | **M.2.G.2.1 (2.G.2.a)** Measure the length of an object using two different length units and describe how the measurements relate to the size of the specific unit. |

| | |
|---|---|
| | **M.2.G.2.2 (2.G.2.b)** Compare the difference in length of objects using inches and feet or centimeters and meters.<br><br>**M.2.G.3.1 (2.G.3.a)** Identify and use appropriate tools for measuring length.<br><br>**M.2.G.3.2 (2.G.3.b)** Measure and estimate lengths using whole numbers with inches, feet, centimeters, and meters.<br><br>**M.2.G.4.1 (2.G.4.a)** Represent whole numbers as equally spaced lengths on a number line diagram. Use number lines to find sums and differences within 100.<br><br>**M.2.G.4.2 (2.G.4.b)** Use addition and subtraction within 100 to solve problems using the same standard-length units. |
| **3** | **M.3.G.2.1 (3.G.2.a)** Solve authentic problems involving perimeters of polygons when given the side lengths or when given the perimeter and unknown side length(s).<br><br>**M.3.G.2.2 (3.G.2.b)** Use concrete and pictorial models to measure areas in square units by counting square units.<br><br>**M.3.G.2.3 (3.G.2.c)** Find the area of a rectangle with whole-number side lengths by modeling with unit squares; show that area can be additive and is the same as would be found by multiplying the side lengths.<br><br>**M.3.G.3.1 (3.G.3.a)** Identify and use the appropriate tools and units of measurement, both customary and metric, to solve authentic problems involving length, weight, mass, liquid volume, and capacity (within the same system and unit).<br><br>**M.3.G.3.2 (3.G.3.b)** Estimate and measure length to the nearest half inch, fourth inch, and centimeter. |
| **4** | **M.4.G.2.1 (4.G.2.a)** Identify and use the appropriate tools, operations, and units of measurement, both customary and metric, to solve authentic problems involving time, length, weight, mass, and capacity.<br><br>**M.4.G.2.2 (4.G.2.b)** Determine the reasonableness of measurements involving time, length, weight, mass, capacity, and angles.<br><br>**M.4.G.2.3 (4.G.2.c)** Generate simple conversions from a larger unit to a smaller unit within the customary and metric systems of measurement.<br><br>**M.4.G.2.4 (4.G.2.d)** Measure angles in whole number degrees using a protractor and relate benchmark angle measurements to their rotation through a circle (e.g., $180^{o}$ = 1/2 of a circle).<br><br>**M.4.G.2.5 (4.G.2.e)** Recognize angle measures as additive and solve problems involving addition and subtraction to find unknown angles on a diagram.<br><br>**M.4.G.3.1 (4.G.3.a)** Apply perimeter and area formulas for rectangles to solve authentic problems. |
| **5** | **M.5.G.3.1 (5.G.3.a)** Generate conversions in authentic mathematical situations from larger units to smaller units and smaller units to larger units, within the customary and metric systems of measurement.<br><br>**M.5.G.4.1 (5.G.4.a)** Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the fraction side lengths and show that the area is the same as would be found by multiplying the side lengths. |

