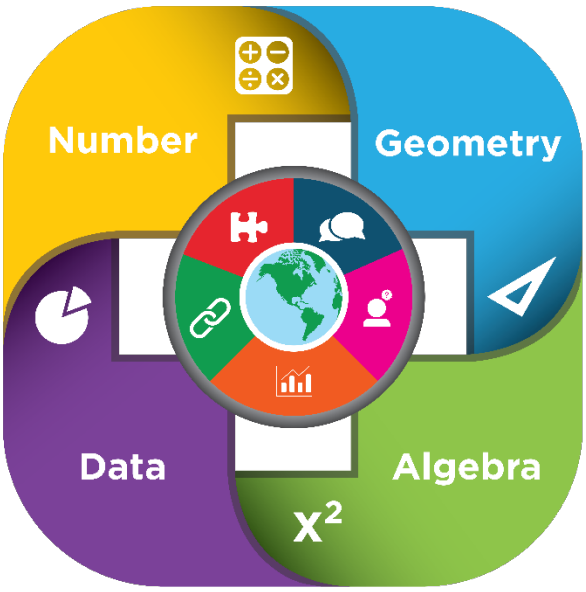
EMBARGOED UNTIL MAY 9, 2022 at 10:00 a.m. CT



Nebraska's College and Career Ready Standards for Mathematics

Draft 1 - April 2022

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Introduction

College and career-readiness for Nebraska's K-12 students requires academic content 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 in the areas of Number, Algebra, Geometry, and Data. The standards, both individually and as an integrated whole, describe not only expectations for college, career, and civic 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 post-secondary and workforce demands.

Content Area Standards Overview

Nebraska Revised Statute 79-760.01 requires the State Board of Education to adopt measurable academic content standards for the areas of reading, writing, mathematics, science, and social studies. Standards describe grade-level expectations for given content areas and provide a framework upon which Nebraska districts develop, establish, and implement curriculum. For effective teaching and learning to occur, the content area standards should drive local decisions related to instructional materials, resources, and interim, formative, and summative assessments.

The Nebraska Department of Education has identified quality criteria in the development of content area standards. These criteria ensure that standards are grounded in a strong research base of human cognition, motivation, and teaching and learning and describe essential knowledge and skills for college, career, and civic readiness. The revised Mathematics standards, written by teams of Nebraska educators and reviewed by local and national experts, were developed with the following indicators of quality:

Measurable. Standards provide benchmarks against which student progress toward learning goals can be measured.

Appropriately challenging. Standards must build in complexity so that by the end of grade 12, students are prepared for postsecondary education and the workforce.

Connected. Student learning is most effective when it connects knowledge and skills to related topics and real-world applications.

Clearly worded. Content area standards must effectively communicate what students should know and be able to do.

Scaffolded. Indicators in the Nebraska content area standards scaffold student learning by sequencing connected knowledge and skills across grades so that students build and deepen understanding and ability over time.

Specific. Specificity assures that the language used in standards and indicators is sufficiently detailed to be accurately interpreted by educators.

Mathematics Standards Design

Nebraska's Mathematics standards reflect the tiered structure common across all Nebraska content area standards. *Grade-level standards* include broad, overarching content-based statements that describe the basic cognitive or affective expectations of student learning. They also reflect, across all grade levels, the long-term goals for learning associated with college- and career-readiness. *Indicators* further describe what students must know and be able to do to meet the standard as well as provide guidance related to classroom instruction. In addition to standards and indicators, some of the Nebraska Standards for Mathematics provide examples. The "e.g." statements, where appropriate, provide guidance relative to topics that may be included in a locally determined curriculum.

Nebraska's standards are organized with three levels of specificity:

- **K-12 Comprehensive Statements**—Identify broad, general statements that are not grade-level specific and cover the five mathematical processes and four content strands for Mathematics.
- **Grade-Level Standards** —Statements that identify what students should know and be able to do by the end of each identified grade/band. These standards are the categories of each strand. Each of these standards includes a statement that describes the expectations for proficiency in the major work of the grades.

- **Indicators**—Specific information to distinguish expectations between grade levels. They are considered an integral part of the standard to be taught.

SPECIAL Coding in this Draft for editing purposes. The standards are organized using a coding system that includes the grade level, an abbreviation for the strand, a number for the standard, and the number of the indicator. *The final numbering structure is TBD based on the finalization of the document*.

Coding Example for this Draft:

Comprehensive Statement:

MA 4.1 NUMBER: Students will communicate number sense concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

Grade-Level Standards:

4.N.1 Numeric Relationships: Students will demonstrate and represent multi-digit numbers using relationships with the base-ten number system.

Indicator:

4.N.1.1 Read, write, and demonstrate multiple equivalent representations for whole numbers up to 999,999 and decimals to the hundredths using objects, visual representations, standard form, word form, and expanded form.

Spiraled, Vertical Progressions. This Draft of the revised 2022 Mathematics Standards is formatted to support the ease of receiving feedback from our stakeholders across the state. After internal review by the State Board of Education the first draft will be made public in which at that time input will be requested. There will be an input survey posted at: https://www.education.ne.gov/math/mathematics-standards-revision/

Nebraska's Mathematical Processes

Introduction. The Nebraska Mathematical Processes reflect overarching processes that students should master as they work towards college and career readiness. 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 real world 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.

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

- **Make sense of problems and persevere in solving them**. Students select tools, including real objects, concrete models, paper and pencil, technology as appropriate, and various techniques (including mental math, estimation, and number sense) to solve problems. They plan a solution pathway and then monitor their progress, changing course as necessary. Problem solving is used to acquire and demonstrate mathematical understanding. **(PROBLEM SOLVING)**

- **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. As students use and create representations, it is implied that they will evaluate the effectiveness of their representations to ensure that they are communicating mathematical ideas clearly. **(REPRESENTATIONS)**

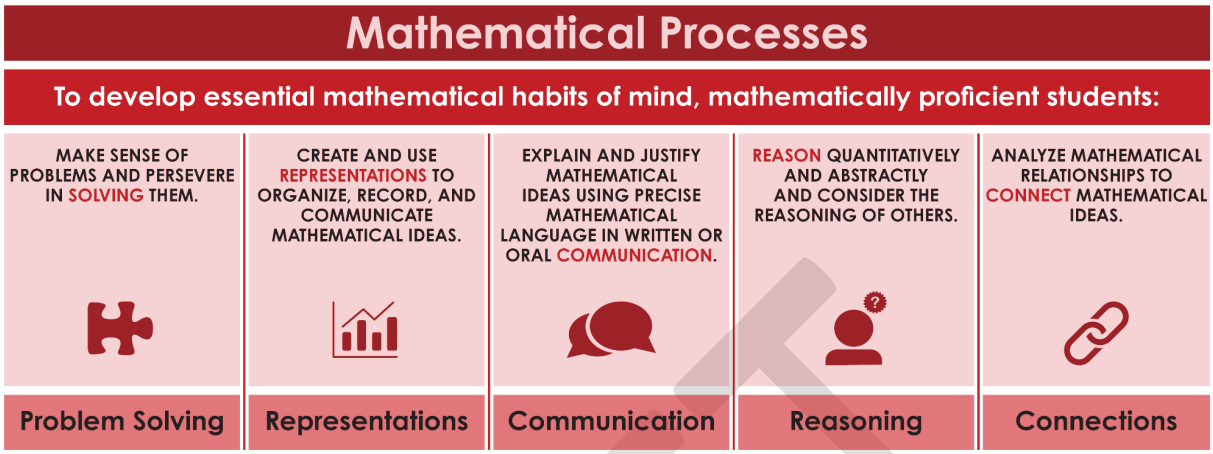
- **Explain and justify mathematical ideas using precise mathematical language in written or oral communication**. Students are expected to validate their solutions with displays, explanations, and justifications. Students make sense of the mathematics by asking helpful questions that clarify or deepen everyone's understanding. Precise mathematical language is expected. For example, students would use "vertex" instead of "corner" when referring to the point at which two edges intersect on a polygon. The intention is to make one's work

visible to others so that explanations and justifications may be shared in written or oral form. **(COMMUNICATION)**

- **Reason quantitatively and abstractly and consider the reasoning of others.** Students make sense of quantities and their relationships in problem situations. Quantitative reasoning entails knowing and flexibly using different properties of operations, numerical relationships, numbers, and geometric objects. Students can contextualize an abstract problem by placing it in a context that they can then use to make sense of the mathematical ideas. Additionally, students represent problem situations using symbols, which are interpreted as having meaning, and then manipulate those symbols in search of a solution(decontextualize). While communicating their own mathematical ideas is important, students also learn to be open to others' mathematical ideas. They appreciate a different perspective or approach to a problem. Students are able to consider the effectiveness of two plausible ideas, distinguish correct logic or reasoning from that which is flawed, and if there is a flaw in an idea, explain what it is. **(REASONING)**

- **Analyze mathematical relationships to connect mathematical ideas**. Students are expected to form conjectures based on patterns or sets of examples and nonexamples. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose. Through the practical application and modeling of mathematical situations, students will make connections among different areas of mathematics and between mathematics and other disciplines, and to real-world contexts. **(CONNECTIONS)**

Kindergarten Standards



K.N NUMBER: Students will communicate number sense concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

K.N.1 Counting: Students will understand the relationship between numbers and quantities and connect counting to cardinality.

K.N.1.1 Demonstrates instant recognition and verbally labels arrangements for briefly shown collections up to 6 (e.g. I saw 3 and 2, that is 5).

K.N.1.2 Count verbally in sequential order by ones making accurate decade transitions (e.g. 89 to 90) and by tens to 100.

K.N.1.3 Count verbally forward and backward from any given number within 20.

K.N.1.4 Write and name numbers 0 to 20 and represent a number of objects with a written numeral 0 to 20.

K.N.1.5 Understand the relationships between numbers and quantities, connecting counting to cardinality.

