Mathematics Benchmark Achievement Level Descriptors – Vertical Articulation

Overview and Purpose

The development of Achievement Level Descriptors (ALDs) is a critical step in communicating student performance in terms of levels or categories of performance on any standardized assessment. For Minnesota Comprehensive Assessments (MCAs), ALDs are developed in collaboration with educators during the first year of full implementation. The ALDs provide a description of grade-level student performance on MCAs for each of the achievement levels of Exceeds the Standards, Meets the Standards, Partially Meets the Standards, and Does Not Meet the Standards. These statements are included on a student's MCA score report to aid families in score interpretation. More detail regarding the development of the MCA Achievement Level Descriptors is on Testing 1, 2, 3.

Over the years, educators have requested more specific descriptions of the knowledge, skills, and abilities of students who typically score in each of the different MCA achievement levels beyond what the traditional ALDs offer. In response to this need, Minnesota Department of Education (MDE) staff collaborated to outline more specific descriptions, the Benchmark ALDs for Mathematics and Reading. The purpose of Benchmark ALDs is to

1. promote equity for all students across the state by clarifying expected learning outcomes for instruction and local assessment of Minnesota Academic Standards in Reading and Mathematics; and
2. support teachers' analysis of the depth of their curriculum, instruction, and classroom assessments.

The Mathematics and Reading Benchmark ALDs were developed by

- reviewing test questions and test data for all operational MCA III questions; in many cases 800–1,000 questions per grade;
- grouping within each benchmark based on student performance on the item relative to their overall performance on the MCA; and
- reviewing the achievement level groupings of questions within each benchmark for commonalities in the skills, understanding, and context needed to correctly answer the item. Each Benchmark ALD describes some of the skills typically demonstrated by students whose overall performance on the MCA is at that achievement level. These skills are in addition to the descriptions at the lower achievement levels.

Released Examples

Where possible, released examples that illustrate skills described in the benchmark and achievement level are listed in the document. To view examples, follow this link which takes you to PDFs of released examples.

Example items are not currently available for all benchmarks and achievement levels. MDE will update the document as more released examples become available.

For Reading, a list of passage sets is available. Download the PDF to view the example questions. Locate the passage title and sequence number named in the document.

Two Formats

The Benchmark ALDs are available in two formats. The content is similar, but the layout is formatted differently to support different uses. The table version, which classroom teachers may find useful for lesson and unit planning, shows all the benchmarks continuously for a grade. The vertical articulation format, which may be preferred for district curriculum planning and professional learning communities (PLCs), provides the benchmarks by reporting category across all grades.

Training Module

By the beginning of November, a training module will be available for on-demand viewing. The training module provides much of the information in this background section.

Reading Specific Background

On the MCA, readers are tasked to use skills to comprehend texts characterized by increasing levels of sophistication, nuance, and abstraction within and across grades. As such, the measurement of reading comprehension is closely connected to different levels of text complexity with varying degrees of explicit and implicit textual evidence. Explicit textual evidence is stated directly or literally; readers are not required to make inferences and judgments based on nonliteral text in order to arrive at meaning. Implicit textual evidence requires readers to make inferences and judgments based on nonliteral text to arrive at meaning. As text complexity levels and more sophisticated implicit textual evidence increase, comprehension skills become more granular and challenging.

Generally, students who score in the Does Not Meet or Partially Meets achievement categories may successfully comprehend either portions of or entire texts that range from low to moderate levels of complexity. Students who score in the Meets or Exceeds categories can also comprehend portions of or entire texts from a wider range of text complexity, including high levels.

The concepts of text complexity, text-based comprehension questions, and students' ability to correctly answer such questions interact in various ways. For example, it is difficult to ask cognitively challenging questions about a low complexity text. However, if a higher complexity text contains direct or literal language and context (explicit text), some less complicated questions can be asked. Students who score in the Does Not Meet or Partially Meets categories may be able to correctly answer some questions about less complex text and less complicated questions about more challenging text. Students who score in the Meets or Exceeds categories may be able to correctly answer many questions about text from all text complexity levels.

More information about text complexity is available in Minnesota K-12 Academic Standards in English Language Arts (2010), pages 45 and 46 (grades K-5) and pages 78 and 79 (grades 6-12).

Number & Operation

Grade 3

3.1.1

Compare and represent whole numbers up to 100,000 with an emphasis on place value and equality.

Exceeds the Standards

- Consistently translates between various representations of whole numbers up to 100,000 (3.1.1.1)
- Interprets models based on unit sizes (3.1.1.1)
- Translates between written and expanded representations of whole numbers up to 100,000 (3.1.1.2)
- Compares differences in 4- and 5-digit numbers shown in various representations (3.1.1.3)
- Rounds numbers with values up to 100,000 to find sums and differences in multi-step situations, including real-world situations (3.1.1.4)
- Makes decisions about place-value rounding in mathematical situations (3.1.1.4)
- Consistently compares and orders whole numbers up to 100,000 with varying combinations and number of digits used in the group of numbers compared (3.1.1.5)
- Finds missing digits in 5-digit whole numbers when ordering least to greatest (3.1.1.5)
- Released Example: 235502

Meets the Standards

- Consistently represents whole numbers up to 100,000 using both symbols and words (3.1.1.1)
- Compares and represents deconstructed expressions in symbols and words containing whole numbers up to 100,000 (3.1.1.1)
- Translates between symbol and expanded representations of whole numbers up to 100,000 (3.1.1.2)
- Recognizes place value of digits in real-world contexts (3.1.1.2)
- Finds 100 and 1000 more or less than 4- and 5-digit numbers (3.1.1.3)
- Finds differences in one-step situations and number representations (3.1.1.3)
- Consistently rounds numbers with values up to 100,000 to the nearest 10, 100, and 1000 place (3.1.1.4)
- Identifies a possible original number when given a rounded value (3.1.1.4)
- Rounds numbers with values up to 100,000 to find sums and differences, including in real-world situations (3.1.1.4)
- Compares and orders whole numbers up to 100,000 using the place value of all digits in the number (3.1.1.5)
- Finds missing digits when comparing and ordering 4- and 5-digit whole numbers (3.1.1.5)

Partially Meets the Standards

- Translates between symbol and word representations of whole numbers up to 100,000 (3.1.1.1)
- Translates between symbol and word representations of expressions containing whole numbers up to 10,000 (3.1.1.1)
- Translates between symbol and expanded representations of whole numbers up to 50,000 (3.1.1.2)
- Uses place value names when solving simple mathematical problems (3.1.1.2)
- Finds 1000 more or less than 4-digit numbers (3.1.1.3)
- Finds 100 or 10,000 more or less than 5-digit numbers (3.1.1.3)
- Understands that decimal points cannot be used in place of a comma (e.g., 13,405 ≠ 13.405) (3.1.1.3)
- Rounds 2-digit numbers to the nearest 10 and estimates their sum (3.1.1.4)
- Orders 4-digit numbers consistently with any place value when all digits are used (3.1.1.5)
- Compares and orders 4- and 5-digit numbers using the thousands place value when all digits are used (3.1.1.5)

Does Not Meet the Standards

- Identifies whole numbers up to 10,000 written as symbols (numerals) and words (3.1.1.1)
- Understands expanded notation (symbolic expressions with operations) at a basic level (3.1.1.1)
- Identifies a number, up to 500, a set of base 10 blocks represents (3.1.1.1)
- Translates between symbol and expanded representations of whole numbers up to 10,000 (3.1.1.2)
- Matches digits to place value names or values when provided (3.1.1.2)
- Finds 100 more than 4-digit numbers (3.1.1.3)
- Rounds numbers down to the nearest 10 (3.1.1.4)
- Compares and orders up to four 3-digit whole numbers (3.1.1.5)
- Compares and orders 3- and 4-digit whole numbers using the hundreds or tens place, no more than one number with a 0 in the tens or hundreds place, and up to four numbers in the group (3.1.1.5)
- Released Example: 230020

Grade 4

4.1.1

Demonstrate mastery of multiplication and division basic facts; multiply multi-digit numbers; solve real-world and mathematical problems using arithmetic.

Exceeds the Standards

- Applies multiplication and division facts to solve mathematical problems (4.1.1.1)
- Consistently multiplies values by 10, 100, and 1000 in multi-step situations (4.1.1.2)
- Identifies equivalent expressions of a product (4.1.1.3)

- Solves for missing digits in factors of a product using the standard algorithm (4.1.1.3)
- Chooses correct operation in a problem-solving situation (4.1.1.5)
- Uses various strategies to solve multi-step problems and assess the reasonableness of results (4.1.1.5)
- Solutions up to 99,999 (4.1.1.5)
- Understands and uses partial quotients strategy in conjunction with the commutative, associative, and distributive properties to divide 3-digit numbers by 2-digit numbers (4.1.1.6)

Meets the Standards

- Knows division facts and finds quotients in multiple expressions with divisors 1 to 9 (4.1.1.1)
- Uses the term "quotient" to aid in solving division problems (4.1.1.1)
- Independently uses multiplication and division facts to solve multi-step situations (4.1.1.1)
- Understands and uses the place-value system by multiplying 2-digit numbers by 10, 100, and 1000 (4.1.1.2)
- Consistently multiplies 2-digit numbers by 10 and 100 in 2-step situations (4.1.1.2)
- Independently uses the standard algorithm to efficiently multiply 2-digit numbers by 2- and 3-digit numbers (4.1.1.3)
- Uses partial products to multiply 2- and 3-digit numbers (decomposing one or both) (4.1.1.3)
- Uses the term "product" to aid in solving multiplication problems (4.1.1.3)
- Solves multi-step, real-world problems involving addition, subtraction, and multiplication (4.1.1.5)
- Provides solutions up to 10,000 (4.1.1.5)
- Solves single-step problems involving division of 3-digit numbers by 2-digit divisors (4.1.1.6)
- Uses the long-division algorithm and introductory use of the partial product method (4.1.1.6)
- Solves division problems by solving for missing factor (4.1.1.6)
- Released Examples: 242189, 246062 & 246099

Partially Meets the Standards

- Knows basic multiplication facts and recognizes some division facts in single expressions with divisors 1 to 9 (4.1.1.1)
- Identifies the product of a 2-digit number and 10, 100, or 1000 (4.1.1.2)
- Finds which multiple of 10 gives a specified product (4.1.1.2)
- Multiplies up to 2-digit numbers by 2- and 3-digit numbers (4.1.1.3)
- Solves basic, multi-step problems involving addition and subtraction using 2- and/or 3-digit numbers (4.1.1.5)
- Solves basic multiplication problems involving whole numbers up to 5 (4.1.1.5)
- Provides solutions up to 1000 (4.1.1.5)
- Identifies the quotient of 3-digit numbers less than 200 by 1-digit divisors for mathematical and real-world context when the dividend is presented first (4.1.1.6)

Does Not Meet the Standards

- Recalls basic multiplication facts, with one factor being digits 1 to 9 and the other 1 to 5 (4.1.1.1)
- Divides when items are straightforward and the quotient is presented first and followed by the divisor (4.1.1.1)
- Multiplies 1- and 2-digit numbers by 10 and 100 (4.1.1.2)
- Identifies the product of a 1-digit by up to a 3-digit number (4.1.1.3)
- Identifies the product of a 2-digit by 2-digit number (4.1.1.3)
- Computes inefficiently (e.g., uses repeated addition) (4.1.1.3)
- Solves two-step, real-world problems using addition or subtraction (4.1.1.5)
- Divides 2-digit numbers by 1-digit divisors (4.1.1.6)

Grade 5

5.1.1

Divide multi-digit numbers; solve real-world and mathematical problems using arithmetic.

Exceeds the Standards

- Computes and represents quotients in all forms as a whole number with a remainder, a mixed number, and a decimal (5.1.1.1)
- Knows when to divide in a problem-solving situation and explains reasoning (5.1.1.2)
- Determines the "fewest/least" and "greatest/most" of something in any context (5.1.1.2)
- Uses various strategies to solve complex and detailed multi-step problems involving addition, subtraction, multiplication, and division (5.1.1.4)
- Assesses the reasonableness of results (5.1.1.4)

Meets the Standards

- Identifies quotients, as a whole number with a remainder, a mixed number, or a decimal, of division of 3- or 4-digit numbers by 1- or 2-digit numbers (5.1.1.1)
- Determines the "fewest/least" and "greatest/most" of something in context with whole number dividends and divisors (5.1.1.2)
- Interprets the quotient and remainder in context (5.1.1.2)
- Solves multi-step, real-world problems involving addition, subtraction, multiplication, and division (5.1.1.4)
- Compares computed rates or quantities (5.1.1.4)
- Released Example: 254085

Partially Meets the Standards

- Identifies the results, as a whole number with a remainder or a fraction, of division of 3- or 4-digit numbers by 1- or 2-digit numbers (5.1.1.1)
- Identifies the remainder portion of a quotient (5.1.1.1)
- Solves real-world problems involving division of 3- and 4-digit numbers by 1- and 2-digit divisors (5.1.1.2)
- Interprets the remainder as what is "left over" (5.1.1.2)
- Solves two-step, real-world problems involving addition and/or subtraction and multiplication or division (5.1.1.4)

Does Not Meet the Standards

- Identifies the results, as a whole number with a remainder, of division of 3- or 4-digit numbers by 1- or 2-digit numbers (5.1.1.1)
- Solves one-step, real-world problems involving division of 2-digit numbers by a 1-digit divisor that is not 7 or 8 (5.1.1.2)
- Solves one-step, real-world problems involving addition, subtraction, multiplication, or division (5.1.1.4)

Grade 6

6.1.1

Read, write, represent and compare positive rational numbers expressed as fractions, decimals, percents and ratios; write positive integers as products of factors; use these representations in real-world and mathematical situations.

Exceeds the Standards

- Uses coordinate grid vocabulary to describe and identify the coordinates of an ordered pair. (6.1.1.1)
- Plots and identifies values on a number line with any scale (6.1.1.1)
- Compares decimals, fractions, percents, etc. that differ by less than 0.001 (6.1.1.2)
- Identifies multiple rational numbers, in various forms, that are greater than, less than, or equal to a given number (6.1.1.2)
- Creates ratios using colon notation (e.g., 3:5) for novel real-world situations (6.1.1.3)
- Solves multi-step problems with fractions and represents the answer in various representations (6.1.1.4)
- Consistently compares and represents numbers (including values less than 0.1) in various forms (6.1.1.4)
- Justifies and explains prime factorization (6.1.1.5)

- Knows that 1 is not used in prime factorization (6.1.1.5)
- Finds the LCM or GCF of two or three numbers that may have 3 or more common factors (6.1.1.6)
- Identifies a group of numbers with a specific GCF or LCM (6.1.1.6)
- Uses the GCF or LCM to identify missing values in a situation (6.1.1.6)
- Converts between non-simplified versions of fractions when the common factors are 2 digit (6.1.1.7)

Meets the Standards

- Identifies the coordinates of points on a coordinate grid (6.1.1.1)
- Plots decimals and fractions on a number line with a fractional scale twice the size of the increments used (e.g., plots 1/6 on a number line marked in thirds) (6.1.1.1)
- Orders positive rational numbers given in various forms (e.g., percent, improper fraction, etc.) that differ by more than 0.001 (6.1.1.2)
- Identifies more than 1 ratio that describes a percent (6.1.1.3)
- Identifies multiple representations of common percents (6.1.1.4)
- Represents numbers as fractions (proper, improper, mixed, simplified and not simplified), decimals (including repeating decimals), and percents (including 1-digit percents) (6.1.1.4)
- Solves one- and two-step problems involving percents and represents the answer as a fraction or a decimal (6.1.1.4)
- Consistently uses exponents when representing the prime factorization of any 3-digit number (6.1.1.5)
- Identifies the LCM or GCF in word problems with numbers less than 30 (6.1.1.6)
- Consistently identifies the LCM for a group of numbers with values less than 30 and having at most 2 common factors (6.1.1.6)
- Identifies the GCF of a group of numbers greater than 100 but multiples of 5 (6.1.1.6)
- Converts from simplified to non-simplified versions of fractions when the common factors are 1 digit (6.1.1.7)
- Released Examples: 264500 & 264927

Partially Meets the Standards

- Plots and identifies fractions and mixed numbers on a number line (6.1.1.1)
- Plots and identifies fractions and mixed numbers in an ordered pair on a coordinate grid (6.1.1.1)
- Identifies a decimal, to the tenths place, or fraction on a number line with the same fractional scale (e.g., plots 0.6, or 3/5 on a number line marked in fifths) (6.1.1.1)
- Orders a short list of fractions with denominators that are multiples of each other or decimals up to the thousandths (6.1.1.2)
- Compares two fractions with differing denominators (6.1.1.2)
- Translates from ratios to percents (6.1.1.3)
- Uses percents or ratios to determine number in part of a group with group sizes of 5, 10, 50, or 200 (6.1.1.3)

- Identifies and writes the percent or decimal equivalent of a given fraction (6.1.1.4)
- When given a fractional amount, identifies the complement represented as a percent (6.1.1.4)
- Adds simple percents and fractions when identifying the total percent of something (6.1.1.4)
- Represents prime factorization of a number without the use of exponents (6.1.1.5)
- Identifies the GCF of a group of numbers with values less than 100 and when there are 3 or fewer common factors (6.1.1.6)
- Converts between mixed numbers and improper fractions (6.1.1.7)
- Simplifies monomial, exponential expressions as well as simple, exponential polynomial expressions (6.1.1.7)
- Released Example: 265515

Does Not Meet the Standards

- Plots and identifies whole-number and basic decimal ordered pairs on a coordinate grid (6.1.1.1)
- Correctly compares whole numbers using the symbols <, =, and > (6.1.1.2)
- Translates between percents, fractions with denominators of 100, and ratios with groups out of 100 (6.1.1.3)
- Identifies and writes the decimal representation of a 2-digit percent (6.1.1.4)
- Identifies the prime factorization of a number less than 200, without the use of exponents, when the prime factors have 3 or fewer repeated uses and are 1 digit (6.1.1.5)
- In groups of numbers with values up to 30, can find GCFs of 5 or less (6.1.1.6)
- Identifies and simplifies repeated multiplication representations of a 1-digit, whole number base with a 1-digit exponent (6.1.1.7)
- Identifies an improper fraction that is equivalent to a given mixed number with 1-digit numerator, denominator, and whole number (6.1.1.7)

Grade 7

7.1.1

Read, write, represent and compare positive and negative rational numbers, expressed as integers, fractions and decimals.

Exceeds the Standards

- Consistently identifies negative rational values as rational
- Explains why a value or ratio of two numbers is rational or not rational (7.1.1.1)
- Determines whether an expression that includes pi is rational or not by adding, subtracting, multiplying, and dividing (7.1.1.1)
- Interprets the quotient of a ratio as a rational number, repeating decimal, terminating decimal, or integer (7.1.1.2)

- Identifies a rational number or its equivalent from a list of values, including identifying when a number is not rational (7.1.1.2)
- Consistently works with negative rational values on a number line divided into different increments or on a coordinate grid (7.1.1.3)
- Consistently plots fractions and decimals and their opposites on a number line divided into different increments than the denominator (7.1.1.3)
- Identifies, compares, and orders inequalities with up to 5 values expressed as positive and negative percentages, decimals, fractions (including less familiar denominators), and/or mixed integers (7.1.1.4)
- Creates equivalent expressions of positive and negative fractions in fraction or decimal form with and without a calculator (7.1.1.5)

Meets the Standards

- Recognizes pi as not rational (7.1.1.1)
- Understands and states that a rational number can be written as a ratio of two integers or as a terminating or repeating decimal (7.1.1.1)
- Creates a ratio that forms a repeating decimal when only the numerator or denominator is given (7.1.1.2)
- Understands the definitions of rational number, terminating decimal, and repeating decimal, and applies these definitions to positive and negative ratios (7.1.1.2)
- Fluently works with negative rational values on a number line divided into different increments and vice versa (7.1.1.3)
- Plots fractions and their opposites on a number line divided into different increments than the denominator (7.1.1.3)
- Identifies and compares two positive and negative percentages, decimals, fractions, or mixed numbers using an inequality (7.1.1.4)
- Identifies equivalent expressions of fractions and repeating negative and positive decimals in reduced fraction or decimal form with and without a calculator (7.1.1.5)

Partially Meets the Standards

- Knows common fractions and repeating decimals are rational numbers (7.1.1.1)
- Knows a decimal is not an integer (7.1.1.2)
- Understands that a single decimal with a bar over it means repeating decimal (7.1.1.2)
- Identifies a point on a number line or on a coordinate grid when multiple points are shown (7.1.1.3)
- Identifies and plots decimals and fractions in increments of fourths on a number line divided into the same or different increments (7.1.1.3)
- Plots a point given as a decimal or fraction or its opposite on a number line (7.1.1.3)
- Identifies positive and negative integers, mixed numbers, fractions (with familiar denominators), and decimals to make a given inequality true (7.1.1.4)
- Identifies equivalent expressions of negative and positive fractions in decimal, fraction, mixed number, and percentage forms with a calculator (7.1.1.5)

Does Not Meet the Standards

- Understands that a non-terminating decimal is a characteristic of numbers that are not rational (7.1.1.1)
- Interprets decimals with a pattern and ellipses and decimals with a vinculum over them as repeating (7.1.1.2)
- Identifies or plots a point with integer values on a 4-quadrant coordinate grid (7.1.1.3)
- Identifies a number and its opposite on a number line (7.1.1.3)
- Identifies positive rational numbers that make a given inequality true (7.1.1.4)
- Recognizes the decimal or percent equivalent of a proper fraction with a calculator (7.1.1.5)
- Released Example: 274125

Grade 8

8.1.1

Read, write, compare, classify and represent real numbers, and use them to solve problems in various contexts.