| | |
|---|---|
| | **M.5.G.4.2 (5.G.4.b)** Multiply fractional side lengths to find areas of rectangles and represent fraction products as rectangular areas.<br><br>**M.5.G.4.3 (5.G.4.c)** Use concrete models to measure the volume of rectangular prisms by counting cubic units.<br><br>**M.5.G.4.4 (5.G.4.d)** Find the volume of a rectangular prism with whole-number side lengths by modeling with unit cubes and show that the volume can be additive and is the same as would be found by multiplying the area of the base times height.<br><br>**M.5.G.4.5 (5.G.4.e)** Solve authentic problems by applying the formulas V = l × w × h and V = B × h for rectangular prisms to find volumes of rectangular prisms with whole number edge lengths. |
| **6** | **M.6.G.3.1** ***(6.G.3.a)*** Determine the area of quadrilaterals (e.g., parallelograms and trapezoids) and triangles by composition and decomposition of these shapes (e.g., a rectangle can be represented as two triangles), as well as applications of properties and formulas.<br><br>**M.6.G.3.2 (6.G.3.b)** Determine the surface area of rectangular and triangular prisms using nets as well as application of formulas.<br><br>**M.6.G.3.3 (6.G.3.c)** Apply volume formulas for triangular prisms. |
| **7** | **M.7.G.3.1 (7.G.3.a)** Solve authentic problems involving perimeter and area of composite shapes made from triangles and quadrilaterals.<br><br>**M.7.G.3.2 (7.G.3.b)** Determine surface area and volume of composite rectangular and triangular prisms.<br><br>**M.7.G.3.3** ***(7.G.3.c)*** Determine the area and circumference of circles both on and off the coordinate plane using 3.14 as an approximation for the value of Pi. |
| **8** | **M.8.G.3.1 (8.G.3.a)** Explain a model of the Pythagorean Theorem.<br><br>**M.8.G.3.2 (8.G.3.b)** Apply the Pythagorean Theorem to find side lengths of triangles and to solve authentic problems.<br><br>**M.8.G.3.3 (8.G.3.c)** Find the distance between any two points on the coordinate plane using the Pythagorean Theorem.<br><br>**M.8.G.3.4 (8.G.3.d)** Determine the volume of cones, cylinders, and spheres and solve authentic problems using volumes. |

## Essential Standard: Time and Money

K: Students will know coin names and values and tell time to the hour.

1: Students will solve problems with coins and tell time to the half hour.

2: Students will solve problems with dollar bills and coins and tell time to the nearest five-minute interval.

3: Students will tell time to the nearest minute and find elapsed time.

| Grade | Content Standard(s) and Indicator(s) |
|---|---|
| **K** | **M.K.G.3.1** ***(K.G.3.a)*** Identify the name and value of pennies, nickels, dimes, and quarters.<br><br>**M.K.G.3.2** ***(K.G.3.b)*** Identify the parts of digital and analog clocks. Tell and write time to the hour using digital and analog clocks. |

| | |
|---|---|
| **1** | **M.1.G.3.1 (1.G.3.a)** Understand the value of dimes and pennies (e.g., a dime is equal to ten pennies) relating to tens and ones and solve problems involving dimes and pennies using the ¢ symbol appropriately.<br><br>**M.1.G.3.2 (1.G.3.b)** Count collections of like coins (penny, nickel, and dime) relating to patterns of counting by 1s, 5s, and 10s.<br><br>**M.1.G.3.3** Count collections of quarters up to one dollar.<br><br>**M.1.G.3.4 (1.G.3.c)** Tell and write time to the half hour and hour using analog and digital clocks. |
| **2** | **M.2.G.5.1 (2.G.5.a)** Solve problems involving dollar bills, quarters, dimes, nickels, and pennies using $ and ¢ symbols appropriately.<br><br>**M.2.G.5.2 (2.G.5.b)** Identify and write time to five-minute intervals using analog and digital clocks and both a.m. and p.m. |
| **3** | **M.3.G.4.1 (3.G.4.a)** Tell and write time to the minute using both analog and digital clocks.<br><br>**M.3.G.4.2 (3.G.4.b)** Solve authentic problems involving addition and subtraction of time intervals and find elapsed time. |

## Essential Standard: Coordinate Geometry

5: Students will graph points on the coordinate plane to solve authentic problems.

6, 7, 8: Students will determine location, orientation, and relationships on the coordinate plane.

HS-HS Advanced Topics: Students will demonstrate and represent location, orientation, and relationships on the coordinate plane.