K.N.1.6 Use one-to-one correspondence when counting objects to show the relationship between numbers and quantities of 1 to 20.

K.N.1.7 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.

K.N.1.8 Count out the number of objects, given a number from 1 to 20.

K.N.1.9 Understand that each successive number name refers to a quantity that is one larger.

K.N.1.10 Compare the number of objects in two groups, up to 20, using the words *greater than*, *less than*, or *the same as*.

K.N.2 Base Ten: Students will work with numbers 11-19 to gain a foundation for place value.

K.N.2.1 Compose and decompose numbers from 11 to 19 into a group of ten ones and some more ones using a model, drawing, or equation.

K.N.3 Number and Algebraic Relationships: Students will understand and demonstrate the meaning of addition and subtraction.

K.N.3.1 Represent 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.

K.N.3.2 Compose and decompose numbers less than or equal to 10 into pairs in more than one way using objects or drawings.

K.N.3.3 For any number from 1 to 9, find the number that makes 10 when added to the given number, showing the answer with a model, drawing, or equation.

K.N.3.4 Fluently add and subtract within 5.

K.N.3.5 Solve real-world situations that involve addition and subtraction within 10 (e.g. by using objects, drawings, and equations to represent the problem).

K.A ALGEBRA: Students will communicate algebraic concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

SEE NUMBER AND ALGEBRAIC RELATIONSHIPS IN NUMBER (K.N.3)

K.G GEOMETRY: Students will communicate geometric concepts and measurement concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

K.G.1 Shapes and Their Attributes: Students will identify and represent the attributes of two-dimensional shapes and three-dimensional solids.

K.G.1.1 Identify two-dimensional shapes including circles, triangles, squares, and rectangles.

K.G.1.2 Identify shapes as two-dimensional (e.g. *flat*) or three-dimensional (e.g. *solid*).

K.G.1.3 Create shapes using materials and describe one or more of the attributes.

K.G.1.4 Combine simple shapes to compose larger shapes.

K.G.2 Measurement: Students will describe and compare measurable attributes.

K.G.2.1 Describe measurable attributes of real-world objects.

K.G.2.2 Directly compare two objects with a measurable attribute in common, and describe which object has *more* or *less* of the attribute.

K.G.3 Time and Money: Students will know coin names and values and tell time to the hour.

K.G.3.1 Identify the name and value of a penny, dime, nickel, and quarter.

K.G.3.2 Tell and write time to the hour using analog and digital clocks.

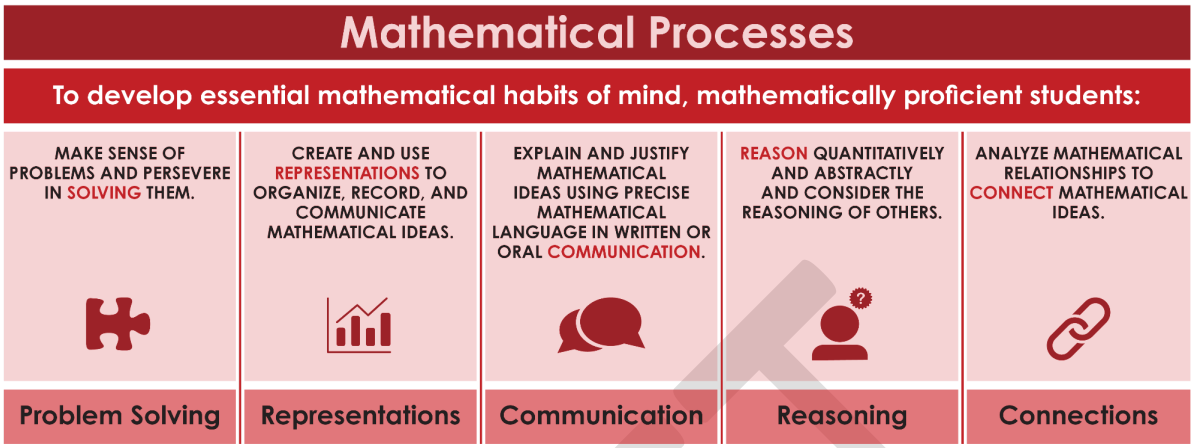
K.D DATA: Students will communicate data analysis/probability concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

K.D.1 Classification: Students will sort and classify objects using one or more attributes.

K.D.1.1 Identify, sort, and classify objects by size, shape, color, and other attributes (e.g. texture, indoors vs. outdoors, living vs. inanimate).

K.D.1.2 Identify objects that do not belong to a particular group and explain the reasoning used.

Grade 1 Standards



1.N NUMBER: Students will communicate number sense concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

1.N.1 Counting: Students will understand the relationship between numbers and quantities to extend the counting sequence.

1.N.1.1 Demonstrates instant recognition by verbally labeling arrangements for briefly shown *structured* collections up to 20 (e.g. I saw 10 on the ten-frame and 3 more, that is 13).

1.N.1.2 Count verbally by ones and tens within 120 starting at any given number.

1.N.1.3 Write and name numbers to 120 and represent a number of objects with a written numeral to 120.

1.N.1.4 Write numerals to match a representation of a given set of objects for numbers up to 120.

1.N.1.5 Understand patterns of skip-counting by 2s, 5s, and 10s.

1.N.2 Base Ten: Students will represent and compare two-digit numbers to gain foundations for place value.

1.N.2.1 Understand 10 as a bundle of ten ones and that the two digits of a two-digit number can be composed of *some* tens and *some* ones.

1.N.2.2 Compare two, two-digit numbers by using words and symbols <, =, and > to justify the comparison based on the number of tens and ones.

1.N.3 Number and Operations: Students will compute using addition and subtraction.

1.N.3.1 Fluently add and subtract within 10.

1.N.3.2 Add and subtract within 20, using flexible strategies and derived combinations.

1.N.3.3 Find the difference between two numbers that are multiples of 10, ranging from 10 – 90 using concrete models, drawings or strategies, and write the corresponding equation.

1.N.3.4 Mentally find 10 more or 10 less than a two-digit number without having to count and explain the reasoning used.

1.N.3.5 Add and subtract within 100 using concrete models, drawings, and strategies which reflect understanding of place value and properties of operations.

1.N.4 Number and Algebraic Relationships: Students will understand and apply properties of operations and the relationship between addition and subtraction to solve problems.

1.N.4.1 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, and 7 + 2 = 5 + 4).

1.N.4.2 Use the relationship of addition and subtraction to solve subtraction problems (e.g., find 12 – 9 = ___, using the addition fact 9 + 3 = 12).

1.N.4.3 Determine the unknown whole number in an addition or subtraction equation (e.g. 7 + ? = 13).

1.N.4.4 Decompose numbers and use the commutative property of addition to develop addition and subtraction strategies including making 10's and counting on from the larger number to add and subtract basic facts within 20.

1.N.4.5 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.

1.N.4.6 Solve real-world situations 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.

1.N.4.7 Create a real-world problem to represent a given equation involving addition and subtraction within 20.

1.A ALGEBRA: Students will communicate algebraic concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

SEE NUMBER AND ALGEBRAIC RELATIONSHIPS IN NUMBER (1.N.4)

1.G GEOMETRY: Students will communicate geometric concepts and measurement concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

1.G.1 Shapes and Their Attributes: Students will represent and describe the attributes of two-dimensional shapes.

1.G.1.1 Determine defining and non-defining attributes of two-dimensional shapes; build and draw shapes that match the given definition.

1.G.1.2 Decompose circles and rectangles into two and four equal parts using the language *halves* and *fourths*.

1.G.2 Measurement: Students will measure and compare lengths.

1.G.2.1 Measure the length of an object as a whole number of same-size, non-standard units by placing them end-to-end.

1.G.2.2 Order three objects by directly comparing their lengths or indirectly by using a third object.

1.G.3 Time and Money: Students will solve problems with coins and tell time to the half hour.

1.G.3.1 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.

1.G.3.2 Count collections of like coins (*penny*, *nickel*, and *dime*) relating to patterns of counting by 1s, 5s, and 10s.

1.G.3.3 Tell and write time to the half hour and hour using analog and digital clocks.

1.D DATA: Students will communicate data analysis/probability concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

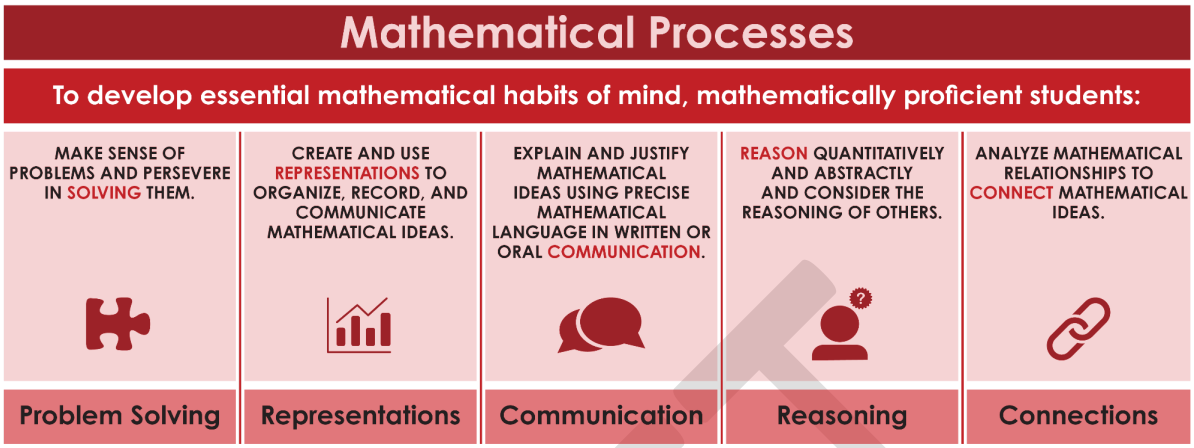
1.D.1 Data Collection: Students will formulate questions to collect, organize, and represent data.