Exceeds the Standards

- Evaluates expressions involving square root symbols and 0, and appropriately classifies resulting value as rational or irrational (8.1.1.1)
- Consistently evaluates multi-term expressions involving one or more square root symbols using sums and products, and classifies the result as rational or irrational (8.1.1.1)
- Consistently recognizes repeating decimals as rational numbers (8.1.1.1)
- Evaluates numbers written with a square root symbol to the thousandths place (with or without a number line) (8.1.1.2)
- Consistently distinguishes between problem-solving strategies for one-dimensional solutions and problem-solving strategies for two-dimensional solutions (8.1.1.3)
- Solves multi-step problems involving rational approximations of real numbers (8.1.1.3)
- Applies properties of exponents to simplify expressions with multi-factor terms and involving products and quotients of monomials to exponential powers (8.1.1.4)
- Works backwards from given simplified expression to fill in missing exponents in an unsimplified version of the expression (8.1.1.4)
- Solves real-world problems involving numbers written in scientific notation requiring the use of multiplication or division including when final answer needs to be re-written in scientific notation (8.1.1.5)
- Released Examples: 280195 & 780873

Meets the Standards

- Evaluates expressions involving square root symbols, and appropriately classifies resulting value as rational or irrational (8.1.1.1)
- Distinguishes between $\sqrt{(x + y)}$ and $(\sqrt{x} + \sqrt{y})$ (8.1.1.1)
- Recognizes pi as irrational (8.1.1.1)
- Recognizes 0 as rational (8.1.1.1)
- Evaluates numbers written with a square root symbol, and locates to the nearest whole number or nearest tenth on a number line (8.1.1.2)
- Distinguishes between squaring a number and doubling it (8.1.1.2)
- Interprets number sentences with two or more of the same inequality signs as statements of order (between, greatest to least, or least to greatest) (8.1.1.2)
- Determines rational approximations for whole number square roots in order to solve two-step problems in context, equations of the form $x^2 = a$, and simple numeric expressions (8.1.1.3)
- Calculates the square or cube of a negative number (8.1.1.4)
- Simplifies multi-step expressions with one or more variables and involving exponents and/or coefficients (8.1.1.4)
- Applies rules for negative exponents when dividing monomials involving the same base raised to different powers when the larger exponent(s) occur in the numerator (8.1.1.4)
- Understands that multiplying and dividing exponentials uses properties of exponents while multiplying and dividing coefficients uses other algebraic rules (8.1.1.4)
- Consistently converts very large and very small numbers between standard and scientific notations (8.1.1.5)
- Multiplies and divides numbers in scientific notation (8.1.1.5)
- Released Examples: 282063, 44407 & 281336

Partially Meets the Standards

- Classifies numbers written with a square root symbol as rational or irrational (e.g., $\sqrt{2}$, $\sqrt{16}$, $\sqrt{36}$) (8.1.1.1)
- Distinguishes between taking the square root of a number and taking half of that number (8.1.1.2)
- Evaluates and compares numbers written with a square root symbol that are not perfect squares and locates between two whole numbers on a number line (8.1.1.2)
- Distinguishes between taking the square root of a number and taking half of that number (8.1.1.3)
- Rounds the square root of a whole number less than 150 to the nearest integer (8.1.1.3)
- Distinguishes between n^m and $n \cdot m$ (8.1.1.4)
- Applies rules for multiplying terms involving the same base raised to different powers (8.1.1.4)
- Orders a list of numbers written in scientific notation (8.1.1.5)
- Matches large and small numbers expressed in standard notation with the equivalent scientific notation and vice versa (8.1.1.5)
- Consistently distinguishes the meaning of the exponent in scientific notation from the number of zeros in a number in standard form (8.1.1.5)
- Released Examples: 281017 & 281038

Does Not Meet the Standards

- Recognizes some perfect squares (e.g., 16, 36) (8.1.1.1)
- Evaluates perfect squares written with a square root symbol (e.g., $\sqrt{100}$), and locates on a number line (8.1.1.2)
- Evaluates the square of a decimal number and locates on a number line (8.1.1.2)
- Identifies the radical symbol ($\sqrt{n}$) as meaning square root of a number (8.1.1.3)
- Applies the properties of exponents to simplify expressions with the same base (8.1.1.4)
- Simplifies expressions with exponents to find equivalent expressions with the same base (8.1.1.4)
- Finds the smallest or largest value in a list of numbers in scientific notation (8.1.1.5)
- Recognizes that numbers written in scientific notation with positive exponents involve moving the decimal point to the right or multiplying by powers of ten and with negative exponents involve moving the decimal point to the left or dividing by powers of ten (8.1.1.5)
- Released Example: 281026

Grade 3

3.1.2

Add and subtract multi-digit whole numbers; represent multiplication and division in various ways; solve real-world and mathematical problems using arithmetic.

Exceeds the Standards

- Finds missing digits in number sentences involving addition or subtraction (3.1.2.1)
- Explains steps and reasoning in multi-step real-world problems (3.1.2.2)
- Compares and makes decisions based on properties of addition and subtraction to solve multi-step real-world problems (3.1.2.2)
- Fluently uses one or more number line representations of multiplication and division facts (3.1.2.3)
- Solves problems using multiple multiplication facts to represent a product or value (3.1.2.3)
- Solves multi-step division problems (3.1.2.4)
- Finds multiple solutions to a problem, and identifies the best solution based on the context (3.1.2.4)
- Uses associative property and partial products to produce equivalent expressions, including numbers with the digit 0 in place values other than the ones (3.1.2.5)
- Uses the term "product" and finds results (3.1.2.5)
- Explains reasoning and strategies for finding or identifying equivalent expressions (3.1.2.5)

Meets the Standards

- Regroups to subtract 4-digit whole numbers (3.1.2.1)
- Understands the terms sum and difference (3.1.2.1)

- Adds three addends with 2-, 3-, and/or 4-digit whole numbers (3.1.2.1)
- Uses addition and subtraction to solve multi-step real-world problems involving whole numbers with up to 4 digits (3.1.2.2)
- Represents multiplication and division with a variety of models (3.1.2.3)
- Uses an array when solving multi-step word problems (3.1.2.3)
- Solves multi-step multiplication problems (3.1.2.4)
- Solves one-step division problems (3.1.2.4)
- Identifies the result of finding the product of two numbers (3.1.2.5)
- Solves multi-step multiplication problems (3.1.2.5)
- Uses the commutative and distributive properties as well as partial products to identify equivalent expressions (3.1.2.5)
- Uses basic descriptions to explain strategies (3.1.2.5)
- Released Example: 235700

Partially Meets the Standards

- Consistently regroups at least one time in order to subtract a 3-digit number (3.1.2.1)
- Adds numbers according to place value (3.1.2.1)
- Regroups to subtract 2- and/or 3-digit whole numbers to solve one-step real-world problems (3.1.2.2)
- Adds and subtracts 2- and/or 3-digit whole numbers to solve two-step problems with little to no regrouping required (3.1.2.2)
- Uses equal-sized groups and arrays to solve multiplication facts (3.1.2.3)
- Understands that multiplication and division are related (3.1.2.3)
- Consistently solves one-step multiplication problems in context (3.1.2.4)
- Solves one-step division problems, where one factor is less than or equal to 5 (3.1.2.4)
- Solves multiplication problems involving a simple 2-digit factor (3.1.2.5)

Does Not Meet the Standards

- Adds and subtracts 2- and/or 3-digit whole numbers when no or minimal regrouping skills are required (3.1.2.1)
- Adds 3- and/or 4-digit whole numbers in context (3.1.2.2)
- Subtracts 3-digit whole numbers when little to no regrouping is required (3.1.2.2)
- Uses an array to represent a multiplication fact using 1-digit factors, where one of the factors is less than 5 (3.1.2.3)
- Uses repeated subtraction to solve division problems (3.1.2.3)
- Solves one-step multiplication problems with 1-digit factors, where one factor is less than 5 (3.1.2.4)
- Uses models to solve one-step division problems with 1-digit factors, where one factor is less than 5 (3.1.2.4)
- Identifies equality of one-step multiplication expressions using the commutative property (3.1.2.5)

Grade 4

4.1.2

Represent and compare fractions and decimals in real-world and mathematical situations; use place value to understand how decimals represent quantities.

Exceeds the Standards

- Interprets fraction models to identify multiple equivalent fractions (4.1.2.1)
- Determines equivalent representation of fractions plotted on a number line with minimal labeling (4.1.2.1)
- Uses a variety of fraction models to order and compare whole numbers, fractions, mixed numbers, and improper fractions (4.1.2.2)
- Creates fraction models to add and subtract fractions with common denominators (4.1.2.3)
- Develops a rule for addition and subtraction of fractions with common denominators (4.1.2.3)
- Consistently converts between various representations of decimals up to 7 digits (4.1.2.4)
- Identifies place-value location of decimals written in words, from thousands to thousandths (4.1.2.4)
- Compares and orders decimals to thousandths (4.1.2.5)
- Uses models to write decimals (4.1.2.6)
- Writes numbers as multiple equivalent fractions and decimals (4.1.2.6)
- Rounds multi-digit numbers to the nearest tenth (4.1.2.7)
- Compares and identifies equivalent values rounded to the nearest tenth (4.1.2.7)
- Identifies why “double-rounding” is incorrect (4.1.2.7)

Meets the Standards

- Uses fraction models (such as fraction strips, fraction circles, other manipulatives, and written descriptions) to determine equivalent fractions (4.1.2.1)
- Uses fully labelled number lines to plot equivalent fractions (4.1.2.1)
- Orders proper fractions and mixed numbers using a number line (4.1.2.2)
- Adds and subtracts fractions with common denominators with one or more fraction models—either combining or eliminating parts of fraction models to find the solution (4.1.2.3)
- Fluently works with twelfths (4.1.2.3)
- Finds a sum of 1 or a difference of 0 when adding or subtracting fractions with like denominators (4.1.2.3)
- Identifies place-value location in decimals, from thousands to thousandths (4.1.2.4)
- Converts decimals from words or expanded representation to symbols, from thousands to thousandths (4.1.2.4)
- Writes decimals based on the meaning of the digit value in the correct place value (4.1.2.4)

- Recognizes and compares decimals to hundredths as being greater than, less than, or equal to other decimals as given in lists or on a number line (4.1.2.5)
- Writes comparisons using inequality signs, >, =, or < (4.1.2.5)
- Reads and writes decimals up to thousandths (4.1.2.6)
- Translates between decimals and mixed numbers for halves, fourths, tenths, and hundredths (4.1.2.6)
- Rounds decimals written to the hundredth to the nearest tenth and all digits are greater than 0 (4.1.2.7)
- Released Examples: 245000 & 242042

Partially Meets the Standards

- Identifies fraction circles representing the same fraction (4.1.2.1)
- Locates mixed numbers on a number line (4.1.2.2)
- Identifies proper fractions and mixed numbers represented as points on a number line (4.1.2.2)
- Adds and subtracts fractions with common denominators using a structured model (4.1.2.3)
- Identifies the order of steps to be taken when adding and subtracting fractions with common denominators (4.1.2.3)
- Matches a decimal written in words to the correct numeric representation, from thousands to thousandths (4.1.2.4)
- Identifies decimals (from hundreds to hundredths) in word, symbol, and expanded representations (4.1.2.4)
- Identifies place value location in decimals, from hundreds to tenths (4.1.2.4)
- Orders decimals to the tenths place (4.1.2.5)
- Orders decimals on a number line, to the tenths place (4.1.2.5)
- Reads and comprehends decimal, fraction, and word equivalents for halves, fourths, tenths, and hundredths (fractions less than 1) (4.1.2.6)
- Rounds numbers to the nearest tenth when written to the hundredths place and the hundredths place contains a 1 or a 2 (4.1.2.7)
- Released Example: 244682

Does Not Meet the Standards

- Identifies fraction strips representing the same fractions (4.1.2.1)
- Locates mixed numbers on a marked number line (from limited choices) (4.1.2.2)
- Solves one-step addition and subtraction problems using models to add and subtract fractions with common denominators (e.g., 2, 4, 5, 8, 10) (4.1.2.3)
- Matches symbol and word representations of a decimal to the tenths place (4.1.2.4)
- Orders decimals (including money) using place value and base 10 blocks (4.1.2.5)
- Reads and writes decimals to the tenths and hundredths place (4.1.2.6)
- Rounds numbers to the nearest ten or to the nearest whole number (4.1.2.7)

Grade 5

5.1.2

Read, write, represent and compare fractions and decimals; recognize and write equivalent fractions; convert between fractions and decimals; use fractions and decimals in real-world and mathematical situations.

Exceeds the Standards

- Converts between various representations of decimals, from millions to millionths, including decimals with multiple leading zeros (5.1.2.1)
- Identifies place-value location of decimals written in words, from millions to millionths (5.1.2.1)
- Finds the difference between two numbers that are 0.1, 0.01, or 0.001 apart (5.1.2.2)
- Locates decimals, fractions, and mixed numbers on a number line (5.1.2.3)
- Orders a combination of decimals, fractions, mixed numbers, and improper fractions (5.1.2.3)
- Identifies decimal between two fractions (5.1.2.3)
- Makes fraction models to represent improper fractions (5.1.2.4)
- Finds multiple representations for a number, including decimals, fractions, mixed numbers, and improper fractions (5.1.2.4)
- Writes equivalent decimal values by rounding to the nearest tenth, hundredth, or thousandth (5.1.2.5)

Meets the Standards

- Writes decimals as symbols and words, from millions to millionths (5.1.2.1)
- Finds 0.1, 0.01, and 0.001 more or less than given numbers in context given tables and word formats (5.1.2.2)
- Locates mixed numbers and improper fractions on a number line (5.1.2.3)
- Identifies decimal between two other decimals (5.1.2.3)
- Identifies fraction between two other fractions (5.1.2.3)
- Orders decimals, fractions, and mixed numbers (5.1.2.3)
- Converts between decimals and fractions, including mixed numbers and improper fractions (e.g., denominators 5, 8, 16, 20, 25, 50, 100) (5.1.2.4)
- Recognizes equivalent fractions, including improper fractions (e.g., denominators 20, 50, 100) (5.1.2.4)
- Writes decimals from contexts (5.1.2.4)
- Rounds multiple decimals to the nearest tenth, hundredth, and thousandth (5.1.2.5)
- Released Example: 254500

Partially Meets the Standards

- Matches a decimal written in words with the correct symbol representation, from thousands to thousandths (5.1.2.1)
- Identifies place-value location in decimals, from hundred thousands to hundred thousandths (5.1.2.1)
- Finds 0.1, 0.01, and 0.001 more or less than given numbers to the thousandths place (5.1.2.2)
- Identifies greatest or smallest fraction (denominators up to 20) (5.1.2.3)
- Orders decimals from greatest to least (5.1.2.3)
- Locates decimals on a number line (5.1.2.3)
- Converts between decimals and fractions, including mixed numbers (e.g., denominators 4, 10) (5.1.2.4)
- Converts between improper fractions and mixed numbers (e.g., denominators 3, 5, 6, 15) (5.1.2.4)
- Recognizes equivalent fractions, including improper fractions (e.g., denominators 2, 3, 4, 5, 6, 8, 10, 12, 15, 16, 25) (5.1.2.4)
- Writes fractions from contexts or fraction models, including mixed numbers (5.1.2.4)
- Rounds decimals to the nearest tenth, hundredth, and thousandth (5.1.2.5)

Does Not Meet the Standards

- Identifies, reads, and writes a decimal, from hundreds to hundredths (5.1.2.1)
- Finds 0.1 more or less than given numbers written to the hundredths place (5.1.2.2)
- Finds 0.01 more or less than given numbers written to the hundredths place (5.1.2.2)
- Locates decimals on a number line with a scale of the same fractional unit (5.1.2.3)
- Recognizes equivalent simple fractions (e.g., denominators 2, 4, 8, 10, 16) (5.1.2.4)
- Rounds decimals to the nearest tenth and hundredth (5.1.2.5)

Grade 6

6.1.2

Understand the concept of ratio and its relationship to fractions and to the multiplication and division of whole numbers. Use ratios to solve real-world and mathematical problems.

Exceeds the Standards

- Uses multi-step problem-solving to determine or compare ratios (6.1.2.1)
- Uses ratios to compare various unknown quantities (6.1.2.1)

- Represents a part or total amount based on a given ratio in a variety of forms (percent of total, fractional amount, various ratio notations, etc.) (6.1.2.2)
- Applies scale factors to measurements in different units within the same system (e.g., mL and liters) (6.1.2.2)
- Finds ratios when the given numbers are fractions and decimals or require multi-step calculations (6.1.2.3)
- Uses known of time conversion rates for units, including small increments, to find unit rates (6.1.2.3)
- Uses multiple ratios or rates to solve real-world problems (6.1.2.4)

Meets the Standards

- Uses two-step problem-solving to determine a ratio of given quantities (6.1.2.1)
- Represents ratios in fraction form (6.1.2.1)
- Uses a given ratio to determine the total amount or the complement part of the ratio (6.1.2.2)
- Uses two rates to identify the unit rate (6.1.2.3)
- Uses and represents rates in a fractional form (6.1.2.3)
- Solves multi-step ratio and rate problems with numbers greater than or equal to 100 (6.1.2.4)
- Solves ratio and rate problems involving one or more unit conversions (6.1.2.4)

Partially Meets the Standards

- Identifies ratios and simplified ratios that are given in a scenario (6.1.2.1)
- Uses unit ratios to find a quantity (6.1.2.2)
- Determines a quantity described by a simple given ratio (6.1.2.2)
- Uses known of time conversions for units greater than a week to find a unit rate (6.1.2.3)
- Solves one-step ratio and rate problems involving decimals and fractions (6.1.2.4)
- Solves two-step ratio and rate problems with whole numbers less than 100 (6.1.2.4)
- Released Example: 264784

Does Not Meet the Standards

- Uses ratios involving 1 to find a quantity in one step (6.1.2.1)
- Uses scale factors to solve a one-step problem (6.1.2.2)
- Represents simple data in a circle graph (6.1.2.2)
- Finds whole-number unit rate in one-step problems (6.1.2.3)
- Finds unit prices greater than $1 in simple one-step problems (6.1.2.3)
- Solves one-step ratio and rate problems involving whole numbers (6.1.2.4)
- Released Example: 263090

Grade 7

7.1.2

Calculate with positive and negative rational numbers, and rational numbers with whole number exponents, to solve real-world and mathematical problems.