| Grade | Content Standard(s) and Indicator(s) |
|---|---|
| **5** | **M.5.G.2.1 (5.G.2.a)** Identify the origin, x axis, and y axis of the coordinate plane.<br><br>**M.5.G.2.2 (5.G.2.b)** Graph and name points in the first quadrant of the coordinate plane using ordered pairs of whole numbers.<br><br>**M.5.G.2.3 (5.G.2.c)** Form ordered pairs from authentic problems involving rules or patterns, graph the ordered pairs in the first quadrant on a coordinate plane, and interpret coordinate values in the context of the situation. |
| **6** | **M.6.G.2.1 (6.R.2.a)** Identify the ordered pair of a given point in the coordinate plane.<br><br>**M.6.G.2.2 (6.R.2.b)** Plot the location of an ordered pair in the coordinate plane.<br><br>**M.6.G.2.3 (6.R.2.c)** Identify the location of a given point in the coordinate plane (e.g., axis, origin, quadrant). |
| **7** | **M.7.G.2.1 (7.G.2.a)** Draw polygons in the coordinate plane given coordinates for the vertices.<br><br>**M.7.G.2.2 (7.G.2.b)** Calculate vertical and horizontal distances in the coordinate plane to find perimeter and area of rectangles. |
| **8** | **M.8.G.2.1 (8.G.2.a)** Perform and describe positions and orientations of shapes under single transformations including rotations in multiples of 90 degrees about the origin, translations, reflections, and dilations on and off the coordinate plane.<br><br>**M.8.G.2.2 (8.G.2.b)**Determine if two-dimensional figures are congruent or similar. |

| | |
|---|---|
| | **M.8.G.2.3 (8.G.2.c)** Perform and describe positions and orientations of shapes under a sequence of transformations on and off the coordinate plane. |
| **HS** | **M.HS.G.3.1 (HS.G.3.a)** Derive the midpoint formula using the concept of average and apply the midpoint formula to find coordinates.<br><br>**M.HS.G.3.2 (HS.G.3.b)** Find the images and preimages of transformations of a point, shape, or a relation on the coordinate plane. Transformations include the following and their compositions: reflections across horizontal and vertical lines and the lines y=x and y=-x, rotations about the origin of 90 degrees, dilations about the origin by any positive scale factor, and any translation.<br><br>**M.HS.G.3.3 (HS.G.3.c)** Find the equation of a circle given the radius and the center. |
| **HS Advanced Topics** | **M.AT.G.3.1 (AT.G.3.a)** Identify symmetry properties of a function (e.g., axis of symmetry of a parabola) and know the connection between its symmetry properties and specific transformations.<br><br>**M.AT.G.3.2 (AT.G.3.b)** Recognize that translations can be described in terms of vectors.<br><br>**M.AT.G.3.3 (AT.G.3.c)** Find the images and preimages of transformations of a point, shape, or relation on the coordinate plane, where transformations include the following compositions: reflections about lines of any rational slope passing through the origins, delations about the origin by any positive scale factor, and translations.<br><br>**M.AT.G.3.4 (AT.G.3.d)** Explain the focus-directrix construction of a parabola and derive the equation of a parabola from focus and directrix for a parabola whose axis of symmetry is a coordinate axis. |
| **Essential Standard: Logic and Proof** | |
| HS-HS Advanced Topics: Students will use geometric definitions and theorems to reason abstractly and quantitively. | |
| **Grade** | **Content Standard(s) and Indicator(s)** |
| **HS** | **M.HS.G.4.1 (HS.G.4.a)** Know and use definitions to make deductions in mathematical argumentation (e.g., syllogism, detachment).<br><br>**M.HS.G.4.2 (HS.G.4.b)** Evaluate the validity of conditional statements, including biconditional statements (e.g., conditional, converse, contrapositive, inverse).<br><br>**M.HS.G.4.3 (HS.G.4.c)** Evaluate the validity of an argument communicated in different ways (e.g., a flow format, two- column, paragraph format).<br><br>**M.HS.G.4.4 (HS.G.4.d)** Use coordinate geometry to prove triangles are right, acute, obtuse, isosceles, equilateral, or scalene.<br><br>**M.HS.G.4.5 (HS.G.4.e)** Prove and apply geometric properties and theorems regarding triangles, congruence, and similarity using deductive reasoning.<br><br>**M.HS.G.4.6 (HS.G.4.f)** Prove and apply geometric theorems about quadrilaterals using deductive reasoning. |

| | |
|---|---|
| **HS Advanced Topics** | **M.AT.G.4.1 (AT.G. 4.a)** Use known definitions and results in informal argumentation to construct logical arguments.<br><br>**M.AT.G.4.2 (AT.G.4.b)** Distinguish between empirical reasoning, examples, and deductive reasoning, as well as informal and formal reasoning.<br><br>**M.AT.G.4.3 (AT.G.4.c)** Evaluate the deductive consequences of alternative definitions of known objects (e.g., whether a trapezoid is defined as a quadrilateral with exactly one pair of parallel sides or defined as at least one pair of parallel sides). |

# K-12 Data (D)

Students will solve problems and reason with data/probability using multiple representations, make connections within math and across disciplines, and communicate their ideas.