1.D.1.1 Collect, organize, and represent a data set with up to three categories using a picture graph.

1.D.2 Analyze Data and Interpret Results: Students will analyze the data and interpret the results.

1.D.2.1 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.

Grade 2 Standards



2.N NUMBER: Students will communicate number sense concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

2.N.1 Counting: Students will understand the relationship between numbers and quantities to extend the counting sequence.

2.N.1.1 Demonstrates instant recognition by verbally labeling *structured* arrangements shown briefly, using groups, multiplicative thinking, and place value (e.g. I saw groups of ten and groups of 4; 4 groups of ten is 40 and 2 groups of 4 is 8 … 48).

2.N.1.2 Count within 1000, including skip-counting by 5s, 10s, and 100s starting at a variety of multiples of 5, 10, or 100.

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

2.N.2.1 Read and write numbers within the range of 0 – 1,000 using standard, word, and expanded forms.

2.N.2.2 Demonstrate 100 as a bundle of ten tens and that the three digits of a three-digit number can be composed of *some* hundreds, *some* tens, and *some* ones.

2.N.2.3 Compare two three-digit numbers by using symbols <, =, and > and justify the comparison based on the value of the hundreds, tens, and ones.

2.N.3 Number and Operations: Students will compute using addition and subtraction.

2.N.3.1 Fluently add and subtract within 20.

2.N.3.2 Add and subtract within 100 using strategies based on place value including algorithms, properties of operations, and/or the relationship between addition and subtraction.

2.N.3.3 Mentally add or subtract 10 or 100 to/from a given number 100-900.

2.N.3.4 Add up to three two-digit numbers using strategies based on place value and understanding of properties.

2.N.3.5 Add and subtract within 1000 using concrete models, drawings, and strategies which reflect understanding of place value and properties of operations.

2.N.4 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.4.1 Solve real-world situations 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.

2.N.4.2 Create real-world situations to represent one-step addition and subtraction within 100, with unknowns in all positions.

2.N.4.3 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.

2.N.4.4 Identify a group of objects from 0-20 as even or odd by counting by 2's or by showing even numbers as a sum of two equal parts.

2.A ALGEBRA: Students will communicate algebraic concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

SEE NUMBER AND ALGEBRAIC RELATIONSHIPS IN NUMBER (2.N.2)

2.G GEOMETRY: Students will communicate geometric concepts and measurement concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

2.G.1 Shapes and Their Attributes: Students will recognize and represent the attributes of two-dimensional shapes and three-dimensional solids.

2.G.1.1 Identify three-dimensional shapes such as cubes, rectangular prisms, cones, spheres, and cylinders.

2.G.1.2 Recognize and draw two-dimensional shapes having a specific number of sides, angles, and vertices including triangles, quadrilaterals, pentagons, and hexagons.

2.G.1.3 Partition a rectangle into rows and columns of equal-sized squares and count to find the total.

2.G.1.4 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*.

2.G.1.5 Recognize that equal shares of identical wholes need not have the same shape.

2.G.2 Describe Measurable Attributes: Students will measure, estimate, and compare lengths to build meaning of the measurement process.

2.G.2.1 Measure the length of an object using two different length units and describe how the measurements relate to the size of the specific unit.

2.G.2.2 Compare the difference in length of objects using inches and feet or centimeters and meters.

2.G.3 Measurement: Students will use tools to measure and estimate length using standard units.

2.G.3.1 Identify and use appropriate tools for measuring length.

2.G.3.2 Measure and estimate lengths using whole numbers with inches, feet, centimeters, and meters.

2.G.4 Relate Addition and Subtraction to Measurement: Students will add or subtract to solve length problems.

2.G.4.1 Represent whole numbers as equally-spaced lengths on a number line diagram. Use number lines to find sums and differences within 100.

2.G.4.2 Use addition and subtraction within 100 to solve problems using the same standard-length units.

2.G.5 Time and Money: Students will solve problems with dollar bills and coins and tell time to the nearest five-minute interval.

2.G.5.1 Solve problems involving dollar bills, quarters, dimes, nickels, and pennies, using $ and ¢ symbols appropriately.

2.G.5.2 Identify and write time to five-minute intervals using analog and digital clocks and both a.m. and p.m.

2.D DATA: Students will communicate data analysis/probability concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

2.D.1 Data Collection: Students will formulate questions to collect, organize, and represent data.

2.D.1.1 Ask real-world questions to generate data and represent the data using scaled picture graphs with up to four categories.

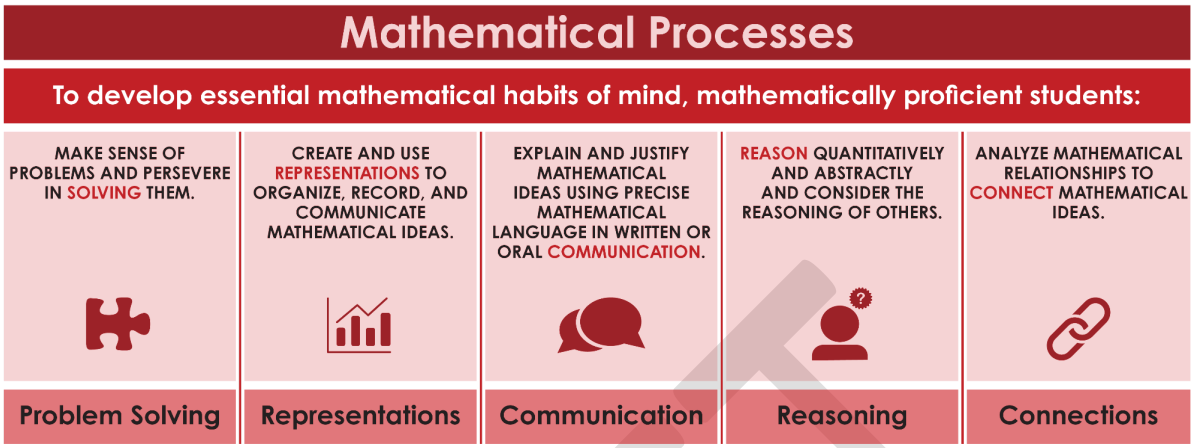
2.D.1.2 Ask real-world questions to generate data and represent the data using bar graphs with up to four categories.

2.D.1.3 Create and represent a data set by making a line plot using whole numbers.

2.D.2 Analyze Data and Interpret Results: Students will analyze the data and interpret the results.

2.D.2.1 Interpret data using scaled picture graphs or bar graphs with up to four categories and solve simple comparison problems using information from the graphs.

Grade 3 Standards



3.N NUMBER: Students will communicate number sense concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

3.N.1 Numeric Relationships: Students will demonstrate and represent multi-digit numbers using place value understanding.

3.N.1.1 Read, write, and demonstrate multiple equivalent representations for numbers up to 99,999 using objects or visual representations including standard form, word form, and expanded form.

3.N.1.2 Compare whole numbers up to 99,999 and represent the comparisons using the symbols >, < or =.

3.N.2 Fractions: Students will develop understanding of fractions as numbers.

3.N.2.1 Represent and understand a fraction as a number on a number line.

3.N.2.2 Find parts of a whole and parts of a set using visual representations.

3.N.2.3 Show and identify equivalent fractions using visual representations including pictures, manipulatives, and number lines.

3.N.2.4 Justify whole numbers as fractions and identify fractions that are equivalent to whole numbers.

3.N.2.5 Compare and order fractions having the same numerators or denominators by reasoning about their size.

3.A ALGEBRA: Students will communicate algebraic concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

3.A.1 Operations and Algebraic Thinking: Students will apply operational properties to solve problems involving the four operations.

3.A.1.1 Add and subtract 4 digit numbers with or without regrouping.

3.A.1.2 Determine the reasonableness of whole number sums and differences in real-world situations.

3.A.1.3 Solve and write a one-step whole number equations using the four operations including the use of a letter to represent the unknown quantity.

3.A.1.4 Interpret and solve two step real-world situations involving whole numbers and involving the four operations.

3.A.1.5 Apply commutative, associative, distributive, identity and zero properties as strategies to multiply and divide.

3.A.1.6 Use drawings, words, arrays, symbols, repeated addition, equal groups, and number lines to interpret and explain the meaning of multiplication.

3.A.1.7 Use objects, drawings, arrays, words and symbols to explain the relationship between multiplication and division (e.g., if 3 x 4 = 12 then 12 ÷ 3 = 4).

3.A.1.8 Identify arithmetic patterns, including patterns in the addition table or multiplication table, and explain them using properties of operations.

3.A.1.9 Fluently multiply and divide within 100 using strategies based on understanding and properties of operations.

3.A.1.10 Multiply one digit whole numbers by multiples of 10 in the range of 10 to 90.

3.G GEOMETRY: Students will communicate geometric concepts and measurement concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

3.G.1 Shapes and Their Attributes: Students will recognize and represent the attributes of two-dimensional shapes.

3.G.1.1 Sort quadrilaterals into categories according to their attributes.

3.G.2 Area and Perimeter: Students will recognize perimeter and area as attributes of plane figures and understand concepts of area measurement.

3.G.2.1 Solve real-world and mathematical problems involving perimeters of polygons given the side lengths and find an unknown side length.

3.G.2.2 Use concrete and pictorial models to measure areas in square units by counting square units.

3.G.2.3 Divide two-dimensional figures into equal areas, and express the area of each part as a unit fraction of the whole.

3.G.2.4 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 it would be found by multiplying the side lengths.

3.G.2.5 Identify and draw rectangles with the same perimeter and different areas or with the same area and different perimeters.

3.G.3 Measurement: Students will use tools to solve measurement problems.

3.G.3.1 Identify and use the appropriate tools and units of measurement, both customary and metric, to solve real-world situations involving length, weight, mass, liquid volume, and capacity (within the same system and unit).