Exceeds the Standards

- Adds, subtracts, multiplies, and divides positive and negative rational numbers including decimals to the thousandths place, fractions with unlike denominators, and rational numbers raised to whole number exponents (7.1.2.1)
- Creates number sentences using the four operations with any positive or negative rational numbers that represent values from real-world situations (7.1.2.2)
- Solves simple and compound interest problems using formulas (7.1.2.4)
- Solves unique multi-step problems involving combinations of positive and negative rational numbers, including percents, decimals, mixed numbers, fractions, and exponents in context (7.1.2.4)
- Uses the total values and the ratio to solve for individual values that represent the ratio (7.1.2.5)
- Solves multi-step problems involving multiple unit conversions (7.1.2.5)
- Sets up proportional equations that can be used to solve situations (7.1.2.5)
- Graphs the solution for an absolute value expression on a number line (7.1.2.6)
- Recognizes and solves for the distance from zero of the solution of an absolute value expression (7.1.2.6)
- Finds all possible values that satisfy an equation or expression when variables are expressed as absolute values and graphs values on a number line (7.1.2.6)

Meets the Standards

- Adds, subtracts, multiplies, and divides with positive and negative rational numbers, including decimals to the hundredths place, proper fractions with unlike denominators, and exponentials (square or cube) with 1-digit whole numbers (7.1.2.1)
- Creates number sentences using adding and subtracting positive and negative integers, common fractions, and/or mixed numbers that represent values from real-world situations (7.1.2.2)
- Solves routine multi-step problems involving combinations of positive and negative rational numbers, including percents, decimals, mixed numbers, fractions, and exponents in context (7.1.2.4)
- Solves simple interest problems when provided the formula and all values in context (7.1.2.4)
- Solves routine word problems involving proportional reasoning or ratios expressed as *a:b*, with positive decimals and mixed numbers; may require multiple steps (7.1.2.5)

- Sorts absolute values and integers on a number line from least to greatest (7.1.2.6)
- Uses absolute value in simple expressions and equations to solve for a value or to represent distances on a number line (7.1.2.6)
- Released Examples: 44327 & 273020

Partially Meets the Standards

- Adds positive and negative integers, decimals to the hundredths, or common fractions with unlike denominators (7.1.2.1)
- Identifies the square or cube of common positive fractions (7.1.2.1)
- Identifies a number sentence or number line that models the real-world situation using positive and negative integers to represent distance or length (7.1.2.2)
- Solves problems in context by adding and/or subtracting up to 3 positive and negative integers or mixed numbers, with denominators all in the same fact family and less than 12, that represent changes in depth or height (7.1.2.4)
- Solves simple word problems using given proportional ratios comprised of integers or common fractions; may also require a common unit conversion (7.1.2.5)
- Understands that ratios are different than the difference between two numbers (7.1.2.5)
- Identifies the absolute value of a number with or without the absolute value symbols (7.1.2.6)
- Understands that absolute value represents a distance from zero (7.1.2.6)

Does Not Meet the Standards

- Finds the value of simple expressions containing positive 1-digit values raised to whole number exponents (7.1.2.1)
- Identifies a number sentence, using addition and subtraction properties, that matches the real-world situation given (7.1.2.2)
- Identifies a model or number line that represents the sum of two integers (7.1.2.2)
- Solves basic change in temperature problems when provided signed integer numbers and the result is positive and less than 20 (7.1.2.4)
- Finds missing whole number quantities in simple ratio problems in familiar, real-world situations with whole numbers and no unit conversion (7.1.2.5)
- Understands that absolute value is in reference to zero (7.1.2.6)

Grade 3

3.1.3

Understand meanings and uses of fractions in real-world and mathematical situations.

Exceeds the Standards

- Fluently uses a number line to represent fractions (3.1.3.1)
- Finds distances on a number line (3.1.3.1)
- Determines the complements of fractions (i.e., the part that is NOT shown) (3.1.3.1)
- Compares and explains differences in amounts based on given or abstract values of a group (3.1.3.2)
- Consistently orders fractions both with and without models (3.1.3.3)
- Finds a fraction that satisfies at least two given comparison criteria (3.1.3.3)

Meets the Standards

- Understands that the denominator represents the whole (3.1.3.1)
- Uses fraction representations for wholes as large as 8 (3.1.3.1)
- Identifies fraction models that represent real-world situations and vice versa (3.1.3.1)
- Distinguishes greatest or least fractional parts, including when given different fractions for sets of different sizes (3.1.3.2)
- Uses models to order multiple fractions with like denominators and make comparisons (3.1.3.3)
- Finds a fraction that is less than or greater than another given fraction (3.1.3.3)
- Released Examples: 234944, 235711 & 236083

Partially Meets the Standards

- Translates between symbol and word representations of fractions (3.1.3.1)
- Matches a fraction model to a given fraction, and vice versa (3.1.3.1)
- Has basic understanding of representing a fraction on a number line (3.1.3.1)
- Distinguishes greatest or least fractional parts when given the same fraction for sets of different sizes (3.1.3.2)
- Distinguishes greatest or least fractional parts when given different fractions for sets of the same size (3.1.3.2)
- Orders 2- or 3-unit fractions with nonadjacent denominators (3.1.3.3)
- Identifies the largest or smallest unit fraction (3.1.3.3)

Does Not Meet the Standards

- Identifies fractions in simple fraction bar models with denominators up to 6 (3.1.3.1)

- Understands that when comparing the same fractional parts of different-sized wholes, only the size of the wholes needs to be compared (3.1.3.2)
- Compares unit fraction models to identify the least fractional amount shaded (3.1.3.3)
- Released Example: 730813

Grade 5

5.1.3

Add and subtract fractions, mixed numbers and decimals to solve real-world and mathematical problems.

Exceeds the Standards

- Subtracts mixed numbers with unlike denominators that require regrouping (5.1.3.1)
- Uses number lines to represent subtraction of decimals with different denominators (5.1.3.2)
- Solves unique and complex multi-step, real-world and mathematical problems involving addition and subtraction of a combination of decimals, fractions, and mixed numbers (5.1.3.4)

Meets the Standards

- Adds and subtracts multi-step addition and subtraction problems involving both decimals and fractions (5.1.3.1)
- Adds both fractions and mixed numbers that require regrouping from the whole numbers and fractional parts (5.1.3.1)
- Subtracts fractions and mixed numbers with denominators up to 12, where one denominator is a multiple of the other (5.1.3.1)
- Uses fraction models to subtract fractions and mixed numbers with denominators up to 12, where one denominator is a multiple of the other (5.1.3.2)
- Represents addition and subtraction of decimals with base ten blocks and number lines (5.1.3.2)
- Creates fraction models to represent addition and subtraction of fractions with different denominators up to 12 (5.1.3.2)
- Solves straightforward multi-step, real-world problems involving addition and subtraction of decimals and fractions, including mixed numbers with denominators up to 12 (5.1.3.4)
- Released Examples: 750129 & 254701

Partially Meets the Standards

- Adds or subtracts two simple fractions with unlike denominators up to 12 (5.1.3.1)
- Adds or subtracts, without regrouping, two simple mixed numbers with denominators up to 12, where one denominator is a multiple of the other (5.1.3.1)

- Uses fraction models to add two fractions with denominators up to 12, where one denominator is a multiple of the other (5.1.3.2)
- Represents addition of decimals with base ten blocks (5.1.3.2)
- Solves multi-step, real-world problems involving addition and subtraction of decimals (5.1.3.4)
- Solves one- and two-step, real-world problems involving addition and subtraction of fractions with denominators up to 12, where one denominator is a multiple of the other or the common denominator is a multiple of both (5.1.3.4)
- Adds mixed numbers with denominators up to 4 (5.1.3.4)
- Released Example: 254728

Does Not Meet the Standards

- Solves one-step addition or subtraction problems involving decimals (5.1.3.1)
- Uses fraction models to add fractions with same denominators up to 12 (5.1.3.2)
- Solves one-step, real-world problems involving addition and subtraction of decimals to the tenths and decimals associated with money (5.1.3.4)

Grade 6

6.1.3

Multiply and divide decimals, fractions, and mixed numbers; solve real-world and mathematical problems using arithmetic with positive rational numbers.

Exceeds the Standards

- Divides two decimals with differing place values after the decimal, including values with zeros after the decimal (e.g., 0.002 and 2.01) (6.1.3.1)
- Consistently uses and understands the term "product" to mean multiplication and the term "quotient" to mean division (6.1.3.1)
- Solves multi-step mathematical problems involving fractions and decimals (6.1.3.1)
- Finds what percent one decimal or fraction is of another in context (6.1.3.3)
- Calculates percents when solving multi-step, real-world situations (6.1.3.3)
- Solves real-world problems with fractions, decimals, and/or mixed numbers to find solutions that answer questions about the minimum, maximum, or fraction of a fraction in context (6.1.3.4)

Meets the Standards

- Divides a fraction or a mixed number by a fraction or a mixed number with denominators that are relatively prime (6.1.3.1)
- Multiplies two decimals that are both less than 10 and one of them is written to the tenths place and the other is written to the hundredths place (6.1.3.1)

- Uses various multiplication symbols [·, ( ), and ×] (6.1.3.1)
- Calculates a percentage of a decimal greater than 1 (6.1.3.3)
- Finds what percent one whole number is of another whole number in context (6.1.3.3)
- Solves real-world problems by adding, subtracting, multiplying, and/or dividing two or more fractions, mixed numbers, or decimals in multi-step problems (6.1.3.4)
- Translates between decimals, fractions, and mixed numbers when solving problems (6.1.3.4)
- Released Examples: 265516 & 264942

Partially Meets the Standards

- Multiplies two decimals to the tenths place with a value greater than 1 but less than 10 (6.1.3.1)
- Multiplies two fractions that each have 1-digit numerators and denominators that are less than or equal to 5 (6.1.3.1)
- Divides a fraction or decimal by a 1-digit whole number (6.1.3.1)
- Knows the term “product” means to multiply (6.1.3.1)
- Calculates a percentage of a whole number (6.1.3.3)
- Solves real-world problems by adding and subtracting 2 fractions with unlike denominators and/or mixed numbers (6.1.3.4)

Does Not Meet the Standards

- Divides or multiplies a decimal by a 1-digit whole number (6.1.3.1)
- Identifies a possible denominator when two fractions are multiplied that each have 1-digit numerators and denominators that are less than or equal to 5 (6.1.3.1)
- Identifies how to find the percentage of a number (6.1.3.3)
- Solves real-world and mathematical problems requiring arithmetic with decimals, fractions, and mixed numbers (6.1.3.4)

Algebra

Grade 3

3.2.1

Use single-operation input-output rules to represent patterns and relationships and to solve real-world and mathematical problems.

Exceeds the Standards

- Finds missing numbers within a list or input-output table containing up to 4-digit numbers in real-world contexts, including noting when the obvious input pattern is not followed (3.2.1.1)
- Writes out rules in terms of their context (3.2.1.1)
- Released Example: 43597

Meets the Standards

- Finds missing numbers within lists and tables when there are gaps in both input and output values listed (3.2.1.1)
- Creates and uses rules with addition, subtraction, or multiplication to find the second or third output past a given pattern (3.2.1.1)
- Identifies rules and their descriptions in tables by analyzing the output based on the input within context (3.2.1.1)
- Released Examples: 235240 & 235258

Partially Meets the Standards

- Identifies the next or second number out in patterns given in lists (3.2.1.1)
- Creates and uses a one-step rule with addition or multiplication to identify a missing value in a list or in a table (3.2.1.1)

Does Not Meet the Standards

- Identifies simple rules in patterns (3.2.1.1)
- Finds the next number in simple patterns (3.2.1.1)

Grade 4

4.2.1

Use input-output rules, tables and charts to represent patterns and relationships and to solve real-world and mathematical problems.

Exceeds the Standards

- Finds and applies multi-step complex rules for patterns presented in different formats (4.2.1.1)
- Identifies input-output tables that represent real-world situations (4.2.1.1)
- Released Example: 245056

Meets the Standards

- Recognizes an algebraic rule for a one-operation pattern (4.2.1.1)
- Applies written rules for input-output tables (4.2.1.1)
- Finds multi-step rules for input-output tables and applies them to find missing values (4.2.1.1)

Partially Meets the Standards

- Uses written rules to continue a pattern (4.2.1.1)
- Finds simple rules for input-output tables and applies them to find missing values (4.2.1.1)
- Released Example: 244507

Does Not Meet the Standards

- Recognizes basic patterns in lists of numbers (4.2.1.1)

Grade 5

5.2.1

Recognize and represent patterns of change; use patterns, tables, graphs and rules to solve real-world and mathematical problems.

Exceeds the Standards

- Creates and uses patterns in tables of values to identify incorrect and unknown values (5.2.1.1)
- Finds rules that describe patterns given sequentially and nonsequentially in lists and tables of values (5.2.1.1)
- Identifies correctly plotted points on a coordinate system that follow a written linear rule (5.2.1.2)
- Finds ordered pairs of positive integers from a linear pattern of points on a coordinate system, where the new ordered pairs may not be shown in the image of the coordinate system (5.2.1.2)

Meets the Standards

- Finds missing values using tables, numeric patterns, geometric patterns, graphs, and input-output tables (5.2.1.1)
- Describes multi-step and complex rules in patterns (5.2.1.1)
- Uses linear rules to find missing positive integer x- and y-values, and graphs the pairs on a coordinate system (5.2.1.2)
- Finds ordered pairs of positive integers from linear rules, including those with fraction slopes, of points on a coordinate system (5.2.1.2)
- Released Examples: 251073 & 42464

Partially Meets the Standards

- Finds and uses patterns in geometric objects to find unknown values (5.2.1.1)
- Finds a two-step rule involving whole numbers in input-output table or list, describes the rule, and uses it to find unknown values (5.2.1.1)
- Finds a linear pattern from a graph to identify additional values (5.2.1.1)
- Finds missing ordered pairs of positive integers in a table, and graphs the pairs on a coordinate system with a scale of 1 or 2 (5.2.1.2)
- Uses linear rules (with integer slopes) to find missing positive integer y-values given positive integer x-values, and graphs the pairs on a coordinate system with a scale of 1 or 2 (5.2.1.2)

Does Not Meet the Standards

- Recognizes an algebraic rule for a one-operation pattern (5.2.1.1)
- Finds and uses multi-step rules in a pattern and applies them to find unknown values (5.2.1.1)
- Graphs ordered pairs of positive integers on a coordinate system with a scale of 1 (5.2.1.2)

Grade 6

6.2.1

Recognize and represent relationships between varying quantities; translate from one representation to another; use patterns, tables, graphs and rules to solve real-world and mathematical problems.

Exceeds the Standards

- Finds the new value of a variable when another variable changes in a complex situation (6.2.1.1)
- Identifies new representations of relationships between variables given in equation, table, or word formats (6.2.1.1)
- Graphs a linear equation on a coordinate grid (6.2.1.2)
- Translates between a linear equation, written description, graph, and table containing rational numbers (6.2.1.2)

Meets the Standards

- Identifies how a change in one variable affects another variable in equations with up to three operations in real-world context or mathematical situations (6.2.1.1)
- Graphs points from a linear equation (in slope-intercept form) given the starting value (y-intercept) (6.2.1.2)
- Translates between a linear equation (in slope-intercept form), graph, and table containing rational numbers (6.2.1.2)
- Released Example: 265280

Partially Meets the Standards

- Identifies the meaning of a variable given in context (6.2.1.1)
- Demonstrates how changing one variable affects a second variable in one-operation equations given context (6.2.1.1)
- Identifies an equation that represents whole numbers in an input-output table where input values increase by 1 and vice versa (6.2.1.2)
- Identifies the graph that matches values given in an input-output table (6.2.1.2)
- Released Example: 266003

Does Not Meet the Standards

- Uses the given meaning of a variable in context to solve simple one-step problems (6.2.1.1)
- Graphs up to 4 points listed in an input-output table (6.2.1.2)
- Describes simple relationships between input and output values listed in table format (6.2.1.2)

Grade 7

7.2.1

Understand the concept of proportionality in real-world and mathematical situations, and distinguish between proportional and other relationships.

Exceeds the Standards

- Identifies and solves equations that represent directly and inversely proportional relationships from real-world and mathematical descriptions (7.2.1.1)
- Identifies multiple equations representing directly and inversely proportional relationships (7.2.1.1)
- Graphs a proportional relationship given the slope (7.2.1.2)
- Understands and demonstrates how changes in the unit rate affect the graph of a line (7.2.1.2)
- Uses and understands the terms slope and constant of proportionality (7.2.1.2)

Meets the Standards

- Identifies proportional relationships in input-output tables (7.2.1.1)
- Identifies the graph of a proportional relationship based on changes to a given proportional relationship (7.2.1.2)
- Identifies the graph of a proportional relationship by solving for the unit rate and vice versa (7.2.1.2)

Partially Meets the Standards

- Identifies equations or points that satisfy given proportional relationships (7.2.1.1)
- Identifies graphs of a proportional relationship for a given unit rate in context when the scales on the graph match the context (7.2.1.2)

Does Not Meet the Standards

- Identifies when a relationship in context is proportional (7.2.1.1)
- Identifies a graph that represents a proportional relationship (7.2.1.2)

Grade 8

8.2.1

Understand the concept of function in real-world and mathematical situations, and distinguish between linear and non-linear functions.

Exceeds the Standards

- Understands and explains the components of a function, identifying the dependent and independent variable (8.2.1.1)
- Solves real-world problems involving linear relationships and using variables other than *x* and *y* (8.2.1.1)
- Explains how the dependent variable changes when there is a change to the independent variable from mathematical and real-world described linear situations (8.2.1.2)
- Finds changes in an independent variable given changes in the dependent variables for linear functions (8.2.1.2)
- Distinguishes linear functions from non-linear functions written symbolically when linear functions are represented in novel forms (8.2.1.3)
- Understands that horizontal lines represent linear functions with a slope of zero, and vertical lines do not represent functions (8.2.1.3)
- Finds the *n*th term of a sequence given a symbolic representation and the domain (8.2.1.4)

- Distinguishes arithmetic from non-arithmetic sequences when the sequence is provided as a list or symbolically (8.2.1.4)
- Consistently finds a symbolic representation for an arithmetic sequence given a list of numbers and with domains starting at 0 or 1 (8.2.1.4)
- Identifies symbolic representation of a geometric sequence when given ordered pairs or points on a graph (8.2.1.5)

Meets the Standards

- Solves problems using function notation with a given value such as *f(a)* by substituting the number "*a*" into the function equation for *x* (8.2.1.1)
- Identifies function *f(x)* that matches a list of input-output pairs (8.2.1.1)
- Consistently finds changes in a dependent variable given changes in the independent variable for real-world linear functions (8.2.1.2)
- Identifies sets of ordered pairs that, when graphed, represent a linear function (8.2.1.3)
- Identifies the function used to create the given terms of an arithmetic sequence (8.2.1.4)
- Understands that the equation $f(x) = mx + b$ can be used to represent an arithmetic sequence where *m* represents the common difference between each term (8.2.1.4)
- Identifies a geometric function symbolically when given the domain and a sequence of numbers (8.2.1.5)
- Computes terms of a sequence when given the domain and sequence in $f(x) = a(b)^x$ form (8.2.1.5)

Partially Meets the Standards

- Solves for *x* or *f(x)* when a linear function is represented in function notation as $f(x) = mx + b$ in context (8.2.1.1)
- Understands that *x* represents the input value and *f(x)* represents the output value (8.2.1.1)
- Uses simple linear functions to solve problems in real-world contexts involving changes to the input value (8.2.1.2)
- Identifies linear functions that model real-world problems (8.2.1.2)
- Distinguishes linear functions from non-linear functions symbolically and graphically (8.2.1.3)
- Identifies the common difference in an arithmetic sequence (8.2.1.4)
- Finds terms of an arithmetic sequence given in symbolic form (8.2.1.4)
- Understands that the difference between successive terms in a geometric sequence is not constant (8.2.1.5)

Does Not Meet the Standards

- Recognizes that a function is a relationship between *x* and *f(x)* (8.2.1.1)
- Finds the next values in a linear pattern from an input-output table (8.2.1.2)
- Understands that the graph of a linear function is a straight line with a constant slope (8.2.1.3)
- Continues a pattern in a list of numbers that represent an arithmetic sequence (8.2.1.4)
- Computes the next term in a list of terms representing a geometric sequence (8.2.1.5)

Grade 11

9.2.1

Understand the concept of function, and identify important features of functions and other relations using symbolic and graphical methods where appropriate.