## Essential Standard: Classification

K: Students will sort and classify objects using one more attributes.

| Grade | Content Standard(s) and Indicator(s) |
|---|---|
| **K** | **M.K.D.1.1 (K.D.1.a)** Identify, sort, and classify objects by size, shape, color, and other attributes.<br><br>**M.K.D.1.2 (K.D.1.b)** Identify objects that do not belong to a particular group and explain the reasoning used. |

## Essential Standard: Data Collection

1, 2, 3, 4, 5: Students will formulate questions to collect, organize, and represent data.

| Grade | Content Standard(s) and Indicator(s) |
|---|---|
| **1** | **M.1.D.1.1 (1.D.1.a)** Collect, organize, and represent a data set with up to three categories using a picture graph. |
| **2** | **M.2.D.1.1 (2.D.1.a)** Ask authentic questions to generate data and represent the data using scaled picture graphs with up to four categories.<br><br>**M.2.D.1.2 (2.D.1.b)** Ask authentic questions to generate data and represent the data using bar graphs with up to four categories.<br><br>**M.2.D.1.3 (2.D.1.c)** Create and represent a data set by making a line plot using whole numbers. |
| **3** | **M.3.D.1.1 (3.D.1.a)** Create scaled picture graphs and scaled bar graphs to represent a data set with more than four categories, including data collected through observations, surveys, and experiments. |
| **4** | **M.4.D.1.1 (4.D.1.a)** Create scaled picture graphs, bar graphs, line graphs, and dot plots to represent a data set with more than four categories, including data collected through observations, surveys, and experiments. |
| **5** | No new skills introduced at this level. |

## Essential Standard: Data Collection and Statistical Methods

6, 7, 8, HS, HS Advanced Topics: Students will formulate statistical investigative questions, collect data, and organize data.

| Grade | Content Standard(s) and Indicator(s) |
|---|---|
| **6** | No new skills introduced at this level. |
| **7** | **M.7.D.1.1 (7.D.1.a)** Create an investigative question and collect data.<br><br>**M.7.D.1.2 (7.D.1.b)** Generate conclusions about a population based on a random sample. |

| | |
|---|---|
| | **M.7.D.1.3 (7.D.1.c)** Identify and critique biases in various data representations. |
| **8** | No new skills introduced at this level. |
| **HS** | **M.HS.D.1.1 (HS.D.1.a)** Formulate multi-variable statistical investigative questions and determine how data can be collected and analyzed to provide an answer.<br><br>**M.HS.D.1.2 (HS.D.1.b)** Apply an appropriate data collection plan when collecting primary data for the statistical investigative question of interest.<br><br>**M.HS.D.1.3 (HS.D.1.c)** Use appropriate technology, including spreadsheet-based logic, to organize data for analysis.<br><br>**M.HS.D.1.4 (HS.D.1.d)** Distinguish between surveys, observational studies, and experiments.<br><br>**M.HS.D.1.5 (HS.D.1.e)** Understand what constitutes good practice in designing a sample survey, an experiment, and an observational study.<br><br>**M.HS.D.1.6 HS.D.1.f)** Understand issues of bias and confounding variables in a study and their implications for interpretation. |
| **HS Advanced Topics** | **M.AT.D.1.1 (AT.D.1.a)** Explain what constitutes good practice in designing a sample survey, an experiment, and an observational study.<br><br>**M.AT.D.1.2 (AT.D.1.b)**Explain the use of randomization to reduce the influence of confounding or lurking variables.<br><br>**M.AT.D.1.3 (AT.D.1.c)** Explain issues of bias and confounding variables in a study and their implications for interpretation.<br><br>**M.AT.D.1.4 (AT.D.1.d)** Demonstrate knowledge of the role sampling distributions play in the estimation of an unknown population parameter through the use of appropriate sampling techniques. |

## Essential Standard: Analyze Data and Interpret Results

1, 2, 3, 4, 5: Students will analyze the data and interpret results.