3.G.3.2 Estimate and measure length to the nearest half inch, quarter inch, and centimeter.

3.G.4 Time: Students will tell time to the nearest minute and find elapsed time.

3.G.4.1 Tell and write time to the minute using both analog and digital clocks.

3.G.4.2 Solve real-world situations involving addition and subtraction of time intervals and find elapsed time.

3.D Students will communicate data analysis/probability concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

3.D.1 Data Collection: Students will formulate questions to collect, organize, and represent data.

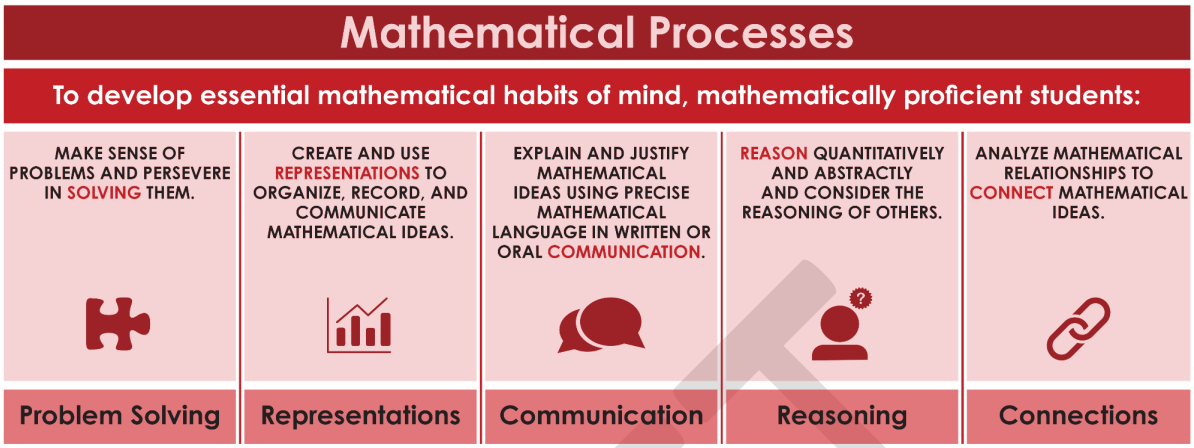
3.D.1.1 Create scaled picture graphs and scaled bar graphs to represent a data set with more than four categories, including data collected through observations, surveys, and experiments.

3.D.1.2 Generate and represent data using line plots where the horizontal scale is marked off in halves and whole number units.

3.D.2 Analyze Data and Interpret Results: Students will analyze the data and interpret the results.

3.D.2.1 Analyze data and make simple statements about quantity differences using information represented in picture graphs, line plots, and bar graphs.

Grade 4 Standards



MA 4.1 NUMBER: Students will communicate number sense concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

4.N.1 Numeric Relationships: Students will demonstrate and represent multi-digit numbers using relationships with the base-ten number system.

4.N.1.1 Read, write, and demonstrate multiple equivalent representations for whole numbers up to 999,999 and decimals to the hundredths using objects, visual representations, standard form, word form, and expanded form.

4.N.1.2 Compare whole numbers up to 999,999 and decimals through the hundredths place using >, <, and = symbols and visual representations.

4.N.1.3 Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.

4.N.1.4 Round a multi-digit whole number to any given place.

4.N.1.5 Use decimal notation for fractions with denominators of 10 or 100. (e.g. 43/100 = 0.43)

4.N.2 Factors and Multiples: Students will find factors and multiples and classify numbers as prime or composite.

4.N.2.1 Determine whether a given whole number up to 100 is a multiple of a given one-digit number.

4.N.2.2 Determine factors of any whole number up to 100 and classify a number up to 100 as prime or composite.

4.N.3 Fractions: Students will explain equivalence of fractions and compare fractions.

4.N.3.1 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.

4.N.3.2 Explain and demonstrate how equivalent fractions are generated by multiplying by a fraction equivalent to 1.

4.N.3.3 Compare and order fractions having unlike numerators or denominators using benchmarks, reasoning strategies, and/or equivalence.

4.N.4 Operations with Fractions: Students will understand and demonstrate fractional computation.

4.N.4.1Decompose 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.

4.N.4.2 Use drawings, words, and/or equations to explain the meaning of addition and subtraction of fractions with like denominators.

4.N.4.3 Solve real-world and mathematical problems involving addition and subtraction of fractions and mixed numbers with like denominators.

4.N.4.4 Multiply a fraction by a whole number using models and visual representations.

4.A ALGEBRA: Students will communicate algebraic concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

4.A.1 Operations and Algebraic Thinking: Students will apply operational properties to solve problems involving the four operations and variables.

4.A.1.1 Add and subtract multi-digit numbers using the standard algorithm.

4.A.1.2 Multiply 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 and the properties of operations.

4.A.1.3 Divide up to a four-digit whole number by a one-digit divisor with and without a remainder using strategies based on place value.

4.A.1.4 Determine the reasonableness of whole number products and quotients in real-world situations.

4.A.1.5 Create a simple algebraic expression or equation using a variable for an unknown number to represent a math process (e.g., 3 + n = 15, 81 ÷ n = 9).

4.A.1.6 Solve one- and two-step real-world situations using the four operations including interpreting remainders and the use of a letter to represent the unknown quantity.

4.G GEOMETRY: Students will communicate geometric concepts and measurement concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

4.G.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.1.1 Identify and create points, lines, line segments, rays, angles, parallel lines, perpendicular lines, and intersecting lines.

4.G.1.2 Classify angles and triangles as acute, obtuse, or right.

4.G.1.3 Classify two-dimensional shapes based on the presence or absence of parallel and perpendicular lines, or the presence or absence of specific angles.

4.G.1.4 Recognize and draw lines of symmetry in two-dimensional shapes.

4.G.2 Measurement: Students will measure and estimate various attributes including angles.

4.G.2.1 Identify and use the appropriate tools, operations, and units of measurement, both customary and metric, to solve real-world situations involving time, length, weight, mass, and capacity.

4G.2.2 Determine the reasonableness of measurements involving time, length, weight, mass, capacity, and angles.

4G.2.3 Generate simple conversions from a larger unit to a smaller unit within the customary and metric systems of measurement.

4.G.2.4 Measure angles in whole number degrees.

4.G.2.5 Recognize angle measure as additive and solve problems involving addition and subtraction to find unknown angles in a diagram.

4.G.3 Area and Perimeter: Students will apply perimeter and area formulas for rectangles.

4.G.3.1 Apply perimeter and area formulas for rectangles to solve real-world situations.

4.D DATA: Students will communicate data analysis/probability concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

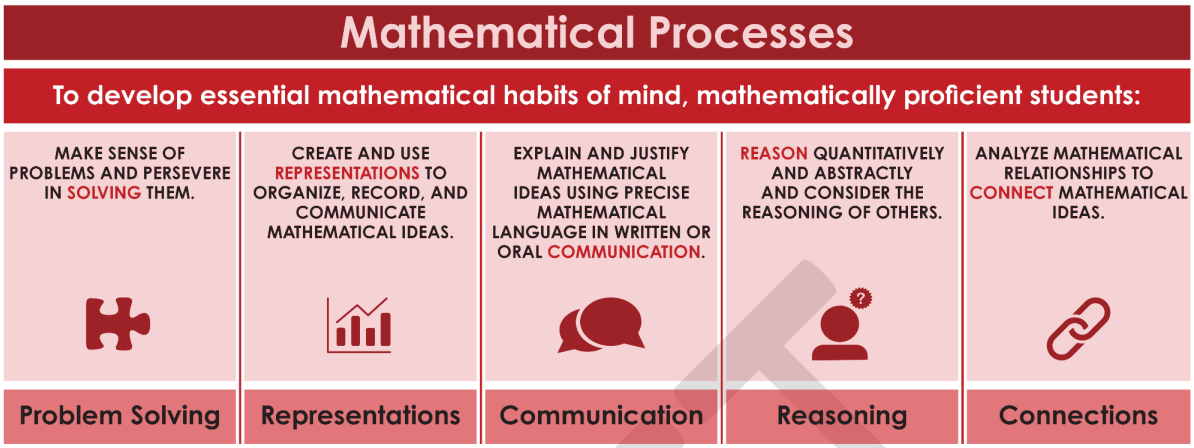
4.D.1 Data Collection: Students will formulate questions to collect, organize, and represent data.

4.D.1.1 Generate and represent data using line plots where the horizontal scale is marked off in appropriate units—whole numbers, halves, quarters, or eighths.

4.D.2 Analyze Data and Interpret Results: Students will analyze the data and interpret the results.

4.D.2.1 Solve real world problems and analyze data involving addition or subtraction of fractions presented in line plots.

Grade 5 Standards



5.N NUMBER: Students will communicate number sense concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

5.N.1 Numeric Relationships: Students will understand the place value system.

5.N.1.1 Read, write, and demonstrate multiple equivalent representations for multi-digit whole numbers and decimals through the thousandths place using standard form, word form, and expanded form.

5.N.1.2 Recognize a digit in one place represents 1/10 what it represents in the place to its left.

5.N.1.3 Round decimals to any given place.

5.N.1.4 Use whole number exponents to denote powers of 10.

5.N.2 Fraction: Students will extend fraction equivalence understanding.

5.N.2.1 Generate equivalent forms of commonly used fractions and decimals (e.g., halves, thirds, fourths, fifths, and tenths).

5.N.2.2 Compare whole numbers, fractions, mixed numbers, and decimals through the thousandths place using symbols <,>, or =.

5.N.3 Operations with Fractions: Students will apply and extend previous understandings of whole number operations to add, subtract, multiply and divide fractions.

5.N.3.1 Interpret a fraction as division of the numerator by the denominator.

5.N.3.2 Multiply a whole number by a fraction or a fraction by a fraction using models and visual representations.

5.N.3.3 Divide a unit fraction by a whole number and a whole number by a unit fraction using models and visual representations.