Exceeds the Standards

- Evaluates complex functions using irrational values as well as composite functions (9.2.1.1)
- Distinguishes functions and relations given in equation, graph, or table format (9.2.1.2)
- Compares and justifies relations and functions (9.2.1.2)
- Identifies the domain of various functions including piecewise functions (9.2.1.3)
- Identifies the domain restrictions of a function in context (9.2.1.3)
- Identifies the graph which models a situation in context, including step functions, involving quantities that change over time (9.2.1.4)
- Defines the range of a function shown graphically (9.2.1.4)
- Calculates the *y*-intercept, vertex, or axis of symmetry (in the form $x = n$) of a quadratic function given graphically or as an equation in standard form or factored form (9.2.1.5)
- Solves problems using only a partial graph of a parabola (9.2.1.5)
- Identifies the y-intercept, multiple zeros, multiple maxima and minima, and increasing and decreasing intervals of functions (9.2.1.6)
- Identifies or describes the vertical and horizontal asymptotes of a given rational or exponential function with translations (9.2.1.7)
- Identifies changes in the rate of change over different intervals from points given in a table or graph (9.2.1.8)
- Differentiates between linear and exponential representations of changes in movement or speed in a given context (9.2.1.8)
- Graphs a new function based on translations of a given function in the form $f(x) = a(x - h)^2 + k$, where h and k are non-zero quantities (9.2.1.9)
- Understands how translations affect equations to solve novel mathematical situations (9.2.1.9)

Meets the Standards

- Evaluates various functions with positive and negative decimal and fraction inputs as well as simple expressions (9.2.1.1)
- Distinguishes between a function and a relation given as the graph of an equation, step function, and plotted points, or when given a list of ordered pairs (9.2.1.2)
- Understands that a set of ordered pairs in which the *x* value repeats is not a function (9.2.1.2)
- Uses inequality symbols to define the domain of various functions, including rational, simple piecewise, and functions with vertical asymptotes (9.2.1.3)

- Identifies correct interpretations of information presented in the graph of a piecewise, step, or quadratic function (9.2.1.4)
- Identifies the *y*-intercept, vertex, or axis of symmetry (for $x \neq 0$) of a quadratic function given graphically or as an equation in standard form or factored form (9.2.1.5)
- Solves problems using a partial equation or graph of a parabola and the vertex (9.2.1.5)
- Uses $a < x < b$ notation consistently to identify intervals over which a function is increasing or decreasing (9.2.1.6)
- Identifies the vertical, horizontal, or pair of asymptotes for a given rational function from an equation or a graph (9.2.1.7)
- Knows that exponential functions have an asymptote (9.2.1.7)
- Identifies parts of a piecewise graph that have greatest or least average rate of change and represents the intervals in words or with inequality notation (9.2.1.8)
- Identifies the equation or graph of a new function based on a written description of applied dilations and/or translations and vice versa (9.2.1.9)
- Graphs a new function based on a description of a translation of $f(x) = x^2$ (9.2.1.9)

Partially Meets the Standards

- Evaluates quadratic, exponential, and simple rational equations using function notation and for a given positive or negative integer value(s) and positive decimals to the tenths place in the domain (9.2.1.1)
- Identifies a point that can be added to a group of points to maintain the function (9.2.1.2)
- Identifies a function when presented with up to 4 points in tabular form (9.2.1.2)
- Understands that the domain of a rational function excludes values which result in a value of zero in the denominator (9.2.1.3)
- Solves one- and two-step problems by reading and analyzing graphs of continuous functions and scatterplots presented in the first quadrant and in context (9.2.1.4)
- Identifies an interval of values from a graph to satisfy a situation in context (9.2.1.4)
- Identifies the axis of symmetry when given a graph of a parabola (9.2.1.4)
- Identifies the *y*-coordinate of the vertex when given a quadratic function in vertex form (9.2.1.5)
- Understands that the zeros of a function are *x*-intercepts and identifies multiple zeros of a function on a graph (9.2.1.6)
- Identifies the vertical and horizontal asymptotes of a given parent function in graph format (9.2.1.7)
- Knows that rational functions have an asymptote that is related to the denominator (9.2.1.7)
- Identifies that rate of change or changes in slope on a graph can represent changes in movement or speed in a given context (9.2.1.8)
- Understands a horizontal line on a piecewise graph as meaning the output value is not changing over time (9.2.1.8)
- Identifies how vertical translations change equations or graphs (9.2.1.9)
- Released Example: 45019

Does Not Meet the Standards

- Uses function notation to evaluate linear and simple quadratic functions to find an output value, *f(a)*, by substituting a given number "*a*" in for *x* when *x* is an integer greater than zero (9.2.1.1)
- Identifies whether the graph of a familiar equation type is a function (9.2.1.2)
- Knows that the domain of a function is a range of possible values that may extend to infinity (9.2.1.3)
- Interprets a horizontal part of a graph in context (9.2.1.4)
- Identifies linear graphs to show constant growth rates (9.2.1.4)
- Identifies the location of the vertex when given the graph of a parabola (9.2.1.5)
- Knows that the vertex and the axis of symmetry are related (9.2.1.5)
- Identifies the maximum and minimum values on the graph of a function (9.2.1.6)
- Identifies the *y*-intercept on the graph of a function (9.2.1.6)
- Knows that graphs of some functions approach but never reach some values (9.2.1.7)
- Identifies a graphed positive linear slope as being correlated to constant increase in a context (9.2.1.8)
- Knows that a translation will move a given function from its current location to another location on the graph (9.2.1.9)

Grade 3

3.2.2

Use number sentences involving multiplication and division basic facts and unknowns to represent and solve real-world and mathematical problems; create real-world situations corresponding to number sentences.

Exceeds the Standards

- Identifies and creates possible contexts to describe multiplication and division number sentences (3.2.2.1)
- Creates real-world situations to represent number sentences (3.2.2.1)
- Identifies missing operation symbols to make a number sentence true with multiple missing symbols (3.2.2.1)
- Identifies and creates number sentences with two operations to represent given situations (3.2.2.2)
- Uses multiplication and division facts to find unknown values in unique and novel number sentences (3.2.2.2)
- Released Examples: 234671, 235299 & 730114

Meets the Standards

- Knows that equal-sized groups is a necessary condition for division contexts (3.2.2.1)
- Uses fact family knowledge to find the missing piece of number sentences using two expressions (3.2.2.1)
- Identifies possible contexts to describe multiplication number sentences using numbers up to 100 (3.2.2.1)
- Identifies and creates multiplication or division number sentences that represent given situations (3.2.2.2)
- Uses multiplication or division facts to find unknown values in given number sentences (3.2.2.2)
- Released Example: 236054

Partially Meets the Standards

- Identifies missing operation symbols to make equivalent expressions (3.2.2.1)
- Finds missing factor when one factor has 2 digits (3.2.2.1)
- Matches multiplication contexts that use traditional words (e.g., each) with the correct multiplication number sentences (3.2.2.2)
- Uses multiplication facts to identify unknown values in given number sentences (3.2.2.2)

Does Not Meet the Standards

- Identifies missing operations and solves number sentences with 1-digit factors (3.2.2.1)
- Uses basic multiplication facts to identify unknown values in given number sentences (3.2.2.2)
- Uses basic division facts to identify the results in given number sentences (3.2.2.2)

Grade 4

4.2.2

Use number sentences involving multiplication, division, and unknowns to represent and solve real-world and mathematical problems; create real-world situations corresponding to number sentences.

Exceeds the Standards

- Translates between real-world situations and number sentences (4.2.1.1)
- Creates a number sentence to represent real-world situations (4.2.1.1)
- Represents the meaning of the parts of a number sentence to find multi-step solutions (4.2.1.1)
- Solves for a variable in a number sentence to make an equation true in multi-step, multi-operation solution process (4.2.1.2)
- Identifies multiple equations that represent real-world situations involving an unknown and at least one operation (4.2.2.2)

Meets the Standards

- Identifies missing operation symbol(s) (+, −, ×, ÷) to make a number sentence true with one or more missing symbols (4.2.1.1)
- Represents the meaning of a variable in a number sentence to describe real-world situations (4.2.1.1)
- Represents real-world situations with a number sentence involving an unknown and one operation (4.2.1.2)
- Finds values for the unknowns that make multiple-operation number sentences true (numbers less than 100) (4.2.2.2)
- Released Examples: 242039 & 241410

Partially Meets the Standards

- Identifies which symbol (+, −, ×, ÷) can be used to make equivalent expressions (4.2.1.1)
- Represents real-world situations using simple number sentences (4.2.1.1)
- Matches number sentences with an isolated unknown in situations involving multiplication and division (4.2.2.2)

Does Not Meet the Standards

- Identifies which symbol (+, −, ×, ÷) makes a simple number sentence true (4.2.1.1)
- Matches a story line to a corresponding simple number sentence using (+, −, ×, ÷) (4.2.1.1)
- Finds values for the unknowns that make single-operation (multiplication or division) number sentences true (numbers less than 100) (4.2.1.2)

Grade 5

5.2.2

Use properties of arithmetic to generate equivalent numerical expressions and evaluate expressions involving whole numbers.

Exceeds the Standards

- Applies the commutative, associative, and distributive properties and order of operations to identify multiple equivalent expressions and to simplify multi-step expressions (5.2.2.1)
- Determines missing operation symbols (+, –, ×, ÷) to form equivalent expressions (5.2.2.1)

Meets the Standards

- Applies commutative, associative, and distributive properties to identify equivalent expressions 5.2.2.1)

Partially Meets the Standards

- Resorts to calculation to verify commutative, associative, and distributive properties to identify equivalent expressions (5.2.2.1)
- Uses order of operations to find unknown values in equivalent expressions (5.2.2.1)

Does Not Meet the Standards

- Uses order of operations to simplify expressions involving whole numbers in two or three steps (5.2.2.1)
- Released Example: 44056

Grade 6

6.2.2

Use properties of arithmetic to generate equivalent numerical expressions and evaluate expressions involving positive rational numbers.

Exceeds the Standards

- Applies the commutative, associative, and distributive properties to simplify and solve multi-step complex expressions and equations involving positive rational numbers (6.2.2.1)
- Simplifies expressions using order of operations and then identifies multiple equivalent expressions (6.2.2.1)

Meets the Standards

- Applies order of operations to create equivalent expressions with multiple operations (+, −, ×, and ÷) involving positive rational numbers (6.2.2.1)
- Released Examples: 266149, 266161, 264717, 266025, 263096 & 263222

Partially Meets the Standards

- Applies the associative and the distributive properties to simplify and solve expressions (6.2.2.1)
- Identifies valid steps for simplifying specific expressions and solving problems (6.2.2.1)

Does Not Meet the Standards

- Identifies valid first steps that use the distributive property to simplify an expression (6.2.2.1)
- Uses order of operations to simplify expressions with up to four operations (+, −, and ×) involving whole numbers and decimals (6.2.2.1)
- Released Example: 262076

Grade 7

7.2.2

Recognize proportional relationships in real-world and mathematical situations; represent these and other relationships with tables, verbal descriptions, symbols and graphs; solve problems involving proportional relationships and explain results in the original context.

Exceeds the Standards

- Understands and applies the meaning of slope and determines the slope using a graph, equation, table, or verbal description (7.2.2.1)
- Understands and applies the meaning of constant of proportionality and identifies it from a table, verbal description, or graph (7.2.2.1)
- Calculates final cost or percent involving discounts and sales tax in context (7.2.2.2)
- Solves real-world problems involving proportional changes including percent change (7.2.2.2)
- Identifies an equation or inequality that represents a real-world situation with one or two variables (7.2.2.4)
- Released Example: 770604

Meets the Standards

- Recognizes a rational proportional relationship and graphs, completes a table of values, or relates to verbal descriptions that match the relationship, with all values (7.2.2.1)
- Compares up to 6 unit rates to determine least or greatest (7.2.2.1)
- Finds the proportion based on data given and then uses that proportion to solve using different data (7.2.2.2)
- Determines percent change from final to original value (7.2.2.2)
- Identifies an equation or inequality that represents a real-world situation with one variable with integers and decimals (7.2.2.4)

Partially Meets the Standards

- Compares up to 4 whole number unit rates to determine least or greatest (7.2.2.1)
- Matches between tables, graphs, equations, or verbal descriptions given in context and when the constant of proportionality is a whole number (7.2.2.1)
- Finds the missing values in a table that match the whole number unit (7.2.2.1)
- Sets up a proportion and solves for missing value in context (7.2.2.2)
- Uses proportions to find percents (7.2.2.2)
- Identifies an expression or equation that represents a real-world situation with one variable and using addition, subtraction, and multiplication with whole numbers and up to one decimal (7.2.2.4)

Does Not Meet the Standards

- Identifies the whole number unit rate of a proportional relationship when given in table or equation form (7.2.2.1)
- Matches a table of values with a given proportional equation, with a whole number constant of proportionality (7.2.2.1)
- Uses a given proportion to solve a simple expression (7.2.2.2)
- Recognizes an expression or equation that represents a real-world situation with one variable and addition or subtraction (7.2.2.4)

Grade 8

8.2.2

Recognize linear functions in real-world and mathematical situations; represent linear functions and other functions with tables, verbal descriptions, symbols and graphs; solve problems involving these functions and explain results in the original context.

Exceeds the Standards

- Translates between various representations of linear functions with rational numbers for slope and *y*-intercept values (8.2.2.1)
- Interprets graphs with scales other than 1, including when different scales are used for two axes (8.2.2.1)
- Finds the slope and *y*-intercept when equations are in standard form (8.2.2.2)
- Relates changes in steepness of linear functions, including by fractional multipliers, to changes in a described context, and vice versa (8.2.2.3)
- Describes how changes to the slope and/or *y*-intercept of linear functions affect the *x*- and *y*-intercepts (8.2.2.3)
- Solves for a future value in a sequence presented as a list of numbers (8.2.2.4)
- Uses equations to represent arithmetic sequences presented in any form (8.2.2.4)
- Generates terms of geometric sequences represented by verbal descriptions (8.2.2.5)

Meets the Standards

- Translates between various representations of linear functions (tables, equations, and graphs with the same scale on both axes), with negative integers, simple fractions (denominators less than 5), and simple decimals for slope and *y*-intercept values (8.2.2.1)
- Relates steepness in graphs to benchmark values of m in equations of the form $y = mx + b$. (8.2.2.1)
- Consistently recognizes that the slope of a line on a graph is positive for lines that rise up from left to right and negative for lines that fall down from left to right (8.2.2.2)

- Recognizes *m* as slope and *b* as y-intercept when equations of functions are given in $y = mx + b$ form (8.2.2.2)
- Calculates the slope of a graphed line and no specific points (8.2.2.2)
- Consistently distinguishes a slope's relationship to the value of *m* from the *y*-intercept's relationship to the value of *b* for equations in the form $y = mx + b$ (8.2.2.3)
- Identifies how adding, subtracting, or multiplying an integer to the slope of a linear function affects the graph or equation of that function (8.2.2.3)
- Understands and uses the terms linear function and slope (8.2.2.3)
- Solves for a missing value in a sequence presented in a table (8.2.2.4)
- Solves for a future value in a sequence presented in a verbal description or context (8.2.2.4)
- Uses equations to represent arithmetic sequences presented as tables, graphs, or verbal descriptions (8.2.2.4)
- Generates specified terms (other than the next) of geometric sequences represented by equations (8.2.2.5)
- Recognizes equations that represent given geometric sequences (8.2.2.5)

Partially Meets the Standards

- Translates between linear equations with a scale of 1 or 2 and input-output tables, including the use of negative integers (8.2.2.1)
- Translates between graphs of linear functions and tables of values, including the use of negative integers (8.2.2.1)
- Distinguishes between slopes and intercepts (8.2.2.2)
- Recognizes that slope is a ratio of the vertical distance to the horizontal distance from one point to another (from left to right) on a graphed line (8.2.2.2)
- Calculates slope between two points on a coordinate grid (8.2.2.2)
- Recognizes that linear equations have a slope and *y*-intercept (8.2.2.3)
- Differentiates between a variable rate of change and a fixed rate of change (8.2.2.4)
- Generates first three or four terms of geometric sequences represented by equations, tables, or graphs (8.2.2.5)
- Released Example: 283232

Does Not Meet the Standards

- Translates from a simple linear equation or graph to values given in an input-output table (8.2.2.1)
- Recognizes that slope involves a change in vertical distance and horizontal distance (8.2.2.2)
- Recognizes intercepts on the graph of a linear function (8.2.2.2)
- Recognizes that the value of *m* is the "steepness" of the line in the form $y = mx$ (8.2.2.3)
- Recognizes the difference between terms in a list of numbers representing an arithmetic sequence (8.2.2.4)
- Generates the next term of geometric sequences represented by lists or tables (8.2.2.5)

Grade 9

9.2.2

Recognize linear, quadratic, exponential and other common functions in real-world and mathematical situations; represent these functions with tables, verbal descriptions, symbols and graphs; solve problems involving these functions, and explain results in the original context.

Exceeds the Standards

- Creates linear and quadratic equations that represent the situations, combining multiple formulas when needed, to solve for an unknown variable (9.2.2.1)
- Solves exponential equations representing changes in interest rate, initial value, or final value in context (9.2.2.2)
- Identifies which exponential function represents a given situation of growth or depreciation (9.2.2.2)
- Sketches graphs of linear, quadratic, and exponential functions presented in novel forms, including functions for which translations or scale factors have been applied (9.2.2.3)
- Identifies the parts of a recursive and explicit function and solves for up to 4 additional terms in the sequence (9.2.2.4)
- Identifies the recursive or explicit function that represents a given real-world or abstract mathematical situation (9.2.2.4)
- Solves real-world problems related to finding the total amount by computing the sum of a finite geometric series given as a verbal description (9.2.2.5)
- Interprets beginning and ending time periods properly and differentiates when to use the exponents $(n-1)$ and n when computing terms of a geometric sequence in real-world contexts (9.2.2.5)
- Computes the *n*th term of a finite increasing or decreasing geometric sequence in real-world context when given recursively or as a verbal description (9.2.2.5)
- Understands the effect of adding or subtracting an abstract number "*n*" inside or outside the argument of a function and uses this information to translate the graph of a function to a specified quadrant (9.2.2.6)
- Released Example: 500002

Meets the Standards

- Solves linear and quadratic problems with real-world and mathematical (e.g., area, perimeter) contexts using rational numbers (9.2.2.1)
- Identifies an equation to represent a linear situation given in context and requiring calculations (9.2.2.1)

- Identifies a solution to a quadratic equation in the format $ax^2 + bx + c = d$, where $a \neq 0$ or 1 (9.2.2.1)
- Creates, identifies, and/or solves the increasing or decreasing exponential equation in $y = ab^x$ format using the data given (9.2.2.2)
- Identifies and/or solves initial or final value of simple compound interest equations, compounded annually or continuously, using given data (9.2.2.2)
- Fluently translates between graphs, tables, equations, and verbal descriptions of linear, quadratic, and exponential functions, including when no information about the type of function has been provided (9.2.2.3)
- Identifies the formula, explicit or recursive, of a given pattern shown in a list, table, graph, or image format (9.2.2.4)
- Calculates the sum of up to 6 terms in a geometric series (9.2.2.4)
- Identifies the common ratio of a given geometric series (9.2.2.4)
- Computes value of account after *n* years using the compound interest formula for various compounding periods (9.2.2.5)
- Calculates the sum of a finite increasing or decreasing geometric series for up to 10 terms (9.2.2.5)
- Represents a geometric sequence and/or finds terms of the sequence in contexts such as salary increase or depreciation when given initial value and percent increase/decrease (9.2.2.5)
- Identifies the equation of a function representing a given graph, or vice versa, when the function contains horizontal and/or vertical translation for rational, absolute value, square root, and cubic functions (9.2.2.6)
- Identifies the graph or equation from a written description of one (horizontal) or two (horizontal and vertical) translations of a parent function (9.2.2.6)
- Identifies the general shape of a graphed cubic and rational function (9.2.2.6)

Partially Meets the Standards

- Solves linear problems in contexts using whole numbers and decimals less than 10,000 and combining like information (terms) (9.2.2.1)
- Identifies an equation to represent a linear situation given in context, without calculation (9.2.2.1)
- Identifies the solution pair to a quadratic equation in the format $x^2 + bx + c = 0$ (9.2.2.1)
- Solves for unknown variables given a simple exponential graph or function in context (9.2.2.2)
- Given the graph of a linear function, computes the slope of the line and finds ordered pairs contained on the line which fall outside of the range of the graph shown (9.2.2.3)
- Translates between graphs, tables, equations, and verbal descriptions of exponential functions in real-world and mathematical situations (9.2.2.3)
- Identifies the value of a designated term in a geometric sequence when given an explicit formula using only integers (9.2.2.4)
- Identifies when an explicit formula produces a geometric sequence versus an algebraic sequence (9.2.2.4)
- Knows a common ratio with an absolute value less than 1 will cause the absolute value of the values in a sequence to decrease instead of increase (9.2.2.4)

- Calculates a solution to problems up to the fifth term in a finite geometric series in context (9.2.2.5)
- Calculates a solution to problems in context using the annual compound interest formula at a given percentage rate (9.2.2.5)
- Identifies the general shape of a graphed square root or absolute value function (9.2.2.6)
- Released Example: 45376

Does Not Meet the Standards

- Solves and identifies linear word problems in contexts such as with money, with whole-number answers (9.2.2.1)
- Identifies a solution to a quadratic equation in the format $x^2 + c = d$ (9.2.2.1)
- Solves a simple exponential growth equation for a given value (9.2.2.2)
- Identifies the table of values that corresponds to a linear graph when the ordered pairs in the table are present on the graph (9.2.2.3)
- Translates between a table of values for a linear function and the equation for the line (9.2.2.3)
- Understands that the point (0, *b*) corresponds to the *y*-intercept of a graphed function (9.2.2.3)
- Identifies the common ratio for a geometric sequence when the absolute value of the terms are increasing and when the common ratio is a whole number less than 5 (9.2.2.4)
- Calculates consecutive terms in a finite geometric series given in context (9.2.2.5)
- Identifies vertical translations of the parent square root, absolute value, and cubic functions (9.2.2.6)
- Released Example: 791064

Grade 5

5.2.3

Understand and interpret equations and inequalities involving variables and whole numbers, and use them to represent and solve real-world and mathematical problems.