6, 7, 8, HS, HS Advanced Topics: Students will represent and analyze the data and interpret the results.

| Grade | Content Standard(s) and Indicator(s) |
|---|---|
| **1** | **M.1.D.2.1 (1.D.2.a)** Ask and answer questions about the total number of data points, how many in each category, and compare categories by identifying how many more or less are in a particular category using a picture graph. |
| **2** | **M.2.D.2.1 (2.D.2.a)** Analyze data using scaled picture graphs or bar graphs with up to four categories. Solve problems including one-step comparison problems, using information from the graphs. |
| **3** | **M.3.D.2.1 (3.D.2.a)** Analyze data and make simple statements using information represented in picture graphs, line plots, and bar graphs.<br><br>**M.3.D.2.2** Represent data using bar graphs, circle graphs, line graphs and line plots.<br><br>**M.3.D.2.3** Find the range for a set of data. |
| **4** | **M.4.D.2.1** ***(4.D.2.a)*** Solve authentic problems and analyze data presented in bar graphs, circle graphs, line graphs, and dot plots.<br><br>**M.4.D.2.2** Represent data using bar graphs, circle graphs, line graphs, and dot plots. |

| | |
|---|---|
| | **M.4.D.2.3** Find and interpret the mean, median, mode, and range for a set of data. |
| **5** | **M.5.D.2.1** ***(5.D.2.a*****)** Represent, analyze, and solve authentic problems using information presented in one or more tables, plots, or graphs.<br><br>**M.5.D.2.2** Represent data using bar graphs, circle graphs, line graphs, line plots, and dot plots.<br><br>**M.5.D.2.3** Solve problems using information presented in bar graphs, circle graphs, line graphs, line plots, and dot plots.<br><br>**M.5.D.2.4** Find and interpret the mean, median, mode, and range for a set of data. |
| **6** | **M.6.D.2.1** ***(6.D.2.a)*** Represent data using dot plots, box-and-whisker plots, stem-and-leaf plots, and histograms.<br><br>**M.6.D.2.2** ***(6.D.2.b)*** Solve problems using information presented in dot plots, box-and-whisker plots, stem-and-leaf plots, histograms, and circle graphs.<br><br>**M.6.D.2.3 (6.D.2.c)** Find and interpret the mean, median, mode, and range for a set of data.<br><br>**M.6.D.2.4 (6.D.2.d)** Compare the mean, median, mode, and range from two sets of data.<br><br>**M.6.D.2.5 (6.D.2.e)** Compare and interpret data sets based upon their measures of central tendency and graphical representations (e.g., center, spread, shape). |
| **7** | **M.7.D.2.1** Interpret and compare data using a variety of graphical representations for modes of central tendency and quantitative information. |
| **8** | **M.8.D.2.1 (8.D.2.a)** Represent and interpret bivariate data (e.g., ordered pairs) using scatter plots.<br><br>**M.8.D.2.2 (8.D.2.b)** Describe patterns such as positive or negative association, linear or nonlinear association, clustering, and outliers when bivariate data is represented on a coordinate plane.<br><br>**M.8.D.2.3 (8.D.2.c)** Draw an informal line of best fit based on the closeness of the data points to the line.<br><br>**M.8.D.2.4 (8.D.2.d)** Use a linear model to make predictions and interpret the rate of change and y-intercept in context. |
| **HS** | **M.HS.D.2.1 (HS.D.2.a)** Identify appropriate ways to summarize and then represent the distribution of univariate data and bivariate data through the construction of histograms, dot plots, stem plots, box plots, cumulative relative frequency graphs, time plots, circle graphs, stacked bar graphs, and mosaic bar graphs by hand or with technology.<br><br>**M.HS.D.2.2 (HS.D.2.b)** Describe the shape, identify any outliers, and determine the spread of a data set.<br><br>**M.HS.D.2.3 (HS.D.2.c)** Select and determine the appropriate measure of center based on the shape of a distribution and/or the presence of outliers.<br><br>**M.HS.D.2.4 (HS.D.2.d)** Recognize when a data set can be reasonably said to be normally distributed and draw conclusions about the data from the associated normal distribution.<br><br>**M.HS.D.2.5 (HS.D.2.e)** Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data and recognize possible associations and trends in the data. |