5.N.3.4 Solve real-world situations involving addition and subtraction of fractions and mixed numbers with like and unlike denominator

5.N.3.5 Add and subtract fractions and mixed numbers with unlike denominators without simplifying.

5.A ALGEBRA: Students will communicate algebraic concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

5.A.1 Operations and Algebraic Thinking: Students will apply operational properties to solve problems involving multiplication and division.

5.A.1.1 Multiply multi-digit whole numbers using the standard algorithm.

5.A.1.2 Divide four-digit whole numbers by a two-digit divisor, with and without remainders, using strategies based on place value

5.A.1.3 Justify the reasonableness of computations involving whole numbers, fractions, and decimals.

5.A.1.4 Form ordered pairs from real-world situations involving rules or patterns and graph the ordered pairs in the first quadrant on a coordinate plane.

5.G GEOMETRY: Students will communicate geometric concepts and measurement concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

5.G.1 Shapes and Their Attributes: Students will describe geometric attributes of two-dimensional shapes and three-dimensional solids.

5.G.1.1 Identify faces, edges, and vertices of rectangular prisms.

5.G.1.2 Recognize volume as an attribute of solid figures that is measured in cubic units.

5.G.1.3 Justify the classification of two-dimensional figures based on their properties.

5.G.2 Measurement: Generate conversions within the customary and metric systems of measurement.

5.G.2.1 Generate conversions in both directions, from larger units to smaller units and smaller units to larger units, within the customary and metric systems of measurement.

5.G.3 Area and Volume: Students will extend area problems for rectangles to include fractions and build meaning for measuring volume.

5.G.3.1 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.

5.G.3.2 Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.

5.G.3.3 Use concrete models to measure the volume of rectangular prisms by counting cubic units.

5.G.3.4 Find the volume of a rectangular prism with whole-number side lengths by modeling with unit squares, 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.

5.G.3.5 Solve real-world and mathematical 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.

5.D DATA: Students will communicate data analysis/probability concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

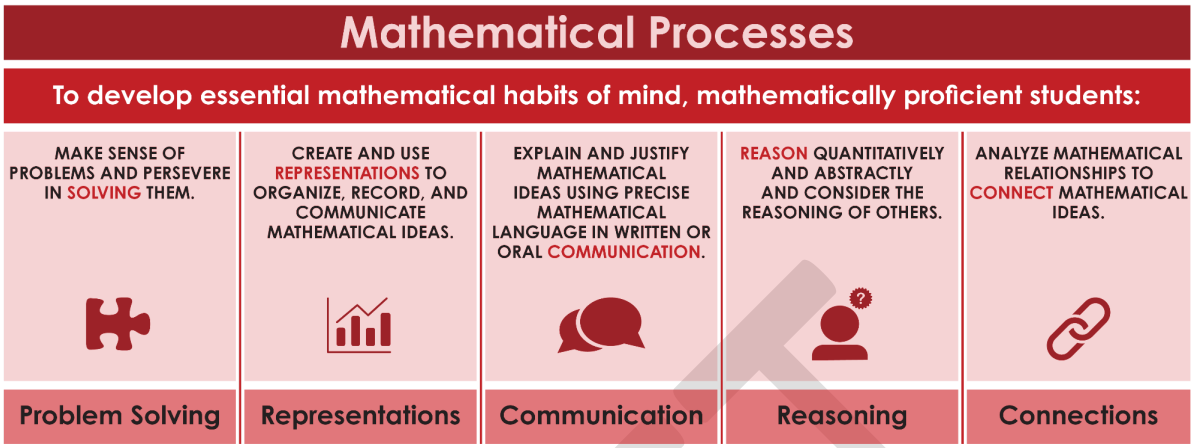
5.D.1 Data Collection: Students will formulate questions to collect, organize, and represent data.

5.D.1.1 Formulate a real-world question that can be addressed with fractional data and represent it on a line plot.

5.D.2 Analyze Data and Interpret Results: Students will analyze the data and interpret the results.

5.D.2.1 Analyze data using information represented in in line plots and apply fraction computation.

Grade 6 Standards



6.N NUMBER: Students will communicate number sense concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

6.N.1 Numeric Relationships: Students will demonstrate, represent, and show relationships among fractions, decimals, percents, and integers within the base-ten number system.

6.N.1.1 Determine common factors and common multiples.

6.N.1.2 Determine prime factorization of numbers with and without exponents.

6.N.1.3 Model integers using drawings, words, number lines, models and symbols.

6.N.1.4 Determine absolute value of rational numbers.

6.N.1.5 Compare and order numbers including non-negative fractions and decimals, integers, and absolute values and locate them on the number line.

6.N.2 Operations: Students will compute with fractions and decimals accurately.

6.N.2.1 Add, subtract, multiply, and divide non-negative fractions, mixed numbers, and decimals.

6.N.2.2 Evaluate numerical expressions including absolute value and/or positive exponents with respect to order of operations.

6.R RATIOS AND PROPORTIONS: Students will understand ratio concepts and use ratio reasoning to solve problems.

6.R.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 them to solve real-world situations.

6.R.1.1 Determine ratios from concrete models, drawings, and/or words.

6.R.1.2 Explain and determine unit rates.

6.R.1.3 Find a percent of a quantity as a rate per 100 and solve problems involving finding the whole, given a part and the percent.

6.R.1.4 Convert among fractions, decimals, and percents using multiple representations.

6.R.1.5 Solve real-world situations using ratios, unit rates, and percents.

6.R.1.6 Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

6.R.2 Represent: Students will represent ratios and rates on the coordinate plane.

6.R.2.1 Identify the ordered pair of a given point in the coordinate plane.

6.R.2.2 Plot the location of an ordered pair in the coordinate plane.

6.R.2.3 Identify the location of a given point in the coordinate plane (e.g. axis, origin, quadrant).

6.R.2.4 Make tables of equivalent ratios relating quantities with whole number measurements.

6.R.2.5 Use the constant of proportionality to find the missing value in ratio tables.

6.R.2.6 Plot the pair of values from a ratio table on the coordinate plane.

6.R.2.7 Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation.

6.A ALGEBRA: Students will communicate algebraic concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

6.A.1 Algebraic Processes: Students will apply the operational properties when evaluating expressions and solving equations and inequalities.

6.A.1.1 Recognize and generate equivalent algebraic expressions involving the distributive property and combining like terms.

6.A.1.2 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.

6.A.1.3 Use substitution to determine if a given value for a variable makes an equation or inequality true.

6.A.1.4 Solve one-step equations with non-negative rational numbers using addition, subtraction, multiplication, and division.

6.A.1.5 Solve one-step inequalities with whole numbers using addition, subtraction, multiplication, and division and represent solutions on a number line (e.g., graph $x > 3$).

6.A.2 Applications: Students will solve real-world situations with algebraic expressions, equations and inequalities.

6.A.2.1 Create algebraic expressions (e.g., one operation, one variable as well as multiple operations, one variable) from word phrases.

6.A.2.2 Write equations (e.g., one operation, one variable) to represent real-world situations involving non-negative rational numbers.

6.A.2.3 Write inequalities (e.g., one operation, one variable) to represent real-world situations involving whole numbers.

6.G GEOMETRY: Students will communicate geometric concepts and measurement concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

6.G.1 Attributes: Students will identify and describe geometric attributes of two-dimensional shapes.

6.G.1.1 Identify and create nets to represent two-dimensional drawings of prisms, pyramids, cylinders, and cones.

6.G.2 Coordinate Geometry: Students will determine location, orientation, and relationships on the coordinate plane.

SEE WORK WITH COORDINATE PLANES IN RATIOS AND PROPORTIONS (6.R.2)

6.G.3 Measurement: Students 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.3.1 Determine the area of quadrilaterals, including parallelograms, trapezoids, and triangles, by composition and decomposition of polygons as well as application of formulas.

6.G.3.2 Determine the surface area of rectangular prisms and triangular prisms using nets as well as application of formulas.

6.G.3.3 Apply volume formulas for triangular prisms.

6.D DATA: Students will communicate data analysis/probability concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

6.D.1 Data Collection & Statistical Methods: Students will formulate statistical investigative questions, collect data, and organize data.

No additional indicators at this level.

6.D.2 Analyze Data and Interpret Results: Students will represent and analyze the data and interpret the results.

6.D.2.1 Represent data using dot plots, box-and-whisker plots, and histograms.

6.D.2.2 Solve problems using information presented in dot plots, box-and-whisker plots, histograms, and circle graphs.

6.D.2.3 Find and interpret the mean, median, mode, and range for a set of data.

6.D.2.4 Compare the mean, median, mode, and range from two sets of data.

6.D.2.5 Compare and interpret data sets based upon their measures of central tendency and graphical representations (e.g., center, spread, and shape).

6.D.3 Probability: Students will interpret and apply concepts of probability.

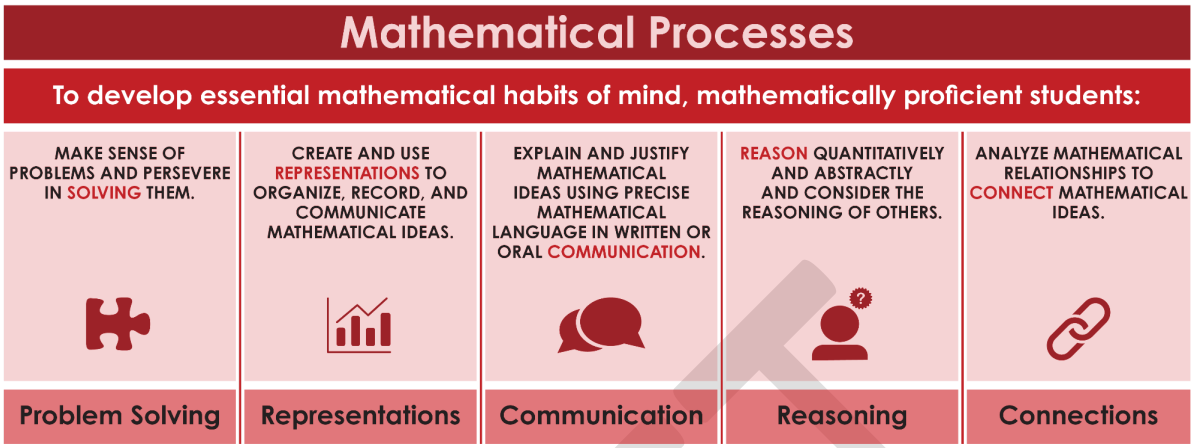
6.D.3.1 Identify a list of possible outcomes for a simple event.