Exceeds the Standards

- Determines which value(s) for a given variable makes multiple equations or inequalities (including fractions and mixed numbers) true (5.2.3.1)
- Creates equations or inequalities to represent real-world situations (5.2.3.2)
- Evaluates complex expressions involving a combination of variables, repeated variables, grouping symbols, and division of expressions by computing with given values of the variable (5.2.3.3)
- Evaluates multiple expressions and equations involving variables by computing with given values of the variables (5.2.3.3)

Meets the Standards

- Determines whether multiple equations and inequalities involving a variable are true or false (5.2.3.1)
- Determines which positive integer value of a variable makes an equation or inequality (containing whole numbers less than 100 and using combinations of operations +, –, ×, and ÷ in various representations) true or vice versa (given the value) and identifies the equation or inequality (5.2.3.1)
- Identifies inequalities that represent real-world situations (5.2.3.2)
- Identifies what the parts of an inequality represent in a real-world situation (5.2.3.2)
- Identifies when to use an equation or an inequality to represent a real-world situation (5.2.3.2)
- Evaluates expressions involving multiple variables, repetition of variables, grouping symbols, and division by computing with given values of the variables (5.2.3.3)
- Solves simple equations when values for the variables are given (5.2.3.3)

Partially Meets the Standards

- Identifies which 1-digit value of a variable makes an equation (containing whole numbers less than 40 and at most two operations where one is division) true or vice versa (given the value) and identifies the equation (5.2.3.1)
- Determines which 1-digit value of a variable makes an equation or inequality (containing whole numbers and uses combinations of operations +, –, and ×) true or vice versa (given the value) and identifies the equation or inequality (5.2.3.1)
- Identifies real-world situations using equations and inequalities involving one or two variables (5.2.3.2)
- Evaluates expressions and equations involving division of expressions, repetition of a variable, or up to three variables by computing with given values of the variables (5.2.3.3)

Does Not Meet the Standards

- Identifies which 1-digit value of a variable makes an equation (containing whole numbers less than 20 and at most two operations of +, –, and ×) true (5.2.3.1)
- Identifies simple real-world situations using an equation involving a variable (5.2.3.2)
- Evaluates expressions involving whole numbers and up to two variables by computing with given 1-digit values for the variable(s) (5.2.3.3)
- Released Example: 44385

Grade 6

6.2.3

Understand and interpret equations and inequalities involving variables and positive rational numbers. Use equations and inequalities to represent real-world and mathematical problems; use the idea of maintaining equality to solve equations. Interpret solutions in the original context.

Exceeds the Standards

- Creates equations and inequalities that represent complex real-world situations involving up to two variables and vice versa (6.2.3.1)
- Explains the meaning of expressions in real-world contexts (6.2.3.1)
- Understands the meaning of the word solution and determines if a solution is reasonable in context (6.2.3.2)
- Identifies the steps needed to solve multi-step equations when given unsimplified equations (6.2.3.2)
- Solves for one or two variables in unsimplified multi-step equations (6.2.3.2)

Meets the Standards

- Identifies equations and inequalities that represent real-world situations using whole numbers and decimals (6.2.3.1)
- Solves for one or two variables in equations that are set in context (6.2.3.2)
- Solves multi-step equations (containing whole numbers, fractions, and decimals) with up to two variables when the value of one variable is given (6.2.3.2)
- Released Example: 265025

Partially Meets the Standards

- Identifies single-operation expressions, linear equations, and one-variable inequalities that represent real-world situations (6.2.3.1)
- Finds the value of the variable in a two- or three-step equation (6.2.3.2)
- Finds the value of a variable in a two-step equation (containing whole numbers) with two variables when the value of the other variable is given (6.2.3.2)
- Released Example: 264220

Does Not Meet the Standards

- Identifies which inequality represents the direct comparison of two variables in context (6.2.3.1)
- Finds the value of the variable in a simple one- or two-step equation (6.2.3.2)
- Released Example: 44635

Grade 7

7.2.3

Apply understanding of order of operations and algebraic properties to generate equivalent numerical and algebraic expressions containing positive and negative rational numbers and grouping symbols; evaluate such expressions.

Exceeds the Standards

- Simplifies algebraic expressions with one or more variables to the first and second degree using properties of algebra and whole number exponents (7.2.3.1)
- Creates multiple equivalent expressions with variables, fractions, integers, and whole number exponents (7.2.3.1)
- Evaluates complex algebraic expressions with up to 3 variables that are rational numbers in various formats (7.2.3.2)
- Released Example: 272359

Meets the Standards

- Finds equivalent expressions using the distributive and associative properties of algebra, grouping symbols, and exponents (7.2.3.1)
- Simplifies algebraic expressions with exponents (7.2.3.1)
- Evaluates algebraic expressions containing rational coefficients and/or whole number exponents with up to 3 variables by computing with given rational values of the variables (7.2.3.2)
- Released Examples: 272365, 274189 & 276010

Partially Meets the Standards

- Simplifies numeric expressions with grouping and whole number exponents up to the power of 4 (7.2.3.1)
- Evaluates algebraic expressions containing positive integer and/or simple fraction coefficients with up to 3 variables by computing with given values of the variables that are whole numbers, simple fractions, or decimals (7.2.3.2)
- Determines the value of an input variable based on context (7.2.3.2)

Does Not Meet the Standards

- Identifies the first step to be used in simplifying numeric and algebraic expressions with grouping and an exponent power of 2 (7.2.3.1)
- Evaluates simple single-variable expressions containing whole number coefficients using multiplication, addition, and exponents to the power of 2, given a whole number or decimal value of the variable (7.2.3.2)

Grade 8

8.2.3

Generate equivalent numerical and algebraic expressions and use algebraic properties to evaluate expressions.

Exceeds the Standards

- Evaluates complex algebraic expressions containing multiple terms that use exponents, absolute values, radicals, and parentheses, and which contain fractions and decimals (8.2.3.1)
- Uses a sophisticated understanding of order of operations to evaluate expressions in which the arguments of the expressions themselves contain one or more algebraic expressions such as absolute value, radicals, and exponents (8.2.3.1)
- Justifies multiple steps when simplifying complex expressions (sometimes containing multiple grouping symbols) by identifying and distinguishing between the associative, commutative, and distributive properties and by applying order of operations (8.2.3.2)
- Understands how to apply and distinguish between the associative, commutative, and identity properties of addition and multiplication (8.2.3.2)

Meets the Standards

- Consistently evaluates algebraic expressions containing absolute value, radicals, and rational expressions for values that are positive and negative rational numbers (8.2.3.1)
- Evaluates multiple expressions for a particular value of a variable (8.2.3.1)
- Understands and uses the commutative property to simplify expressions (8.2.3.2)
- Identifies errors in the simplification of an expression using understanding of properties of algebra (8.2.3.2)
- Understands that applying the associative property changes the position of grouping symbols when no other properties have been used (8.2.3.2)
- Released Example: 44549

Partially Meets the Standards

- Evaluates algebraic expressions, including one type of expression (radical or rational) and/or containing exponents of 2, for values that are positive and negative rational numbers (8.2.3.1)
- Understands and uses the distributive property to simplify expressions (8.2.3.2)
- Understands that commutativity involves a change in position (8.2.3.2)
- Released Example: 44793

Does Not Meet the Standards

- Evaluates simple algebraic expressions, including rational expressions and containing exponents of 2, for values that are positive rational numbers (8.2.3.1)
- Understands that simplifying exponents and multiplication precedes simplifying addition and subtraction (8.2.3.2)

Grade 11

9.2.3

Generate equivalent algebraic expressions involving polynomials and radicals; use algebraic properties to evaluate expressions.

Exceeds the Standards

- Fluently evaluates multi-term polynomial expressions containing more than two rational expressions, absolute value, or radical expressions with multiple variables and/or multiple occurrences of the variable (9.2.3.1)
- Fluently adds, subtracts, multiplies, and divides polynomials including when presented in novel forms (9.2.3.2)
- Fluently factors polynomials presented in novel forms (9.2.3.3)
- Multiplies and divides algebraic fractions, including when numerators and denominators contain linear or quadratic expressions that have not been factored to simplify (9.2.3.4)
- Adds and subtracts algebraic fractions with unlike multiple factor and/or multiple term denominators to simplify (9.2.3.4)
- Understands that complex number solutions to quadratic equations come in pairs (9.2.3.5)
- Substitutes numbers of the form $a \pm bi$ into quadratic equations to check whether they are solutions (9.2.3.5)
- Uses solution in $a \pm bi$ form of quadratic equation to solve for an unknown coefficient in quadratic equation (9.2.3.5)
- Consistently simplifies complex algebraic expressions involving multiple variables and/or containing both negative and positive rational exponents (9.2.3.6)
- Generates equivalent expressions containing *n*th roots and multiplies radical expressions containing unlike roots (9.2.3.6)
- Consistently differentiates between properties of equality and uses them to justify steps to simplify expressions (9.2.3.7)

Meets the Standards

- Consistently evaluates polynomial expressions with exponents of 2 or 3 and polynomial expressions that are the arguments of radical or absolute value expressions for integer values of the variable (9.2.3.1)

- Understands that odd powers of negative numbers result in a negative number (9.2.3.1)
- Divides polynomials using long division when the divisor is a linear polynomial such as ($ax + b$) (9.2.3.2)
- Factors trinomials of the form $ax^2 + bx + c$ and containing monomial common factors (9.2.3.3)
- Adds and subtracts two algebraic fractions with unlike single factor denominators to simplify (9.2.3.4)
- Multiplies two algebraic fractions with linear term (9.2.3.4)
- Substitutes a complex number of the form $\pm bi$ into a quadratic equation of the form $x^2 + c = 0$ to check if the numbers are solutions (9.2.3.5)
- Uses the laws of exponents to simplify algebraic expressions involving positive and negative integer exponents with multiple variables and positive rational exponents (9.2.3.6)
- Understands that when rational expressions are simplified, the original and simplified forms may not be equivalent for all values of the variable (9.2.3.7)
- Uses the distributive, commutative, and associative properties of equality to generate equivalent expressions (9.2.3.7)
- Released Example: 44803

Partially Meets the Standards

- Evaluates multi-term expressions containing one or more rational expressions, absolute value expression, or radical expression and for rational number values of the variable (9.2.3.1)
- Adds and subtracts polynomial expressions containing two or more terms (9.2.3.2)
- Multiplies binomials of the form $(x \pm a)(x \pm b)$ (9.2.3.2)
- Factors quadratic polynomials of the form $x^2 + bx + c$ and difference of two squares (9.2.3.3)
- Adds algebraic fractions with like denominators (9.2.3.4)
- Understands that some quadratic equations have two solutions that may contain the notation "i" and "±" (9.2.3.5)
- Understands that $\frac{1}{n} = n^{-1}$ (9.2.3.6)
- Understands the denominator of a rational exponent as corresponding to a root in a radical expression (9.2.3.6)
- Identifies the distributive, commutative, and associative properties of equality to justify solution steps in generating equivalent expressions (9.2.3.7)

Does Not Meet the Standards

- Evaluates simple rational expressions or expressions containing radicals or absolute values for integer values of the variable (9.2.3.1)
- Multiplies single variable monomials and combines like terms when positive coefficients are larger than negative coefficients (9.2.3.2)

- Factors a monomial from a binomial (9.2.3.3)
- Understands that dividing equivalent monomials results in a quotient of 1 (9.2.3.4)
- Knows that imaginary numbers exist (9.2.3.5)
- Applies the exponent product rule to simple equations and expressions with integer exponents (9.2.3.6)
- Identifies the distributive property of the form *a(b + c)* to generate equivalent expressions of the form *ab + ac* (9.2.3.7)

Grade 7

7.2.4

Represent real-world and mathematical situations using equations with variables. Solve equations symbolically using the properties of equality. Also solve equations graphically and numerically. Interpret solutions in the original context.

Exceeds the Standards

- Uses properties of equality to solve for one variable in real-world equations with rational coefficients in one or more variables when values of the other variables are provided, including rational expressions with variables in denominators (7.2.4.1)
- Matches real-world situations to the correct equations with rational coefficients, including rational expressions with variables in denominators (7.2.4.1)
- Solves for one variable in real-world proportional equations when the values of the other variables are provided $(\text{e.g., } \frac{x}{w} = \frac{y}{z})$ (7.2.4.2)
- Solves for a variable in non-standard proportional equations $(\text{e.g., } \frac{x}{3} = \frac{2x-6}{4})$ (7.2.4.2)

Meets the Standards

- Uses properties of equality to solve for one variable in real-world, multivariable equations when values of the other variables are provided (7.2.4.1)
- Matches real-world situations to a multi-variable equation with whole number coefficients (7.2.4.1)
- Justifies steps in solving equations using properties of equality (7.2.4.1)
- Solves for one variable in real-world proportional equations when the value of the other variable is provided $(\text{e.g., } \frac{x}{10} = \frac{y}{2} \text{ and } y = 7)$ (7.2.4.2)
- Explains steps to solve real-world problems when the proportional relationships are written (7.2.4.2)
- Released Examples: 275282 & 275292

Partially Meets the Standards

- Uses properties of equality to solve for real-world, single-variable equations (7.2.4.1)
- Matches real-world situations with correct single-variable equations (7.2.4.1)
- Uses proportional reasoning to solve simple real-world problems (7.2.4.2)
- Writes proportional relationships to model a situation (7.2.4.2)
- Released Example: 274215

Does Not Meet the Standards

- Solves for a variable in equations that require one-step addition (7.2.4.1)
- Solves real-world, proportional relationships that are multiples of each other (7.2.4.2)

Grade 8

8.2.4

Represent real-world and mathematical situations using equations and inequalities involving linear expressions. Solve equations and inequalities symbolically and graphically. Interpret solutions in the original context.

Exceeds the Standards

- Creates non-proportional linear equations in complex or novel real-world situations, given only input-output pairs, by determining the unit rate and the initial amount (8.2.4.1)
- Solves for one variable in terms of other variables in equations with two, three or four variables and containing grouping symbols and multiple terms (8.2.4.2)
- Fluently converts between slope-intercept, standard, and point-slope forms of a linear equation (8.2.4.3)
- Writes an equation of a line given either two points or a point and the slope (8.2.4.3)
- Fluently solves linear inequalities in novel mathematical and real-world situations and interprets solutions in the context of the problem (8.2.4.4)
- Fluently solves complex linear inequalities (including compound inequalities) with both positive and negative coefficients on variable terms and with variables on both sides of inequality, provides solution in symbolic form, and graphs solution on number line (8.2.4.5)
- Understands that multiplying or dividing by a negative number in a linear inequality has the effect of reversing the direction of the inequality (8.2.4.5)
- Solves equations and inequalities involving the absolute value of a linear expression and graphs the solutions on a number line (8.2.4.6)
- Recognizes the equation or inequality involving the absolute value of a linear expression that best represents a described relationship (8.2.4.6)

- Solves real-world problems involving two linear relationships between two variables by creating a system of linear equations and providing solutions in the context of the situation (8.2.4.7)
- Identifies the system of equations that represents a described relationship when equations are presented in different forms (8.2.4.7)
- Understands the differences between a system of equations with no solution, one solution, and infinitely many solutions (8.2.4.7)
- Recognizes the inverse effect of squaring the square root of a number or of taking the square root of a squared number (8.2.4.9)
- Solves multi-step problems involving squares and square roots in mathematical and real-world contexts (8.2.4.7)
- Released Examples: 286066 & 285614

Meets the Standards

- Recognizes and creates linear equations to model real-world situations when the unit rate is positive or negative (8.2.4.1)
- Determines the unit rate when provided two input-output pairs, and relates it to the slope in a linear equation (8.2.4.1)
- Consistently solves multi-step equations with one variable and addition and subtraction symbols that contain multiple terms and grouping symbols, including when presented in novel forms (8.2.4.2)
- Converts a linear equation from standard and point-slope forms to slope-intercept form (8.2.4.3)
- Computes the slope of a line given two ordered pairs and creates an equation of the line in slope-intercept form (8.2.4.3)
- Consistently uses or creates linear inequalities to represent relationships in real-world contexts, and interprets “at least” and “at most” correctly (8.2.4.4)
- Solves linear inequalities with both positive and negative coefficients on variable terms, and provides solution in symbolic form (8.2.4.5)
- Understands $x > b$ to mean *b* is not included in the solution set, and uses an open circle at point *b* when graphing solutions on the number line (8.2.4.5)
- Understands $x \geq b$ to mean *b* is included in the solution set, and uses a closed circle at point *b* when graphing solutions on the number line (8.2.4.5)
- Solves equations involving the absolute value of a linear expression (8.2.4.6)
- Graphs inequalities on number lines, using an open circle for an endpoint for < and >, and a closed circle for an endpoint with ≤ or ≥ (8.2.4.6)
- Identifies the system of equations that represents a described relationship, including situations where fractions or decimals are involved (8.2.4.7)
- Understands that the point of the intersection of two lines is the solution to the system of equations (8.2.4.7)
- Solves a simple system of equations involving two variables (8.2.4.7)

- Distinguishes between the *x*-value and *y*-value of a solution and interprets their meaning in a described relationship with or without context (8.2.4.7)
- Consistently distinguishes between solution strategies (e.g., squaring or taking the square root) depending on whether the variable is under the radical or the base of the square in the equation or situation (8.2.4.9)
- Consistently distinguishes between solution strategies (e.g., taking the square root or dividing by 4) when area or perimeter is involved (8.2.4.9)
- Solves equations involving squares and square roots including when values are not perfect squares and/or when equations involve more than one step (8.2.4.9)

Partially Meets the Standards

- Identifies equations describing a real-world linear relationship when the unit rate is a positive value (8.2.4.1)
- Distinguishes between variable and fixed quantities (8.2.4.1)
- Understands how to solve for an unknown quantity given familiar real-world situations (8.2.4.2)
- Solves straightforward, one-variable equations with several steps involving whole numbers and addition symbol (8.2.4.2)
- Identifies the equation of a line in slope-intercept form when given rational values for the slope and *y*-intercept (8.2.4.3)
- Represents familiar real-world contexts using linear inequalities with proportional and non-proportional relationships (8.2.4.4)
- Solves one- and two-step linear inequalities using sums or differences with positive coefficients on the variable term and whole-number solutions (8.2.4.5)
- Finds one of the two values that satisfy an equation involving the absolute value of a linear expression (8.2.4.6)
- Identifies both solutions to an absolute value equation of the form $|mx| = k$ (8.2.4.6)
- Identifies the system of equations that represents a described relationship when whole numbers or monetary values are involved and both equations are presented in $ax + by = c$ form (8.2.4.7)
- Distinguishes between taking the square root of a perfect square and taking half of that number (8.2.4.9)
- Finds whole number solutions to one-step and simple two-step mathematical and real-world problems by taking the square or square root of whole numbers (8.2.4.9)
- Released Example: 284702

Does Not Meet the Standards

- Identifies the unit rate in familiar real-world situations and connects it to the variable term in a linear function (8.2.4.1)
- Combines like terms (8.2.4.2)
- Identifies the equation of a line in the form $y = mx$ when given the slope (8.2.4.3)

- Distinguishes a quantity that varies from a fixed quantity when creating linear inequalities in real-world situations (8.2.4.4)
- Solves simple linear inequalities involving positive rational numbers and addition (8.2.4.5)
- Identifies the positive solution to an absolute value equation of the form $|mx| = k$ (8.2.4.6)
- Identifies an *x*-value and/or *y*-value that satisfies one equation in a system of linear equations (8.2.4.7)
- Solves one-step, real-world problems by taking the square root of a perfect square that is less than 150 (8.2.4.9)

Grade 11

9.2.4

Represent real-world and mathematical situations using equations and inequalities involving linear, quadratic, exponential and nth root functions. Solve equations and inequalities symbolically and graphically. Interpret solutions in the original context.