| | |
|---|---|
| | **M.HS.D.2.6 (HS.D.2.f)** Represent data on two quantitative variables on a scatter plot and describe how the variables are related.<br><br>**M.HS.D.2.7 (HS.D.2.g)** Use technology to develop regression models for linear and non-linear data to predict unobserved outcomes. Interpret slope and y-intercept in the context of the problem.<br><br>**M.HS.D.2.8 (HS.D.2.h)** Measure the strength of association using correlation coefficients for regression curves and interpret their meanings for the model.<br><br>**M.HS.D.2.9 (HS.D.2.i)** Use residuals and residual plots to judge the quality of a regression model.<br><br>**M.HS.D.2.10 (HS.D.2.j)** Recognize and explain when arguments based on data confuse correlation with causation.<br><br>**M.HS.D.2.11 (HS.D.2.k)** Understand what constitutes statistical significance. Interpret statistical significance in the context of a situation and answer investigative questions appropriately.<br><br>**M.HS.D.2.12 (HS>D.2.l)** Use probability as a tool for assessing risk and for informed decision making by interpreting P-values. |
| **HS Advanced Topics** | **M.AT.D.2.1 (AT.D.2.a)** Determine when a data set can be reasonably said to be normally distributed and draw conclusions about the data from the associated normal distribution.<br><br>**M.AT.D.2.2 (AT.D.2.b)** Use technology to develop regression models for linear and non-linear data to predict unobserved outcomes. Apply algebraic transformations to non-linear data to generate a linearized data set and employ linear regression techniques to analyze the non-linear data set. |
| **Essential Standard: Probability** | |
| 6, 7, 8, HS, HS Advanced Topics: Students will interpret and apply concepts of probability. | |
| **Grade** | **Content Standard(s) and Indicator(s)** |
| **6** | **M.6.D.3.1** ***(6.D.3.a)*** Identify a list of possible outcomes for a simple event (e.g., heads/tails).<br><br>**M.6.D.3.2 (6.D.3.b)** Describe the theoretical and experimental probability of an event using a fraction, percentage, and decimal.<br><br>**M.6.D.3.3** ***(6.D.3.c)*** Express the degree of likelihood (impossible, less likely, equally likely, more likely, or certain) of simple events.<br><br>**M.6.D.3.4 (6.D.3.d)** Compare and contrast theoretical and experimental probabilities. |
| **7** | **M.7.D.3.1** ***(7.D.3.a)*** Find theoretical and experimental probabilities for compound independent (e.g., drawing multiple marbles from a bag with replacement) and dependent (e.g., drawing multiple marbles from a bag without replacement) events.<br><br>**M.7.D.3.2** ***(7.D.3.b)*** Identify complementary events (e.g., rolling a two on a die compared to not rolling a two) and calculate their probabilities. |
| **8** | No new skills introduced at this level. |
| **HS** | **M.HS.D.3.1 (HS.D.3.a)** Describe events as subsets of a sample space using characteristics of the outcomes or as unions, intersections, or complements of other events.<br><br>**M.HS.D.3.2 (HS.D.3.b)** Explain independent versus dependent probability of an event. |

| | |
|---|---|
| | **M.HS.D.3.3 (HS.D.3.c)** Determine when order in counting matters and use permutations and combinations to compute probabilities of events accordingly.<br><br>**M.HS.D.3.4 (HS.D.3.d)** Recognize and explain the concepts of conditional probability in everyday language and everyday situations. |
| **HS Advanced Topics** | **M.AT.D.3.1 (AT.D.3.a)** Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. Interpret the expected value as the mean of a probability distribution.<br><br>**M.AT.D.3.2 (AT.D.3.b)** Communicate what constitutes statistical significance. Interpret statistical significance in the context of a situation and answer investigative questions appropriately.<br><br>**M.AT.D.3.3 (AT.D.3.c)** Use data to compare two groups, describe sample variability, and decide if differences between parameters are significant based on the statistics.<br><br>**M.AT.D.3.4 (AT.D.3.d)** Use probability as a tool for assessing risk and for informed decision making by computing and interpreting P-values.<br><br>**M.AT.D.3.5 (AT.D.3.e)** Use confidence intervals to estimate an unknown population parameter. |