6.D.3.2 Describe the theoretical and experimental probability of an event using a fraction, percentage, and decimal.

6.D.3.3 Express the degree of likelihood (possible, impossible, certain, more likely, equally likely, or less likely) of simple events.

6.D.3.4 Compare and contrast theoretical and experimental probabilities.

Grade 7 Standards



7.N NUMBER: Students will communicate number sense concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

7.N.1 Numeric Relationships: Students will demonstrate, represent, and show relationships among rational numbers within the base-ten number system.

No additional indicator(s) at this level.

7.N.2 Operations: Students will compute with rational numbers accurately.

7.N.2.1 Add, subtract, multiply, and divide rational numbers (e.g., positive and negative fractions, decimals, and integers).

7.N.2.2 Apply properties of operations (commutative, associative, distributive, identity, inverse, zero) as strategies for problem solving with rational numbers.

7.R RATIOS AND PROPORTIONS: Students will understand proportions and use proportional reasoning to solve problems.

7.R.1 Proportional Relationships: Students will understand the concept of proportions, use language to describe the relationship between two quantities, and use them to solve real-world situations.

7.R.1.1 Decide whether two quantities are in a proportional relationship (e.g., by testing for equivalent ratios in a table).

7.R.1.2 Represent and solve real-world situations with proportions.

7.R.1.3 Use proportional relationships to solve real-world percent problems (e.g., % increase, % decrease, mark-up, discount, tip).

7.R.1.4 Solve real-world situations involving scale drawings.

7.A ALGEBRA: Students will communicate algebraic concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

7.A.1 Algebraic Processes: Students will apply the operational properties when evaluating expressions, and solving equations and inequalities.

7.A.1.1 Use factoring and properties of operations to create equivalent algebraic expressions (e.g., $2x + 6 = 2(x + 3)$).

7.A.1.2 Given the value of the variable(s), evaluate algebraic expressions which may include absolute value.

7.A.1.3 Solve one- and two-step equations involving rational numbers.

7.A.1.4 Solve equations using the distributive property and combining like terms.

7.A.1.5 Solve one- and two-step inequalities involving integers and represent solutions on a number line.

7.A.2 Applications:Students will solve real-world situations with algebraic expressions, equations and inequalities.

7.A.2.1 Write one- and two-step equations involving rational numbers from words, tables, and real-world situations.

7.A.2.2 Write one- and two-step inequalities to represent real-world situations involving integers.

7.G GEOMETRY: Students will communicate geometric concepts and measurement concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

7.G.1 Geometric Attributes: Students will identify angle relationships and apply properties to determine angle measures.

7.G.1.1 Apply properties of adjacent, complementary, supplementary, linear pair, and vertical angles to find missing angle measures.

7.G.2 Coordinate Geometry: Students will determine location, orientation, and relationships on the coordinate plane.

7.G.2.1 Draw polygons in the coordinate plane given coordinates for the vertices.

7.G.2.2 Calculate vertical and horizontal distances in the coordinate plane to find perimeter and area of polygons.

7.G.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.3.1 Solve real-world situations involving perimeter and area of composite shapes made from triangles and quadrilaterals.

7.G.3.2 Determine surface area and volume of composite rectangular and triangular prisms.

7.G.3.3 Determine the area and circumference of circles both on and off the coordinate plane using 3.14 for the value of Pi.

7.D DATA: Students will communicate data analysis/probability concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

7.D.1 Data Collection & Statistical Methods: Students will formulate statistical investigative questions, collect data, and organize data.

7.D.1.1 Create an investigative question and collect data.

7.D.1.2 Generate conclusions about a population based on a random sample.

7.D.1.3 Identify and critique biases in various data representations.

7.D.2 Analyze Data and Interpret Results: Students will represent and analyze the data and interpret the results.

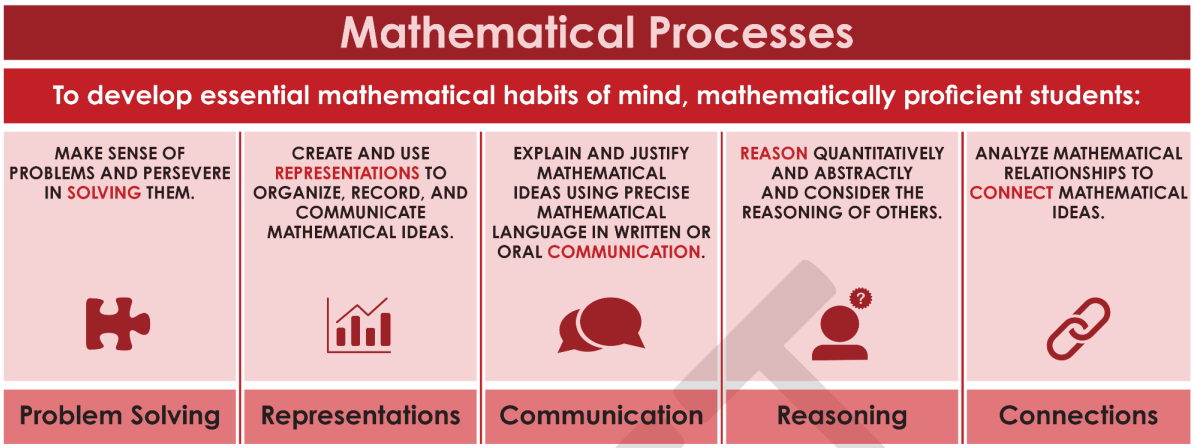
No additional indicator(s) at this level.

7.D.3 Probability: Students will interpret and apply concepts of probability.

7.D.3.1 Find theoretical and experimental probabilities for compound independent and dependent events.

7.D.3.2 Identify complementary events and calculate their probabilities.

Grade 8 Standards



8.N NUMBER: Students will communicate number sense concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

8.N.1 Numeric Relationships: Students will demonstrate, represent, and show relationships among real numbers within the base-ten number system.

8.N.1.1 Determine subsets of numbers as natural, whole, integer, rational, irrational, or real based on the definitions of these sets of numbers.

8.N.1.2 Represent numbers with positive and negative exponents and in scientific notation.

8.N.1.3 Describe the difference between a rational and irrational number.

8.N.1.4 Approximate, compare, and order real numbers, both rational and irrational, and locate them on the number line.

8.N.2 Operations: Students will compute with exponents and roots.

8.N.2.1 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.

8.N.2.2 Simplify numerical expressions involving integer exponents, square roots, and cube roots (e.g., 4^{-2} is the same as 1/16).

8.N.2.3 Evaluate numerical expressions involving absolute value.

8.N.2.4 Multiply and divide numbers using scientific notation.

8.A ALGEBRA: Students will communicate algebraic concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

8.A.1 Algebraic Processes: Students will apply the operational properties when evaluating expressions and solving equations.

8.A.1.1 Describe single variable equations as having one solution, no solution, or infinitely many solutions.

8.A.1.2 Solve multi-step equations involving rational numbers with the same variable appearing on both sides of the equation.

8.A.1.3 Solve equations of the form $x^2 = k (k <= 400)$ and $x^3 = k (k <= 125)$, where k is a positive rational number, using square root and cube root symbols.

8.A.2 Applications: Students will solve real-world situations with algebraic equations.

8.A.2.1 Write multi-step single variable equations from words, tables, and real-world situations.

8.A.2.2 Determine and describe the rate of change for given situations through the use of tables and graphs.

8.A.2.3 Graph proportional relationships and interpret the rate of change.

8.G GEOMETRY: Students will communicate geometric concepts and measurement concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

8.G.1 Geometric Attributes: Students will apply properties of angle relationships in triangles and with lines to determine angle measures.

8.G.1.1 Determine and use the relationships of the interior angles of a triangle to solve for missing measures.

8.G.1.2 Identify and apply geometric properties of parallel lines cut by a transversal and the resulting corresponding, same side interior, alternate interior, and alternate exterior angles to find missing measures.

8.G.2 Coordinate Geometry: Students will determine location, orientation, and relationships on the coordinate plane.

8.G.2.1 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.

8.G.2.2 Determine if two-dimensional figures are congruent or similar.

8.G.2.3 Perform and describe positions and orientations of shapes under a sequence of transformations on and off the coordinate plane.

8.G.3 Measurement: Students will perform and compare measurements and apply formulas.

8.G.3.1 Explain a model of the Pythagorean Theorem.

8.G.3.2 Apply the Pythagorean Theorem to find side lengths of triangles and to solve real-world situations.

8.G.3.3 Find the distance between any two points on the coordinate plane using the Pythagorean Theorem.

8.G.3.4 Determine the surface area and volume of cones, cylinders, and spheres and solve real-world situations using volumes.

8.D DATA: Students will communicate data analysis/probability concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

8.D.1 Data Collection & Statistical Methods: Students will formulate statistical investigative questions, collect data, and organize data.

No additional indicator(s) at this level.

8.D.2 Analyze Data and Interpret Results: Students will represent and analyze the data and interpret the results.

8.D.2.1 Represent and interpret bivariate data (e.g., ordered pairs) using scatter plots.

8.D.2.2 Describe patterns such as positive or negative association, linear or nonlinear association, clustering, and outliers when bivariate data is represented on a coordinate plane.