Exceeds the Standards

- Consistently solves quadratic equations presented in any form including using the quadratic formula (9.2.4.1)
- Solves multi-step problems for which solving a quadratic equation is a step in the process (9.2.4.1)
- Interprets solutions to real-world quadratic problems and recognizes when solutions may not be applicable (9.2.4.1)
- Models real-world exponential growth or decay situations, and uses them to solve problems (9.2.4.2)
- Solves quadratic equations in all forms and with solutions that are real and non-real ($a \pm bi$ form where b is not zero) (9.2.4.3)
- Uses understanding of the structure of the quadratic formula and of quadratic equations to determine, without solving, the number and type (i.e., real or non-real) of solutions (9.2.4.3)
- Graphs a system of linear inequalities from a written description in context or as symbolic inequalities (9.2.4.4)
- Solves mathematical and real-world linear programming problems in two variables given a verbal description or a list of constraints and objective function, including a mix of inequality types (<, >, ≤, and ≥) and when the slopes of the boundaries are different from 0 or undefined (9.2.4.5)
- Identifies absolute value inequality symbolically given a verbal description or a graph of absolute value inequality (9.2.4.6)
- Creates an absolute value inequality for a real-world or mathematical context (9.2.4.6)
- Consistently solves equations containing one or more radical expressions involving cube or square roots and recognizes extraneous solutions (9.2.4.7)

- Explains why a given solution is reasonable in the provided context (9.2.4.8)
- Interprets the meaning of a given point(s) of an equation or inequality in context of the meaning of the *x*- and *y*-axis (9.2.4.8)
- Released Example: 790524

Meets the Standards

- Consistently solves quadratic equations in context using factoring and for which the solutions are rational numbers (9.2.4.1)
- Uses an exponential function, in equation or graph form, to solve real-world problems (9.2.4.2)
- Solves quadratic equations of the form $ax^2 + c = 0$ and interprets the square root of a negative number to mean that the solutions will be 2 non-real complex numbers of the form $\pm bi$ (9.2.4.3)
- Identifies the system of linear inequalities symbolically that represents a described context (9.2.4.4)
- Understands that when a system of linear inequalities is graphed on a coordinate grid, ordered pairs on a solid line are contained in the solution set while ordered pairs on a dashed line are not contained in the solution set (9.2.4.4)
- Identifies the solution set for a system of linear inequalities graphically when given in symbolic form and when one of the two inequalities uses < or > and the other uses ≤ or ≥ (9.2.4.4)
- Identifies a system of linear inequalities symbolically when given a graph of the linear inequalities when one of the lines is dashed and the other is solid (9.2.4.4)
- Solves linear programming problems in two variables given graph of constraints, feasible region, and objective function (9.2.4.5)
- Identifies graph of an absolute value inequality in the form $|x \pm b| \pm c$ (9.2.4.6)
- Identifies solutions to equations containing radical expressions (9.2.4.7)
- Identifies extraneous solutions when one or both solutions are negative (9.2.4.7)
- Interprets the meaning of a point located on a graph or in an equation in original context, including exponential and quadratic situations (9.2.4.8)
- Released Examples: 503106, 506031, 45413 & 506036

Partially Meets the Standards

- Solves quadratic equations which yield integer solutions using substitution or factoring (9.2.4.1)
- Computes input or output value of an exponential function when given the other (9.2.4.2)
- Understands that some quadratic equations have non-real solutions (9.2.4.3)
- Verifies a solution point for a linear inequality within the shaded region (9.2.4.4)
- Identifies maximum or minimum values as solutions to linear programming problems (9.2.4.5)
- Identifies the graph of absolute value inequalities with vertical translation $|x| \pm c$ (9.2.4.6)
- Solves an equation in the form $\sqrt{ax \pm b} = \sqrt{cx \pm d}$ (9.2.4.7)
- Interprets solutions to linear and quadratic situations in context (9.2.4.8)

Does Not Meet the Standards

- Solves quadratic equations which yield integer solutions using factoring (9.2.4.1)
- Substitutes values into an exponential function to find the requested result (9.2.4.2)
- Recognizes that some quadratic equations cannot be solved (with real numbers) (9.2.4.3)
- Understands that dashed lines graphed on a coordinate grid represent strict inequalities (< or >) (9.2.4.4)
- Identifies solutions to linear programming problems as points within the feasible region (9.2.4.5)
- Identifies the shape of an absolute value graph (9.2.4.6)
- Solves simple square root equations (e.g., $\sqrt{(ax + b)} = c$) that do not have extraneous solutions (9.2.4.7)
- Finds and interprets a solution to a problem in context that uses positive integers (9.2.4.8)

Geometry & Measurement

Grade 3

3.3.1

Use geometric attributes to describe and create shapes in various contexts.

Exceeds the Standards

- Identifies geometric shapes based on the presence or lack of parallel and perpendicular sides (3.3.1.1)
- Consistently identifies perpendicular lines in various contexts (3.3.1.1)
- Completes figures to satisfy descriptions based on the number of sides and vertices (3.3.1.2)
- Knows that polygons must be enclosed to be classified as polygons (3.3.1.2)

Meets the Standards

- Identifies triangles and quadrilaterals based on the number of parallel and/or perpendicular sides (3.3.1.1)
- Identifies parallel and perpendicular line segments in various contexts (3.3.1.1)
- Identifies and uses the terms rhombus, trapezoid, and pentagon (3.3.1.2)
- Names polygons based on written descriptions (3.3.1.2)
- Orders the names of shapes by the number of sides, angles, or vertices (3.3.1.2)

Partially Meets the Standards

- Identifies 2 pairs of parallel sides in parallelograms (3.3.1.1)
- Identifies a pair of parallel sides in trapezoids (3.3.1.1)
- Identifies and uses the terms hexagon and octagon (3.3.1.2)
- Identifies multiple figures given the numbers of vertices (3.3.1.2)

Does Not Meet the Standards

- Identifies 1 pair of parallel sides in rectangles (3.3.1.1)
- Identifies and uses the terms side, vertices, angle, triangle, square, and rectangle (3.3.1.2)
- Identifies figures given the numbers of sides or vertices (less than 7) (3.3.1.2)
- Released Example: 730542

Grade 4

4.3.1

Name, describe, classify, and sketch polygons.

Exceeds the Standards

- Justifies properties of triangles by angles and sides (4.3.1.1)
- Names and classifies multiple quadrilaterals in a variety of contexts and orientations, including by multiple properties (4.3.1.2)
- Knows some quadrilaterals can be classified with more than one name (4.3.1.2)

Meets the Standards

- Names and describes multiple triangles by angles and sides in a variety of contexts and orientations (4.3.1.1)
- Names triangles from a written description (without images) (4.3.1.1)
- Understands relationships between types of quadrilaterals. (4.3.1.2)
- Names quadrilaterals from a written description (without images) (4.3.1.2)

Partially Meets the Standards

- Names, describes, and draws triangles by angles and sides shown (4.3.1.1)
- Classifies quadrilaterals by the number of parallel sides and right angles (4.3.1.2)

Does Not Meet the Standards

- Names and classifies triangles by angles shown (4.3.1.1)
- Names common quadrilaterals shown (4.3.1.2)

Grade 5

5.3.1

Describe, classify, and draw representations of three-dimensional figures.

Exceeds the Standards

- Understands the connections between two- and three-dimensional representations of prisms and pyramids (5.3.1.1)
- Understands the connections between two-dimensional nets and three-dimensional representations of cylinders, prisms, and pyramids (5.3.1.2)
- Draws nets that would make cylinders, prisms, and pyramids (5.3.1.2)

Meets the Standards

- Identifies cubes, prisms, and pyramids from descriptions of attributes (such as sides) (5.3.1.1)
- Describes distinct attributes of prisms and pyramids using correct vocabulary (5.3.1.1)
- Classifies and compares two or more prisms and pyramids by their attributes (5.3.1.1)
- Identifies correct nets, including non-traditional nets, that would make a cylinder, cube, prism, or pyramid (including triangular pyramids) (5.3.1.2)
- Draws simple nets that would make rectangular prisms (5.3.1.2)
- Released Example: 44317

Partially Meets the Standards

- Finds number of faces, edges, and vertices for cubes, prisms, and pyramids (5.3.1.1)
- Names parts of prisms and pyramids (5.3.1.1)
- Recognizes square and rectangular prisms and pyramids from less traditional nets, and vice versa (5.3.1.2)

Does Not Meet the Standards

- Finds number of faces and vertices for cubes, prisms, and pyramids (5.3.1.1)
- Identifies cubes, prisms, and pyramids by the number of faces and vertices (5.3.1.1)
- Identifies cubes, prisms, and pyramids from side and top views (5.3.1.1)
- Identifies names of cylinders, cubes, prisms, and square pyramids from traditional nets (5.3.1.2)

Grade 6

6.3.1

Calculate perimeter, area, surface area and volume of two- and three-dimensional figures to solve real-world and mathematical problems.

Exceeds the Standards

- Solves for unknown dimensions, volume, or surface area in prisms when given surface area or volume (6.3.1.1)
- Justifies how to find the surface area of a prism (6.3.1.1)
- Uses the perimeter or diagonals of a quadrilateral and its properties to find the area of the quadrilateral (6.3.1.2)
- Decomposes figures into quadrilaterals to find the area of the figure (6.3.1.2)
- Combines units/partial units or square units/partial square units to estimate areas and perimeters of irregular and curved figures with precision (6.3.1.3)

Meets the Standards

- Uses formulas to compute volumes and surface areas of cubes, triangular prisms, and rectangular prisms (6.3.1.1)
- Understands how to find unknown dimensions of a rectangular prism when given the volume (6.3.1.1)
- Uses formulas to compute area of parallelograms, trapezoids, and kites (6.3.1.2)
- Uses the perimeter of a rectangle or square to find a missing side length or the area (6.3.1.2)
- Estimates area or perimeter of irregular objects using scale other than 1 (6.3.1.3)
- Uses strategies to estimate parts of areas of irregular figures and then sums the parts (6.3.1.3)

Partially Meets the Standards

- Computes volume of a rectangular prism given all 3 dimensions (6.3.1.1)
- Finds missing side length or possible dimensions of a rectangle when given area (6.3.1.2)
- Finds the area of a square given a side length (6.3.1.2)
- Understands that square units correspond to area and units correspond to lengths (6.3.1.3)
- Estimates perimeter or area of simple irregular figures using a scale of 1 unit or 1 square unit (6.3.1.3)

Does Not Meet the Standards

- Computes volume of a rectangular prism given base area, height, and an image (6.3.1.1)
- Finds areas of simple figures on a grid by counting whole squares (6.3.1.2)
- Computes the area of a rectangle when the dimensions of both the length and width are provided (6.3.1.2)
- Estimates areas of simple irregular figures by counting whole square units (6.3.1.3)
- Identifies square units as a measurement of area (6.3.1.3)

Grade 7

7.3.1

Use reasoning with proportions and ratios to determine measurements, justify formulas and solve real-world and mathematical problems involving circles and related geometric figures.

Exceeds the Standards

- Solves multi-step problems involving use of properties of a circle as well as formulas for area/circumference (7.3.1.1)
- Finds areas of part or whole circles given circumferences (7.3.1.1)

- Computes surface and lateral area of cylinders in both real-world and mathematical situations using radius or diameter (7.3.1.2)
- Creates and justifies expressions that can be used to calculate surface area and volume (7.3.1.2)
- Computes volumes and partial volumes of cylinders with rational dimension values (7.3.1.2)
- Released Examples: 274781 & 770527

Meets the Standards

- Finds areas of sectors of circles given diameter or radius (7.3.1.1)
- Solves real-world and mathematical problems involving the area or circumference of circles (7.3.1.1)
- Applies a formula for the volume of cylinders to real-world situations given whole number diameters and heights (7.3.1.2)
- Finds missing whole number dimensions of cylinders given volume (7.3.1.2)

Partially Meets the Standards

- Computes areas or circumferences of circles given radius or diameter in mathematical problems (7.3.1.1)
- Finds diameters of circles when given circumference (7.3.1.1)
- Computes volumes of cylinders given radius and height when all dimensions are whole numbers (7.3.1.2)

Does Not Meet the Standards

- Computes circumferences of circles given diameter and pi (7.3.1.1)
- Computes volumes of cylinders given area of base and height (7.3.1.2)

Grade 8

8.3.1

Solve problems involving right triangles using the Pythagorean Theorem and its converse.

Exceeds the Standards

- Uses the Pythagorean Theorem to solve problems related to three-dimensional figures such as triangular prisms (8.3.1.1)
- Solves multi-step, real-world and mathematical problems involving right triangles (including isosceles) to compute missing lengths in one or multiple triangles (8.3.1.1)

- Computes length of diagonals in rectangles given area of rectangle and length of one side (8.3.1.1)
- Finds distance between two points on a coordinate grid with scales other than 1 (8.3.1.2)
- Finds length of hypotenuse and/or vertical or horizontal distances between points given 3 vertices of a right triangle without a diagram or additional information (8.3.1.2)
- Determines possible locations of second point when given a point and the distance between the two points (8.3.1.2)

Meets the Standards

- Understands that the Pythagorean Theorem is the relationship between the lengths of the legs and the hypotenuse in right triangles (8.3.1.1)
- Uses the Pythagorean Theorem and strategies such as Pythagorean triples or decomposition of rectangles to flexibly compute multiple missing sides in triangles with a shared side and to compute lengths in real-world contexts (8.3.1.1)
- Understands shortest distance between two points as the straight line distance (hypotenuse) of a right triangle comprised of vertical and horizontal components (8.3.1.2)
- Uses the distance formula flexibly to find lengths of segments on a coordinate grid or the distance between two points without reference to a coordinate grid (8.3.1.2)
- Finds the distance between two points in real-world situations (8.3.1.2)

Partially Meets the Standards

- Uses the Pythagorean Theorem to find an unknown side length in a right triangle given the other two lengths (8.3.1.1)
- Finds distance between two points on vertical or horizontal line when differences involve any combination of negative and positive rational numbers (8.3.1.2)
- Understands that horizontal lines contain points with the same y-value and vertical lines contain points with the same *x*-value (8.3.1.2)
- Understands distance as a non-negative quantity (8.3.1.2)

Does Not Meet the Standards

- Understands that the hypotenuse is the longest side in a right triangle (8.3.1.1)
- Finds distance between two points on a vertical or horizontal line if coordinates are both positive integers, or one positive and one negative integer (8.3.1.2)

Grade 11

9.3.1

Calculate measurements of plane and solid geometric figures; know that physical measurements depend on the choice of a unit and that they are approximations.

Exceeds the Standards

- Consistently works backwards to find the measure of an unknown dimension, including when the task involves a context (9.3.1.1)
- Appropriately chooses between height and slant height when determining surface area of pyramids and cones (9.3.1.1)
- Decomposes multiple two-dimensional figures represented in diagrams or described in words to find and compare areas and perimeters (9.3.1.2)
- Decomposes three-dimensional figures represented in diagrams to determine surface area or volume, including when the figure involves at least one curved surface (9.3.1.2)
- Identifies cross-sectional shapes of three-dimensional figures (9.3.1.2)
- Solves conversion problems involving square and cubic units (9.3.1.3)
- Applies scale factor changes to polygons and prisms (9.3.1.4)
- Understands how to apply scale factor changes to different dimensions on figures involving curved sides (e.g., circles, cylinders, spheres) (9.3.1.4)

Meets the Standards

- Determines the surface area of a sphere when given the radius or diameter and vice versa (9.3.1.1)
- Determines the volume of a small square pyramid when given all dimensions (9.3.1.1)
- Determines area or perimeter of a composite figure that decomposes into rectangles, triangles, and/or parts of circles (9.3.1.2)
- Solves two- and three-step unit conversion problems when the conversions are in different measurement systems or across two different unit types (e.g., quarts/minute to gallons/hour, minutes to days) (9.3.1.3)
- Explains how to solve simple problems in words or with linear dimensional analysis that includes the appropriate unit labels (9.3.1.3)
- Applies scale factor changes to areas of quadrilaterals and volumes of rectangular prisms (9.3.1.4)

Partially Meets the Standards

- Finds the volume of a square pyramid when given a formula and all dimensions (9.3.1.1)
- Calculates the area of a composite figure that is shown decomposed into a rectangle and triangles (9.3.1.2)
- Solves two-step unit conversion problems when both conversions are within the same measurement system and unit type (e.g., inches to feet to yards) (9.3.1.3)
- Applies a given scale factor to a given dimension (9.3.1.4)

Does Not Meet the Standards

- Identifies the surface area of a sphere when given a radius less than 4 (9.3.1.1)
- Identifies a reasonable estimate for the volume of a sphere from a list of disparate values (9.3.1.1)
- Identifies the volume of a cone when given a formula and all dimensions (9.3.1.1)
- Calculates the areas of triangles and rectangles given the dimensions (9.3.1.2)
- Calculates the volume of rectangular prisms given the dimensions (9.3.1.2)
- Solves one-step problems involving a basic conversion (9.3.1.3)
- Knows that "square units" and "cubic units" are not used in linear measurements (9.3.1.3)
- Understands that a given scale factor *k* will make lengths *k* times larger (9.3.1.4)

Grade 3

3.3.2

Understand perimeter as a measurable attribute of real-world and mathematical objects. Use various tools to measure distances.