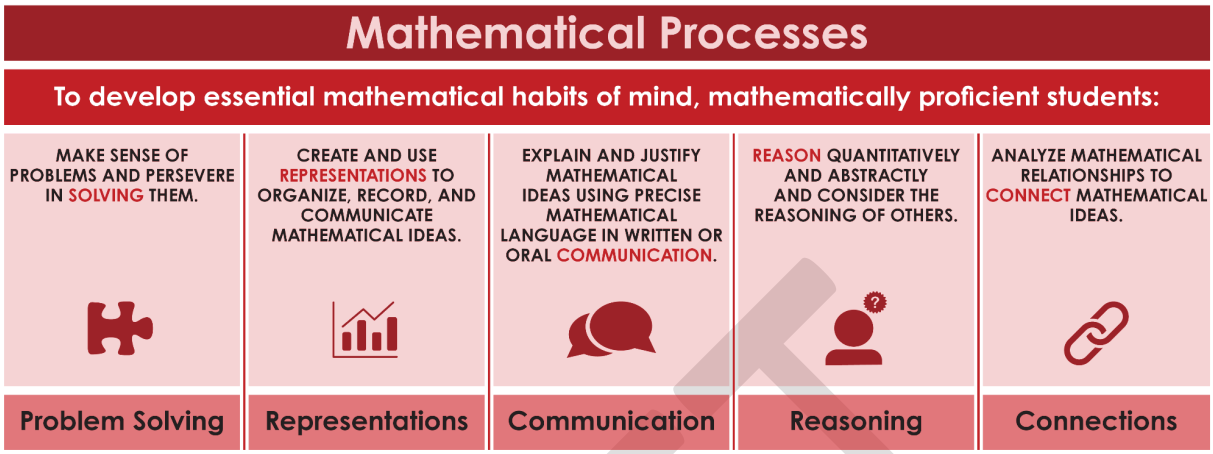
8.D.2.3 Draw an informal line of best fit based on the closeness of the data points to the line.

8.D.2.4 Use a linear model to make predictions and interpret the rate of change and y-intercept in context.

8.D.3 Probability: Students will interpret and apply concepts of probability.

No additional indicator(s) at this level.

High School Standards



HS.N NUMBER: Students will communicate number sense concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

HS.N.1 Estimation and Technology: Students will estimate quantities prior to solving a problem with or without technology.

HS.N.1.1 Select, apply, and explain the method of computation when problem solving using real numbers (e.g., models, mental computation, paper-pencil, or technology).

HS.N.1.2 Determine if the context of a problem calls for an approximation or an exact value.

HS.N.1.3 Determine the rounding convention to be used based on the context of a problem

HS.N.1.4 Estimate a value using the concept of betweenness by bounding above and below (e.g., since log(10) = 1 and log(1000) = 3 we know log(500) is between 1 and 3).

HS. N.1.5 Determine the tolerance interval and percent of error in measurement.

HS.N.1.6 Convert equivalent rates (e.g., miles per hour to feet per second).

HS.N.1.7 Determine whether extremely large or extremely small quantities can be reasonably represented by a calculator or graphing utility.

HS.N.1.8 Use scientific notation to appropriately represent large and small quantities.

HS.N.2 Sets and Operations: Students will use number sets and operations to reason and to solve problems.

HS.N.2.1 Demonstrate, represent, and show relationships among the subsets of real numbers and the complex number system.

HS.N.2.2 Compute with subsets of the complex number system, including imaginary, rational, irrational, integers, whole, and natural numbers.

HS.N.2.3 Extend the properties of exponents to rational numbers.

HS.N.2.4 Use properties of rational and irrational numbers.

HS.N.3 Interpretation and Sense Making: Students will reason quantitatively using units to solve problems and interpret results in context.

HS.N.3.1 Understand roundoff error and why roundoff error accumulates when rounding occurs prior to the last step in a computation.

HS.N.3.2 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.

HS.N.3.3 Use units to assess the validity of an answer in the context of a problem.

HS.N.3.4 Communicate the meaning of an answer in the context of a problem.

HS.A ALGEBRA: Students will communicate algebraic concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

HS.A.1 Algebraic Relationships: Students will demonstrate, represent, and show relationships with functions.

HS.A.1.1 Demonstrate that functions are a well-mapped subdomain of a relation.

HS.A.1.2 Analyze domain and range of relations to determine if they are a function given mapping diagrams, function notation (e.g., $f(x) = x^2$), tables, or graphs.

HS.A.1.3 Classify a function given its mapping diagram, function notation, table, or graph as a linear, quadratic, absolute value, exponential, or other function.

HS.A.1.4 Analyze a function's domain and range to determine if it is one-to-one and has an inverse function both algebraically and graphically.

HS.A.1.5 Define, interpret, and analyze linear, quadratic, absolute value, and exponential functions using the points of interest of the functions and graphing technology.

HS.A.2 Algebraic Processes: Students will apply the operational properties when evaluating rational expressions, and solving linear and quadratic equations, and inequalities.

HS.A.2.1 Analyze and explain the properties used in solving equations and inequalities (linear, quadratic, absolute value, and literal equations).

HS.A.2.2 Generate expressions in equivalent forms by using algebraic properties to make different characteristics or features visible.

HS.A.2.3 Analyze equations and inequalities (linear, linear systems, absolute value, and quadratic) to determine and apply the most efficient method to solve using appropriate technology.

HS.A.2.4 Calculate the slope(rate of change) of a line given coordinate points, a graph, or a table of values.

HS.A.2.5 Write and graph equations of functions (linear, absolute value, quadratic, and exponential) using the points of interest of the function.

HS.A.2.6 Given a line, write the equation of a line that is parallel or perpendicular to it.

HS.A.2.7 Perform operations (addition subtraction, multiplication, division, and factoring) on polynomials using multiple representations.

HS.A.2.8 Explain the connection between the factors of a polynomial and the zeros of a polynomial.

HS.A.2.9 Combine functions by composition and perform operations on functions.

HS.A.3 Applications: Students will solve real-world situations including nonlinear functions.

HS.A.3.1 Analyze and model real-world situations using various representations and appropriate technology.

HS.A.3.2 Identify, interpret, relate and graph the factors, x-intercepts, roots, and zeros of polynomial functions using algebraic and graphing methods.

HS.A.3.3 Identify and predict appropriate solutions to equations given context and domain/range (eg., extraneous solutions, imaginary solutions, no solution, infinitely many solutions).

HS.G GEOMETRY: Students will communicate geometric concepts and measurement concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

TOOLS: Students will sketch, draw, and construct appropriate representations using a variety of tools and methods which may include ruler/straight edge, protractor, compass, reflective devices, paper folding, or dynamic geometric software.

HS.G.1 Attributes: Students will identify and describe geometric attributes, apply formulas and create two-dimensional shapes.

HS.G.1.1 Apply interior and exterior angle formulas for n-gons and apply to real-world situations.

HS.G.1.2 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.

HS.G.1.3 Describe symmetries of a figure in terms of rigid motions that map a figure onto itself, in problems both with and without coordinates.

HS.G.1.4 Identify and apply right triangle relationships including sine, cosine, tangent.

HS.G.1.5 Explain how the criteria for triangle congruence and similarity (ASA, SAS, and AAS SSS congruence; AA similarity criterion) follow from the definition of congruence and similarity in terms of corresponding parts.

HS.G.1.6 Identify and apply right triangle relationships including converse of the Pythagorean Theorem.

HS.G.1.7 Apply side and angle relationships of special right triangles (30-60-90 & 45-45-90) to solve geometric problems.

HS.G1.8 Use slope and the distance formula to determine the type of quadrilateral.

HS.G.1.9 Compare/contrast the properties of quadrilaterals: parallelograms, rectangles, rhombi, squares, kites, trapezoids, and isosceles trapezoids.

HS.G.1.10 Apply the properties of central angles, inscribed angles, angles formed by intersecting chords, and angles formed by secants and/or tangents to find the measures of angles related to the circle.

HS.G.1.11 Find the equation of a circle given the radius and the center.

HS.G.2 Attributes: Students will identify and describe geometric attributes, apply formulas and create three-dimensional shapes.

HS.G.2.1 Convert between various units of volume (e.g., such as cubic feet to cubic yards).

HS.G.2.2 Apply the effect of a scale factor to determine the volume of similar three-dimensional shapes and solids.

HS.G.2.3 Determine surface area and volume of pyramids using formulas and appropriate units.

HS.G.3 Coordinate Geometry & Transformations: Students will determine location, orientation, and relationships on the coordinate plane.

HS.G.3.1 Apply the midpoint formula to real-world situations.

HS.G.3.2 Find the images of transformations of a shape or graph about the origin. Translations include: any translation; reflecting a point across the x-axis, y-axis, and the line y=x; rotating a point around the origin, by multiples of 90 degree angles; and dilating a point about the origin by any positive scale factor.

HS.G.4 Logic & Proof: Students will use geometric definitions and theorems strategically to reason abstractly and quantitatively.

HS.G.4.1 Evaluate the validity of conditional statements, including biconditional statements (eg., conditional, converse, contrapositive, inverse).

HS.G.4.2 Use definitions to make deductions in mathematical argumentation (eg., syllogism, detachment).

HS G.4.3 Evaluate the validity of an argument communicated in different ways (eg., a flow format, two-column, or paragraph format).

HS.G.4.4 Use coordinate geometry to prove triangles are right, acute, obtuse, isosceles, equilateral, or scalene.

HS.G.4.5 Prove and apply geometric theorems about triangles, congruent triangles using deductive reasoning.

HS.G.4.6 Prove and apply geometric theorems about quadrilaterals using deductive reasoning.

HS.D DATA: Students will communicate data analysis/probability concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

HS.D.1 Data Collection & Statistical Methods: Students will formulate statistical investigative questions, collect data, and organize data.