Exceeds the Standards

- Uses the shapes of polygons to calculate unknown side lengths and perimeters (3.3.2.2)
- Finds possible unknown side lengths for polygons (3.3.2.2)
- Calculates perimeters of rectangles (perimeters larger than 100) based on only written descriptions of length and width (3.3.2.2)
- Gives complete and correct directions on various ways to measure the distance around objects (3.3.2.3)

Meets the Standards

- Finds perimeters of polygons in context with written descriptions (3.3.2.2)
- Compares perimeters of well-labeled polygons (3.3.2.2)
- Finds the unknown side length of a polygon when given the other lengths and the perimeter (3.3.2.2)
- Finds the unknown side lengths of regular polygons given the perimeter (3.3.2.2)
- Identifies a method and best tool(s) needed for measuring distance around any object (3.3.2.3)
- Understands the uses and limits of different measuring tools (3.3.2.3)

Partially Meets the Standards

- Finds perimeters of regular polygons with written descriptions of side length (3.3.2.2)
- Finds perimeters of rectangles with two sides clearly labeled (3.3.2.2)
- Gives basic descriptions of how to measure perimeter of rectangles (3.3.2.3)

Does Not Meet the Standards

- Finds the perimeter of a given polygon where all side lengths are labeled with values up to 20 (3.3.2.2)
- Finds the perimeter of a regular polygon with only one side length labeled with a value up to 10 (3.3.2.2)
- Identifies which tool is best for measuring the perimeter of one object (3.3.2.3)
- Released Example: 231460

Grade 4

4.3.2

Understand angle and area as measurable attributes of real-world and mathematical objects. Use various tools to measure angles and areas.

Exceeds the Standards

- Classifies multiple figures based on types of angles (4.3.2.2)
- Calculates area by decomposing shapes into rectangles (4.3.2.3)
- Calculates area by decomposing shapes into rectangles (4.3.2.4)
- Released Examples: 246085, 242222 & 24477202

Meets the Standards

- Classifies multiple angles in complex figures (4.3.2.2)
- Has a conceptual understanding of area as length times width (4.3.2.3)
- Draws rectangles with a given area (4.3.2.3)
- Calculates the area of rectangles in multiple ways (4.3.2.3)
- Calculates the areas of well-labeled geometric figures that can be divided into rectangular shapes (4.3.2.4)
- Released Examples: 243109 & 246072

Partially Meets the Standards

- Classifies angles in polygons (4.3.2.2)
- Identifies how changes in an angle can change its classification (4.3.2.2)
- Finds the area of rectangles containing part of a grid of unit squares (4.3.2.3)
- Explains how to find the area of rectangles containing a grid of unit squares (4.3.2.3)
- Finds the area of 1 or more rectangular shapes when displayed in unit grid form (4.3.2.4)

Does Not Meet the Standards

- Classifies angles in a familiar orientation (e.g., one ray is horizontal) (4.3.2.2)
- Finds the area of rectangles containing a grid of unit squares (4.3.2.3)
- Finds the area of rectangular shapes when displayed in a unit grid form (4.3.2.4)
- Released Example: 240228

Grade 5

5.3.2

Determine the area of triangles and quadrilaterals; determine the surface area and volume of rectangular prisms in various contexts.

Exceeds the Standards

- Calculates areas of complex figures that can be decomposed into triangles and parallelograms
- Matches multiple triangles and parallelograms with the same areas (5.3.2.1)
- Finds missing dimensions of rectangular prisms given volume or surface area (5.3.2.2)
- Calculates volume of rectangular prisms by decomposing into smaller cubes (5.3.2.2)
- Calculates an unknown side length given the surface areas and other side lengths of rectangular prisms given a net (5.3.2.2)
- Compares rectangular prisms with the same volume to find an unknown dimension (5.3.2.4)
- Finds unknown base areas of rectangular prisms given volume and height (5.3.2.4)

Meets the Standards

- Uses formulas to calculate areas of figures that are shown decomposed into triangles and parallelograms (5.3.2.1)
- Matches a triangle and a parallelogram with the same areas (5.3.2.1)
- Calculates surface areas of rectangular prisms given a net or three-dimensional image with labeled side lengths (5.3.2.2)
- Demonstrates the accuracy of the formula $V = Bh$ by decomposing rectangular prisms into layers (5.3.2.4)
- Released Examples: 252159, 255019 & 255030

Partially Meets the Standards

- Uses formulas to calculate areas of triangles and parallelograms given base length and height (5.3.2.1)
- Calculates and compares the volumes of multiple rectangular prisms (5.3.2.2)
- Uses the formulas $V = Bh$ and $V = \ell wh$ to calculate volumes of rectangular prisms when dimensions are given (5.3.2.4)

Does Not Meet the Standards

- Determines the area of parallelograms given the base length and height (5.3.2.1)
- Uses formulas to calculate volumes of rectangular prisms with given 1-digit dimensions (5.3.2.2)
- Finds surface areas of rectangular prisms from nets with unit grids (5.3.2.2)
- Uses formulas to calculate volumes of rectangular prisms when given 1-digit side lengths (5.3.2.4)

Grade 6

6.3.2

Understand and use relationships between angles in geometric figures.

Exceeds the Standards

- Describes relationships between angles using appropriate vocabulary such as congruent, supplement, complement, vertical, or adjacent (6.3.2.1)
- Solves multi-step missing angle problems (angle measures both inside and outside a triangle) using triangle properties and angle relationships for intersecting lines (6.3.2.2)
- Knows or can calculate the sum of the measures of the interior angles of any polygon (6.3.2.3)
- Explains how to calculate the sum of the measures of the interior angles by decomposing any polygon into triangles (6.3.2.3)

Meets the Standards

- Solves problems involving angle measures by applying understanding of angle relationships, properties, and the terms: intersecting lines and supplementary, complementary, and vertical angles (6.3.2.1)
- Solves multi-step problems to find missing angle measures in complex diagrams (6.3.2.1)
- Determines more than one possible combination of missing angle measures in a triangle using properties of angles (6.3.2.2)
- Interprets "m$\angle A$" to mean "measure of angle A" (6.3.2.3)
- Determines the measure of a missing angle in a polygon with up to 7 sides (6.3.2.3)
- Decomposes a polygon with up to 7 sides into triangles to determine the sum of interior angles (6.3.2.3)

Partially Meets the Standards

- Identifies the measure of the complementary angle given the other angle with which it forms a right angle (6.3.2.1)
- Calculates the measure of a supplementary angle to a given angle (6.3.2.1)
- Understands isosceles triangles have two equal base angles (6.3.2.2)
- Determines a missing angle measure or two missing angle measures in an isosceles triangle (6.3.2.2)

- Finds the missing angle in a quadrilateral given the 3 other angles (6.3.2.3)
- Determines the measure of two missing angles in a quadrilateral given they are congruent (6.3.2.3)
- Released Example: 263771

Does Not Meet the Standards

- Identifies the measure of the supplementary angle given the other angle with which it forms a straight angle (6.3.2.1)
- Identifies the measure of the third angle of a triangle using a drawing of the triangle and the fact that the sum of the interior angles of a triangle is 180 degrees (6.3.2.2)
- Understands angle/vertex notation and meaning of right-angle symbol (6.3.2.2)
- Knows that angle measures in a triangle sum to 180 degrees (6.3.2.3)
- Knows that opposite angles are congruent in parallelograms (6.3.2.3)

Grade 7

7.3.2

Analyze the effect of change of scale, translations and reflections on the attributes of two-dimensional figures.

Exceeds the Standards

- Calculates scale factors that are proper or improper fractions based on the directionality of the transformation (7.3.2.1)
- Calculates areas of similar figures based on the ratio of side lengths and vice versa (7.3.2.2)
- Solves multi-step problems involving a scale factor (7.3.2.2)
- Solves and explains multi-step problems that involve both scale drawings and conversion of measurement units (7.3.2.3)
- Performs reflections over horizontal lines, vertical lines, and the line $y = x$ (7.3.2.4)
- Performs multiple transformations involving both translations and reflections (7.3.2.4)

Meets the Standards

- Calculates scale factors given some side lengths to compare similar figures represented in different orientations or from written descriptions (7.3.2.1)
- Identifies corresponding sides and angles of polygons in different orientations (7.3.2.1)
- Consistently uses ~ (similar), ≅ (congruent), $\overline{FG}$ (segment *FG*), *FG* (length of segment *FG*) notation (7.3.2.1)
- Applies scale factors (including decimals), given side lengths and ratios to compute unknown side lengths in similar figures that are either shown in the same orientation or described in words (7.3.2.2)
- Finds scale factor of area by calculating area and comparing (7.3.2.2)

- Consistently applies scales involving rational numbers (7.3.2.3)
- Solves multi-step problems that are represented visually and involve both scale drawings and conversion of measurement units, including measures of time (7.3.2.3)
- Uses translation notation $(x, y) \rightarrow (x + a, y + b)$ to perform translations of polygons on a coordinate grid (7.3.2.4)
- Identifies image of figure reflected over either axis (7.3.2.4)
- Released Examples: 770028 & 274033

Partially Meets the Standards

- Calculates whole number scale factors between two labeled figures and identifies a scale factor of $\frac{1}{2}$ (7.3.2.1)
- Identifies corresponding sides and angles of polygons in the same orientation or reflections
- Calculates differences in lengths of corresponding sides (7.3.2.2)
- Solves one-step problems by multiplying or dividing a given dimension by a common or given scale/ratio by calculating with fractions or mixed numbers with denominators less than 5 or decimals to the tenths place (7.3.2.3)
- Identifies vertex coordinates of a figure after two translations when given original figure and written translation rule (7.3.2.4)

Does Not Meet the Standards

- Identifies corresponding sides and angles of similar triangles in the same orientation (7.3.2.1)
- Recognizes one-letter labels as referring to vertices and two-letter labels as referring to sides
- Uses a 1-digit scale factor to scale up a 1-digit dimension (7.3.2.2)
- Identifies corresponding sides of similar figures in the same orientation (7.3.2.2)
- Solves one-step problems by multiplying or dividing whole-number dimensions by a given scale (1 to X, where X is a 1-digit number), whose result is a whole number (7.3.2.3)
- Determines coordinates of the image of a point reflected across an axis (7.3.2.4)

Grade 8

8.3.2

Solve problems involving parallel and perpendicular lines on a coordinate system.

Exceeds the Standards

- Understands that $y = b$ is a special case of $y = mx + b$ when the slope is 0 and represents a horizontal line in which all y-values are the same (8.3.2.1)
- Compares slopes of quadrilaterals to determine slopes of missing sides (8.3.2.1)
- Identifies, graphs, or creates the equation of one or more lines, in any form or representation, that is parallel or perpendicular to a linear function given in any form or representation (8.3.2.1)

- Classifies type of polygon formed using only slopes of sides and in the absence of vertices or a diagram (8.3.2.2)
- Uses the slope formula to determine an unknown coordinate in an ordered pair based on knowledge of polygons (8.3.2.2)
- Uses information about slopes to determine multiple missing vertices in polygons or to explain why a parallelogram is a rectangle (8.3.2.2)
- Finds equations of lines that are perpendicular or parallel to a given line when equation of given line is in a form other than slope-intercept form (8.3.2.3)
- Determines the equation of a line and graphs the line that is perpendicular to a line given on a coordinate grid or as an equation and that passes through a given point that is not on the line (8.3.2.3)
- Released Example: 284513

Meets the Standards

- Understands that slopes of perpendicular lines are negative reciprocals (8.3.2.1)
- Graphs a line parallel to a given line using the equation of the line and a point it passes through (8.3.2.1)
- Identifies the equation of a line, in slope-intercept form, that is parallel or perpendicular to a given equation of a line, in slope-intercept form (8.3.2.1)
- Classifies type of quadrilateral given vertices by determining slopes of all sides (e.g., parallelogram, trapezoid) (8.3.2.2)
- Understands that parallelograms have two sets of parallel sides and thus two different slopes (8.3.2.2)
- Determines slope of missing side or a missing vertex of quadrilateral by identifying the slopes of remaining sides (8.3.2.2)
- Finds the equation of, or draws a line parallel to, a given equation of a line, passing through a given point not on that line (8.3.2.3)
- Understands that the slope, m, of a line perpendicular to another line is the opposite reciprocal of m in the equation $y = mx + b$ (8.3.2.3)
- Identifies an equation for a line that is perpendicular to a line given in equation form and passing through a point (0, b) not on that line (8.3.2.3)
- Released Examples: 285290, 283157 & 284134

Partially Meets the Standards

- Understands that slopes of perpendicular lines have opposite signs (8.3.2.1)
- Determines the slope of a line parallel to a graphed line with two labeled points (8.3.2.1)
- Recognizes that horizontal and vertical lines are perpendicular (8.3.2.2)
- Finds slopes of lines or sides of a quadrilateral given figures on a coordinate grid with a scale of 1 (8.3.2.2)
- Determines slope of a line that connects two given points using the slope formula (8.3.2.2)
- Recognizes m as relating to the slope of a line in the equation $y = mx + b$ (8.3.2.3)

Does Not Meet the Standards

- Understands that parallel lines have the same slope (8.3.2.1)
- Identifies the coordinate of a missing vertex on a rectangle when given 3 other vertices and the slope of one side is 0. (8.3.2.2)
- Understands that parallel lines have the same slope (8.3.2.3)

Grade 11

9.3.2

Construct logical arguments, based on axioms, definitions and theorems to prove theorems and other results in geometry.

Exceeds the Standards

- Identifies the converse and contrapositive of a given statement (9.3.2.2)
- Identifies an equivalent statement to a given statement (9.3.2.2)
- Understands how and when to use CPCTC and transitive properties (9.3.2.4)
- Completes parts of triangle congruence proofs when the structure has been provided (9.3.2.4)
- Consistently carries out all necessary steps to construct a congruent figure or bisector (9.3.2.5)

Meets the Standards

- Identifies the inverse of a given statement (9.3.2.2)
- Follows along a given 2-column or flow-chart proof to identify which triangle congruence postulate can be used in the proof (9.3.2.4)
- Identifies steps in the process of constructing either an angle or perpendicular bisector (9.3.2.5)
- Determines congruence based on a construction process (9.3.2.5)
- Released Example: 790537

Partially Meets the Standards

- Identifies a true statement based on the transitive property (9.3.2.2)
- Identifies congruent segments based on the definition of midpoint (9.3.2.4)
- Knows that triangle congruence postulates can be used to show triangle congruence (9.3.2.4)
- Knows that an arc must be used when constructing either an angle or perpendicular bisector (9.3.2.5)

Does Not Meet the Standards

- Writes the sentence that reflects "$P \rightarrow Q$" given statements for *P* and *Q* (9.3.2.2)
- Knows some of the common terms used (e.g., proof, given, definition, theorem) (9.3.2.4)
- Knows that a compass can be used to construct equal length segments (9.3.2.5)
- Released Example: 502314

Grade 3

3.3.3

Use time, money and temperature to solve real-world and mathematical problems.

Exceeds the Standards

- Consistently determines elapsed times when times occur across hours (including from a.m. to p.m.) when times are given digitally (3.3.3.1)
- Determines elapsed time when times are given with analog clocks (3.3.3.1)
- Fluently represents amounts of time in minutes and in hours and minutes (3.3.3.1)
- Uses unit relationships when solving mathematical and real-world questions (3.3.3.2)
- Orders amounts of time from least to greatest when time is expressed in mixed units (3.3.3.2)
- Solves questions about the fewest number of coins that can be given as change (3.3.3.3)
- Correctly adds or subtracts prices when determining how much change should be given (3.3.3.3)
- Finds the increase or decrease in temperatures given in any format (3.3.3.4)
- Reads dual-labeled thermometers in Fahrenheit and Celsius (3.3.3.4)

Meets the Standards

- Determines elapsed times that are more than 1 hour when times are given digitally (3.3.3.1)
- Converts between amounts of time expressed in mixed units into the smaller unit (3.3.3.2)
- Converts smaller units into mixed-unit expressions of the same amount of time (e.g., minutes to hours and minutes) (3.3.3.2)
- Identifies correct value and combinations of coins to give as change (3.3.3.3)
- Identifies the fewest combination of coins to make a given amount of money (3.3.3.3)
- Applies an increase or decrease in temperature to find the new temperature with scale increments of 1, 2, or 5 degrees (3.3.3.4)
- Finds the difference between two temperatures (3.3.3.4)
- Released Example: 235208

Partially Meets the Standards

- Reads the time on an analog clock for all times (3.3.3.1)
- Determines short, elapsed times that occur within the same hour (3.3.3.1)
- Converts from 1 to 3 hours into minutes (3.3.3.2)
- Converts from days to weeks and days (less than 50 weeks) (3.3.3.2)
- Converts larger time units into one unit smaller (e.g., years to months, weeks to days) (3.3.3.2)
- Finds the difference between the price of an item and next dollar amount (e.g., $3.55 and $4) (3.3.3.3)
- Identifies which temperatures on thermometers are different than a given temperature (3.3.3.4)
- Released Examples: 230231 & 233086

Does Not Meet the Standards

- Reads the time on a digital clock (3.3.3.1)
- Reads the time on an analog clock up to the first 30 minutes (3.3.3.1)
- Knows that weeks are made up of days and that hours are made up of minutes (3.3.3.2)
- Makes change with quarters (3.3.3.3)
- Represents temperatures given on a thermometer that uses a scale of 1 or 5 degrees (3.3.3.4)

Grade 4

4.3.3

Use translations, reflections and rotations to establish congruency and understand symmetries.

Exceeds the Standards

- Applies and describes translations to shapes (4.3.3.1)
- Identifies lines of symmetry in multiple shapes (compound as well as multiple single shapes) (4.3.3.2)
- Applies 90˚ rotations to shapes (4.3.3.3)
- Identifies multiple congruent and noncongruent shapes (4.3.3.4)
- Has a conceptual understanding of congruency (4.3.3.4)
- Released Example: 244022

Meets the Standards

- Identifies images from translations of shapes (4.3.3.1)
- Reflects shapes over lines (4.3.3.2)
- Identifies images from 90˚ rotations of shapes (4.3.3.3)
- Identifies congruent shapes from multiple shapes shown (4.3.3.4)
- Justifies that shapes are congruent because they are the results of a translation, reflection, or rotation (4.3.3.4)
- Released Examples: 244676 & 740143

Partially Meets the Standards

- Identifies images from translations when shown on a grid (4.3.3.1)
- Identifies lines of symmetry in complex shapes and complex situations (4.3.3.2)
- Draws a line of symmetry in simple shapes (4.3.3.2)
- Identifies images from 90˚ rotations of simple shapes (4.3.3.3)
- Justifies that shapes are congruent because they are the results of a reflection (4.3.3.4)
- Released Example: 42240

Does Not Meet the Standards

- Knows that a translation moves an object (4.3.3.1)
- Identifies a line of symmetry in simple shapes (4.3.3.2)
- Knows that a rotation turns an object (4.3.3.3)
- Identifies a congruent shape that is a reflection of a given shape (4.3.3.4)
- Released Examples: 244060 & 740778

Grade 6

6.3.3

Choose appropriate units of measurement and use ratios to convert within measurement systems to solve real-world and mathematical problems.

Exceeds the Standards

- Solves real-world, multi-step problems involving conversions and calculating with decimals and fractions (6.3.3.1)
- Consistently applies conversion factors for all metric conversions (6.3.3.1)
- Distinguishes between appropriate estimates for volume and area that may require some calculations (6.3.3.2)
- Recognizes appropriate estimates including when measures are fractional (6.3.3.2)
- Released Example: 760112

Meets the Standards

- Solves one- and two- step conversions by calculating with whole numbers and converting between more common units within the customary system, the time system, and the metric system (e.g., hours to days is one step; meters to millimeters is two steps) (6.3.3.1)
- Recognizes appropriate estimates for area and other characteristics, including when the best unit is less common (6.3.3.2)

Partially Meets the Standards

- Converts measurements in a smaller unit to a larger unit with some smaller units left over (e.g., 70 minutes to 1 hour, 10 minutes) and vice versa with either known time conversions or given conversions (6.3.3.1)
- Multiplies or divides to solve one-step conversion problems (6.3.3.1)
- Identifies appropriate metric or customary unit for capacity or weight when given a value and an object or situation (6.3.3.2)

Does Not Meet the Standards

- Uses multiplication or division (not addition or subtraction) to convert units when given conversion information (6.3.3.1)
- Identifies which common unit is most appropriate to use when estimating length or weight of an object or distance traveled (6.3.3.2)
- Identifies an appropriate 1-digit value for a given unit measuring a characteristic of an object (6.3.3.2)

Grade 11

9.3.3

Know and apply properties of geometric figures to solve real-world and mathematical problems and to logically justify results in geometry.