HS.D.1.1 Formulate multivariable statistical investigative questions and determine how data can be collected and analyzed to provide an answer.

HS.D.1.2 Apply an appropriate data collection plan when collecting primary data for the statistical investigative question of interest.

HS.D.1.3 Distinguish between surveys, observational studies, and experiments.

HS.D.1.4 Understand what constitutes good practice in designing a sample survey, an experiment, and an observational study.

HS.D.1.5 Understand issues of bias and confounding variables in a study and their implications for interpretation.

HS.D.2 Analyze Data & Interpret Results: Students will represent and analyze the data and interpret the results.

HS.D.2.1 Identify appropriate ways to summarize and then represent the distribution of univariate data and bivariate data through the construction of histograms, dotplots, stem plots, box plots, cumulative relative frequency graphs, time plots, circle graphs, stacked bar graphs, and mosaic bar graphs by hand or with technology.

HS.D.2.2 Describe the shape, identify any outliers, and determine the spread of a data set.

HS.D.2.3 Select and determine the appropriate measure of center based on the shape of a distribution and/or the presence of outliers.

HS.D.2.4 Recognize when a data set can be reasonably said to be normally distributed and draw conclusions about the data from the associated normal distribution.

HS.D.2.5 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.

HS.D.2.6 Represent data on two quantitative variables on a scatter plot and describe how the variables are related.

HS.D.2.7 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.

HS.D.2.8 Measure the strength of association using correlation coefficients for regression curves and interpret their meanings for the model.

HS.D.2.9 Use residuals and residual plots to judge the quality of a regression model.

HS.D.2.10 Recognize and explain when arguments based on data confuse correlation with causation.

HS.D.3 Probability: Students will interpret and apply concepts of probability.

HS.D.3.1 Describe events as subsets of a sample space using characteristics of the outcomes, or as unions, intersections, or complements of other events.

HS.D.3.2 Explain independent versus dependent probability of an event.

HS.D.3.3 Determine when order in counting matters, and use permutations and combinations to compute probabilities of events accordingly.

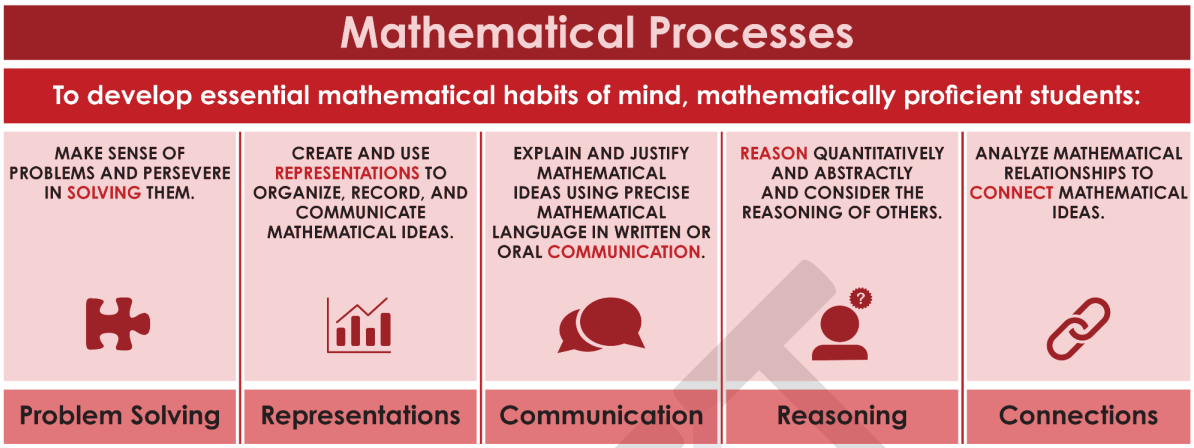
HS.D.3.4 Determine whether or not events are mutually exclusive (disjoint) and calculate their probabilities in either case.

HS.D.3.5 Recognize and explain the concepts of conditional probability in everyday language and everyday situations.

HS.D.3.6 Understand what constitutes statistical significance. Interpret statistical significance in the context of a situation and answer investigative questions appropriately.

HS.D.3.7 Use probability as a tool for assessing risk and for informed decision making by interpreting P-values.

Advanced Topics Standards



AT.N NUMBER: Students will communicate number sense concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

AT.N.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.1.1 Use domain and range restrictions to apply an appropriate viewing window while using graphing technology.

AT.N.1.2 Compare and contrast radians and degrees as measures of angles and the reason graphing utilities tend to use radians as the default setting.

AT.N.2 Sets and Operations: Students will compare and contrast subsets of the complex number system to reason and to solve problems.

AT.N.2.1Perform arithmetic operations with complex numbers.

AT.N.2.2 Represent complex numbers and their operations in the complex plane.

AT.N.2.3 Use complex numbers in polynomial identities and equations.

AT.N.2.4 Represent quantities using bases other than decimal such as binary (base 2) or hexadecimal (base 16) and convert numbers to and from base 10.

AT.N.2.5 Explain modular arithmetic and its role in computer programming.

AT.N.2.6 Represent and model vector quantities.

AT.N.2.7 Perform operations on vectors.

AT.N.2.8 Perform operations on matrices and use matrices in applications.

AT.N.3 Interpretation and Sense Making:Students will reason quantitatively using units to solve problems and interpret results in context.

AT.N.3.1 Use vectors to communicate the geometric relationships between complex numbers in the complex plane.

AT.A ALGEBRA: Students will communicate algebraic concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

AT.A.1 Algebraic Relationships: Students will demonstrate, represent, and show relationships with non-linear functions and relations

AT.A.1.1 Analyze and graph nonlinear functions (trigonometric, rational, higher-order polynomials, logarithmic, & piecewise) and relations (conic sections) using their points of interest and graphing technology.

AT.A.1.2 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).

AT.A.1.3 Identify, analyze, and apply transformations of existing functions (including translation & dilation).

AT.A.1.4 Define the radian unit of measure and its relationship with degrees.

AT.A.2 Algebraic Processes: Students will evaluate and solve nonlinear equations.

AT.A.2.1 Explain symmetry of functions and determine whether a function is odd, even, or neither.

AT.A.2.2 Represent, interpret, and analyze inverses of functions algebraically and graphically using domain restrictions when necessary.

AT.A.2.3 Write equations of nonlinear functions using points of interest of the function.

AT.A.2.4 Convert between radian and degree measures of an angle.

AT.A.2.5 Use limits to describe the behavior of a function near its asymptotes and removable discontinuities.

AT.A.3 Applications: Students will solve real-world situations including nonlinear functions.

AT.A.3.1 Analyze and model real-world situations using various non-linear representations and relations with appropriate technology.

AT.A.3.2 Model and solve real-world periodic problems using trigonometric functions.

AT.G GEOMETRY: Students will communicate geometric concepts and measurement concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

TOOLS: Students will sketch, draw, and construct appropriate representations using a variety of tools and methods which may include ruler/straight edge, protractor, compass, reflective devices, paper folding, or dynamic geometric software.

AT.G.1 Attributes: Students will identify and describe geometric attributes, apply formulas and create two-dimensional shapes.

AT.G.1.1 Apply the Law of Sines and the Law of Cosines to find unknown measures in triangles.

AT.G.1.2 Apply properties of lengths of chords, secant segments, and tangent segments.

AT.G.1.3 Apply the relationship that the length of the arc intercepted by an angle is proportional to the radius.

AT.G.1.4 Find arc length and area of sectors of a circle.

AT.G.2 Attributes: Students will identify and describe geometric attributes, apply formulas and create three-dimensional shapes.

AT.G.2.1 Determine the three-dimensional object created by rotating or revolving a two-dimensional object about an axis.

AT.G.2.2 Determine the shape of a two-dimensional cross-section of a three-dimensional object.

AT.G.2.3 Use Cavalieri's Principle to determine volume of three-dimensional figures.

AT.G.3 Coordinate Geometry & Transformations: Students will determine location, orientation, and relationships on the coordinate plane.

AT.G.3.1 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.

AT.G.3.2 Recognize that translations can be described in terms of vectors.

AT.G.4 Logic & Proof: Students will use geometric definitions and theorems strategically to reason abstractly and quantitatively.

AT.G.4.1 Use known definitions and results in informal argumentation to construct logical arguments.

AT.G.4.2 Distinguish between empirical reasoning, examples, and deductive reasoning, as well as informal and formal reasoning.

AT.D DATA: Students will communicate data analysis/probability concepts using multiple representations to reason, solve problems, and make connections within mathematics and across disciplines.

AT.D.1 Data Collection & Statistical Methods: Students will formulate statistical investigative questions, collect data, and organize data.

AT.D.1.1 Explain what constitutes good practice in designing a sample survey, an experiment, and an observational study.

AT.D.1.2 Explain the use of randomization to reduce the influence of confounding or lurking variables.

AT.D.1.3 Explain issues of bias and confounding variables in a study and their implications for interpretation.

AT.D.1.4 Demonstrate knowledge of the role sampling distributions play in the estimation of an unknown population parameter through the use of appropriate sampling techniques.

AT.D.2 Analyze Data & Interpret Results: Students will represent and analyze the data and interpret the results.

AT.D.2.1 Explain how multiplicative and additive transformations on a data set affect measures of central tendency and spread.

AT.D.2.2 Determine when a data set can be reasonably said to be normally distributed and draw conclusions about the data from the associated normal distribution.

AT.D.2.3 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.

AT.D.3 Probability: Students will interpret and apply concepts of probability.

AT.D.3.1 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.

AT.D.3.2 Communicate what constitutes statistical significance. Interpret statistical significance in the context of a situation and answer investigative questions appropriately.

AT.D.3.3 Use data to compare two groups, describe sample variability, and decide if differences between parameters are significant based on the statistics.

AT.D.3.4 Use probability as a tool for assessing risk and for informed decision making by computing and interpreting P-values.

AT.D.3.5 Use confidence intervals to estimate an unknown population parameter.