Exceeds the Standards

- Applies at least four properties involving parallel and/or perpendicular lines to solve problems finding at least one unknown angle measure in a diagram (9.3.3.1)
- Applies multiple angle properties to solve multi-step problems presented with verbal descriptions, finding more than one unknown angle measurement (9.3.3.2)
- Consistently applies properties of triangles to solve multi-step problems involving either a complex diagram with more than one type of triangle or no diagram at all (9.3.3.3)
- Consistently applies the relationship between angle measure and length of the side opposite the angle in scalene triangles (9.3.3.3)
- Consistently interprets complex contexts and/or diagrams to apply the Pythagorean Theorem and its converse to solve multi-step problems (9.3.3.4)
- Knows and applies properties of 45-45-90 and 30-60-90 triangles to solve problems involving complex figures (9.3.3.5)
- Uses multi-step reasoning involving properties to draw conclusions about the relationships represented in a geometric diagram when the diagram involves multiple and overlapping figures (9.3.3.6)
- Consistently solves problems involving the interior angles of regular polygons with or without a diagram (9.3.3.7)
- Knows and applies the hierarchy of quadrilaterals (9.3.3.7)
- Justifies statements about polygons (9.3.3.7)
- Applies multiple properties of a circle to solve problems involving multiple and overlapping figures (e.g., opposite angles of an inscribed quadrilateral are supplementary, tangents drawn from a point collinear with the center to two different radii are congruent, and an inscribed angle that intersects a diameter at its endpoints forms a right triangle) (9.3.3.8)

Meets the Standards

- Applies up to three properties involving parallel and/or perpendicular lines to find an unknown angle measure in a diagram, including when angles are represented by algebraic expressions (9.3.3.1)
- Applies multiple angle properties to solve multi-step problems presented with diagrams involving finding one or more unknown angle measures, including when angle measures are represented by algebraic expressions (9.3.3.2)
- Uses properties of isosceles triangles to find unknown angles or sides, including when the isosceles triangle is rotated (9.3.3.3)
- Consistently interprets context to apply the Pythagorean Theorem and its converse to solve problems (9.3.3.4)
- Knows and applies properties of 45-45-90 and 30-60-90 triangles to solve problems involving one triangle (9.3.3.5)
- Consistently uses equivalent ratios, not differences, to find unknown side lengths in similar figures described in words or displayed figures (9.3.3.6)
- Consistently recognizes that angle measure remains the same in similar triangles (9.3.3.6)
- Fluently uses definitions and properties of polygons to solve problems involving angle measures or side lengths (9.3.3.7)
- Calculates measure of a central angle given the inscribed angle and vice versa (9.3.3.8)
- Recognizes that a triangle formed with a central or an inscribed angle as its apex is isosceles (9.3.3.8)
- Uses proportional reasoning and knowledge of area and circumference to calculate areas of sectors and lengths of arcs (9.3.3.8)

Partially Meets the Standards

- Applies up to two properties involving parallel and/or perpendicular lines to find an unknown angle measure in a diagram when known angle measures are whole numbers (9.3.3.1)
- Uses properties of vertical and/or complementary angles to find an unknown angle measure in a diagram (9.3.3.2)
- Finds measure of one corresponding angle of another angle in a diagram (9.3.3.2)
- Understands that the base angles opposite congruent sides are congruent (9.3.3.3)
- Uses properties of equilateral triangles to find unknown angles or sides (9.3.3.3)
- Applies the Pythagorean Theorem to find an unknown side length in a right triangle (9.3.3.4)
- Knows 45-45-90 triangles are isosceles triangles and that two sides are the same length (9.3.3.5)
- Recognizes information needed for proving congruence or similarity (e.g., SAS and AA) (9.3.3.6)
- Uses proportions to represent and find unknown side lengths in similar figures (9.3.3.6)
- Uses properties of parallelograms to find unknown lengths of diagonals (9.3.3.7)
- Knows that a tangent line to a circle forms a right angle with the radius at the point of tangency (9.3.3.8)

Does Not Meet the Standards

- Finds measure of one alternate interior or same-side interior angle of another angle in a diagram (9.3.3.1)
- Finds the measure of a complementary angle in a diagram involving perpendicular lines intersected by a third line (9.3.3.1)
- Uses properties of supplementary and/or corresponding angles to find an unknown angle measure in a diagram (9.3.3.2)
- Knows the definitions of equilateral, isosceles, and scalene triangles (9.3.3.3)
- Recites "*a* squared plus *b* squared equals *c* squared" (9.3.3.4)
- Knows 45-45-90 and 30-60-90 triangles are right triangles (9.3.3.5)
- Recognizes relationships of corresponding angles and sides in triangles when the triangles are specifically described as congruent or similar in words or with symbols, including when one triangle is a rotation of the other (9.3.3.6)
- Uses properties of parallelograms and trapezoids to find unknown angle measures (9.3.3.7)
- Computes areas or circumferences of circles given radius or diameter in mathematical problems (9.3.3.8)
- Finds diameters of circles when given circumferences (9.3.3.8)

Grade 11

9.3.4

Solve real-world and mathematical geometric problems using algebraic methods.

Exceeds the Standards

- Finds unknown side lengths of similar right triangles, with or without a labeled diagram given, and then solves for trigonometric ratios (9.3.4.1)
- Solves for other trigonometric ratios in a right triangle when one ratio is given in decimal format (9.3.4.1)
- Uses multiple trigonometric ratios to find lengths of unknown parts of segments involving right triangles for real-world problems (9.3.4.2)
- Uses trigonometric ratios to solve for unknown side lengths of right triangles for real-world problems in three dimensions (9.3.4.2)
- Calculates length and slopes of segments using midpoint formula, distance formula, and properties of polygons (e.g., parallelogram, rhombus, square) (9.3.4.4)
- Determines the equation of circle from its graph on a coordinate grid (9.3.4.5)
- Finds the radius and equation of a circle given the center point and another point on the circle (9.3.4.5)
- Rotates shapes about the origin by multiples of 90 degrees to find location of images (9.3.4.6)

- Finds coordinates of image or preimage, when given the other, of polygons or lines which have undergone multiple transformations, including scale changes, rotations, reflections across lines other than the axes, and translations (9.3.4.6)
- Identifies the rule used for a compound transformation (i.e., involving more than one basic transformation) (9.3.4.6)
- Uses properties of parallel lines, squares, rectangles, triangles, and cylinders to solve for unknown side lengths, perimeter, angle measurements, area, or volume (9.3.4.7)
- Creates equivalent expressions for area or volume of similar triangles, rectangles, and cylinders (9.3.4.7)

Meets the Standards

- Knows similar triangles have the same trigonometric ratios for corresponding angles (9.3.4.1)
- Knows and uses the trigonometric relationships between the two acute angles in a right triangle (9.3.4.1)
- Uses trigonometric ratios to solve for unknown side lengths or areas for real-world problems that can be decomposed into right triangles (9.3.4.2)
- Knows that inverse trigonometric functions can be used to find angle measurements (9.3.4.2)
- Calculates the length or slope of a line segment given coordinates of the endpoints or when shown on a grid (9.3.4.4)
- Finds coordinates of one endpoint of a line segment given the other endpoint and the midpoint (9.3.4.4)
- Identifies the equation of a circle given the center and the radius (9.3.4.5)
- Finds the center and the radius given the equation of a circle (9.3.4.5)
- Finds coordinates of points when scaling (dilation centered at the origin) (9.3.4.6)
- Demonstrates understanding of how reflections over the *x*- and *y*-axis change points on a graph and finds the distance between a point and its reflection (9.3.4.6)
- Uses properties of triangles, parallelograms, and similar triangles to solve for unknown angle measures and side lengths (9.3.4.7)
- Uses the Pythagorean Theorem to solve for unknown side lengths (9.3.4.7)

Partially Meets the Standards

- Identifies the trigonometric values of a given angle from a labeled right triangle (9.3.4.1)
- Uses the definitions of trigonometric ratios to find the side lengths of similar triangles (9.3.4.1)
- Sets up an equation to find an unknown side length of a triangle using a trigonometric ratio and can solve if needing only multiplication (9.3.4.2)
- Uses verbal description of points on a line segment to identify midpoint, endpoints, or other points on the line (9.3.4.4)
- Finds coordinates of the midpoint of a line segment given the coordinates of the endpoints (9.3.4.4)

- Uses the Pythagorean Theorem to find the hypotenuse length of right triangles given two leg lengths (9.3.4.5)
- Translates polygons on a grid given a rule of the form $(x, y) \rightarrow (x + a, y + b)$ (9.3.4.6)
- Identifies the type of transformations used given a shape and its image (9.3.4.6)
- Uses the Pythagorean Theorem to find the hypotenuse length of right triangles given two leg lengths (9.3.4.7)

Does Not Meet the Standards

- Uses the Pythagorean Theorem to find a whole-number, unknown side length in a right triangle (9.3.4.1)
- Knows sine, cosine, and tangent involve ratios from triangles (9.3.4.2)
- Finds the length of a horizontal or vertical line segment given coordinates of the endpoints or when shown on a grid (9.3.4.4)
- Identifies the coordinates of the center of a circle when it falls on a lattice point in a coordinate grid (9.3.4.5)
- Identifies the radius of a circle as being the distance from the center point to the edge of the circle (9.3.4.5)
- Identifies the translation that moves point *A* to point *B* on a grid (9.3.4.6)
- Computes areas and volumes of basic shapes when provided with all dimensions (9.3.4.7)

Data Analysis

Grade 3

3.4.1

Collect, organize, display, and interpret data. Use labels and a variety of scales and units in displays.

Exceeds the Standards

- Finds missing data points when information is displayed in multiple ways (3.4.1.1)
- Precisely describes data points and groups of points in context (3.4.1.1)
- Analyzes and makes comparisons of data displayed in line plots (3.4.1.1)
- Interprets the value of 0 from data displays in context (3.4.1.1)
- Describes how changes in data, scales, or keys alters the data display (3.4.1.1)
- Released Examples: 234783 & 234794

Meets the Standards

- Answers questions that require up to three steps to solve using information given and data displays (3.4.1.1)
- Solves problems involving finding how many more or less using line plots (3.4.1.1)
- Completes data displays in both their original format as well as a different data display (3.4.1.1)
- Works with bar graphs and tables (including frequency tables) with data values up to 50 (3.4.1.1)
- Released Examples: 233177, 730597, 231075, 234748 & 235725

Partially Meets the Standards

- Answers questions from pictographs (up to 4 categories and key 2-5) and simple line plots (3.4.1.1)
- Answers one-step questions based on information given in pictographs (up to 4 categories and key 2–5), tables, and/or bar graphs (up to 4 bars and scales of 1, 2, and 5) (3.4.1.1)
- Identifies good titles for graphs in context (3.4.1.1)

Does Not Meet the Standards

- Identifies information from tally charts, pictographs (up to 3 categories and key = 5), bar graphs (up to 5 bars and scales of 1, 2, and 5), and tables (3.4.1.1)
- Displays a few data points in tally charts, pictographs (key = 5), bar graphs (up to 5 bars and scales of 1, 2, and 5), or tables (3.4.1.1)

Grade 4

4.4.1

Collect, organize, display and interpret data, including data collected over a period of time and data represented by fractions and decimals.

Exceeds the Standards

- Has a conceptual understanding of solving problems involving data displays, including tables, bar graphs, timelines (including hour increments), line plots, pictograms, and Venn diagrams (including 3 circles) (4.4.1.1)
- Analyzes, interprets, and solves novel problems with real-world scenarios involving data displays (tables, bar graphs, timelines, line plots, pictograms, and Venn diagrams) (4.4.1.1)

Meets the Standards

- Collects, organizes, and displays data in bar graphs, timelines, pictograms, and Venn diagrams, (including elements not in a circle but in the sample space), including finding missing values (4.4.1.1)
- Solves problems in data displays (tables, bar graphs, timelines, line plots, pictographs, Venn diagrams) involving fractions and decimals (4.4.1.1)
- Solves for differences between data models, finds missing values, and creates equivalent models (4.4.1.1)
- Uses timelines to show events in relation to one another (4.4.1.1)
- Released Examples: 740060 & 243074

Partially Meets the Standards

- Displays data (including decimals) from tables and bar graphs and finds a missing value in a data display (4.4.1.1)
- Interprets a data value (including decimals) from data displays (tables, bar graphs, timelines, line plots, pictographs) (4.4.1.1)
- Finds missing key for pictographs (4.4.1.1)
- Translates between tables and bar graphs or pictograms (4.4.1.1)
- Released Examples: 245040 & 740061

Does Not Meet the Standards

- Identifies and plots data (whole numbers) from tables in simple bar graphs, timelines, pictographs, and Venn diagrams (4.4.1.1)
- Identifies a basic interpretation of a data value (whole numbers) from a simple data display (tables, bar graphs, line plots, line graphs, pictographs, Venn diagrams) (4.4.1.1)

Grade 5

5.4.1

Display and interpret data; determine mean, median, and range.

Exceeds the Standards

- Conceptually understands mean, median, and range (5.4.1.1)
- Finds unknown data values given the mean, median, and/or range of the data, and data can be provided in a variety of formats (e.g., tables, bar graphs) (5.4.1.1)
- Analyzes complex situations that include double-bar graphs and line graphs to solve problems, find multiple missing data values, and make interpretations (5.4.1.2)

Meets the Standards

- Calculates mean, median, and range for data provided in a variety of formats (e.g., tables, bar graphs) and not presented in order (5.4.1.1)
- Finds an unknown data value given the mean or range of the data (5.4.1.1)
- Fluently works with data categories labeled with numbers (5.4.1.1)
- Works fluently with double-bar graphs or line graphs to solve problems and make comparisons, including situations with inverse relationships to numeric values (e.g., efficiency and time) (5.4.1.2)
- Works fluently with fractional and decimal data points (5.4.1.2)

Partially Meets the Standards

- Applies rote procedures for calculating mean, median (when values are presented in order), and range (5.4.1.1)
- Interprets simple double-bar graphs and line graphs to solve problems (5.4.1.2)
- Constructs double-bar graphs and line graphs from descriptions and applies appropriate labels (5.4.1.2)
- Solves simple, one-step problems using data from a double-bar graph or line graph (5.4.1.2)
- Released Examples: 253008, 255036 & 254796

Does Not Meet the Standards

- Calculates the median value in a table of up to 9 items, all with whole-number values less than 100 (5.4.1.1)
- Reads double-bar graphs and line graphs (5.4.1.2)
- Matches data tables to double-bar graphs and line graphs of data (5.4.1.2)
- Adds data to simple double-bar graphs and line graphs from data tables (5.4.1.2)

Grade 6

6.4.1

Use probabilities to solve real-world and mathematical problems; represent probabilities using fractions, decimals and percents.

Exceeds the Standards

- Determines possible outcomes and number of occurrences of each outcome in a probability experiment (6.4.1.1)
- Identifies scenarios to match given experiments (6.4.1.1)
- Creates sample spaces for stated probabilities (6.4.1.2)
- Determines probabilities of complements of events (6.4.1.2)
- Explains why there could be a difference between expected and experimental results (6.4.1.3)
- Compares and explains differences in relative frequency data with theoretical probabilities (6.4.1.3)
- Uses experimental probabilities stated for events to predict future events in real-world situations (6.4.1.4)
- Uses experimental data to make predictions when theoretical probabilities are not known, including group sizes other than 10, 20, 50, or 100 (6.4.1.4)

Meets the Standards

- Determines one possible outcome from the total sample space when given in table, tree diagram, or written description (6.4.1.1)
- Determines probabilities of compound events written as a fraction, percent, or decimal in real-world situations (6.4.1.2)
- Understands the concept of random selection (6.4.1.2)
- Determines if relative frequencies match theoretical probabilities (6.4.1.3)
- Determines if expected results match experimental results (6.4.1.3)
- Identifies important information to use with experimental data and makes predictions based on context and given data (6.4.1.4)
- Determines the probability of event A or event B occurring (6.4.1.4)
- Determines the probability of an event occurring when data is presented verbally and without tables (6.4.1.4)
- Released Example: 264172

Partially Meets the Standards

- Determines number of possible outcomes in sample spaces for more than two events using multiplication facts up to 5 (6.4.1.1)
- Consistently interprets tree-diagrams (6.4.1.1)

- Determines probabilities of events as the ratio of the size of an event to the size of the sample space written as a fraction or percent in real-world situations (6.4.1.2)
- Understands the meaning of probability or likelihood (certain, impossible, likely, and unlikely) of an event (6.4.1.2)
- Understands the meaning of relative frequency and applies it to simple experiments (mostly coin toss) (6.4.1.3)
- Compares experimental probabilities with expected probabilities for two or three events, where the number of trials is a multiple of 10 (6.4.1.3)
- Finds an experimental probability (as a fraction or percent) from a group of up to 5 items from real-world experiments and no extra information (6.4.1.4)
- Released Example: 44165

Does Not Meet the Standards

- Identifies which sample space describes or does not describe an experiment (6.4.1.1)
- Determines number of possible outcomes in sample spaces for two events using multiplication facts up to 5 (6.4.1.1)
- Identifies how probability is written as a fraction as a ratio of success over total, and as a percent (6.4.1.2)
- Identifies probabilities (%) between 70% and 95% as being "likely" and percents between 5% and 30% as "unlikely" (6.4.1.2)
- Determines which relative frequencies are more than or less than expected results when no more than 5 items are listed in table format (6.4.1.3)
- Calculates experimental probabilities from 2 or 3 items listed in a table with a sum of 10 objects total (6.4.1.4)
- Released Examples: 263076 & 260633

Grade 7

7.4.1

Use mean, median and range to draw conclusions about data and make predictions.

Exceeds the Standards

- Compares means, medians, and ranges of different data sets displayed in tables, frequency tables, and plots (7.4.1.1)
- Finds multiple missing data values given some data and mean, median, or range (7.4.1.1)
- Creates data sets satisfying given conditions on means, medians, and ranges (7.4.1.1)
- Explains how the addition or removal of a data point to a data set described in context will cause the mean and median to increase or decrease, and by how much (7.4.1.2)
- Solves multi-step problems using given mean, median, or range values (7.4.1.2)
- Finds possible data values to add to or remove from a data set described in context that causes a specified change in the mean and median (7.4.1.2)

Meets the Standards

- Compares means, medians, or ranges of different data sets displayed in tables and plots (7.4.1.1)
- Finds a single missing data value given some data and mean, median, or range (7.4.1.1)
- Determines means, medians, and ranges from provided data values in data displays (e.g., bar graphs, stem-and-leaf plots) (7.4.1.1)
- Determines whether the addition or removal of a data point to a data set in a list or table will cause the mean or median to increase or decrease, and by how much (7.4.1.2)
- Finds data point value to add or remove from a data set in a list or table that causes a specified change in the mean or median (7.4.1.2)

Partially Meets the Standards

- Calculates means, medians, and ranges from data sets in lists, tables, and line plots with whole numbers or decimals to the hundredths place (7.4.1.1)
- Reads and calculates range from a stem-and-leaf plot (7.4.1.1)
- Identifies the original and new mean or median in a small data set when adding or removing a value (7.4.1.2)
- Identifies whether the mean and median increase, decrease, or remain the same in a straightforward situation with a small data set (7.4.1.2)
- Released Examples: 273097 & 273002

Does Not Meet the Standards

- Calculates means and medians from small data sets with whole-number values less than 100 or money (with a quarter value) in lists and tables (7.4.1.1)
- Knows the general process of how to find the mean of a set of numbers (7.4.1.2)

Grade 8

8.4.1

Interpret data using scatterplots and approximate lines of best fit. Use lines of best fit to draw conclusions about data.

Exceeds the Standards

- Draws lines of best fit on scatterplots (8.4.1.1)
- Finds equations for lines of best fit given scatterplots (8.4.1.1)
- Answers and justifies real-world questions using multiple real-world scatterplots (8.4.1.1)
- Identifies when data have non-linear relationships from scatterplots (8.4.1.1)
- Interprets meanings in context of positive and negative average rates of change for data shown on scatterplots, either with or without the line of best fit provided (8.4.1.2)

- Uses lines of best fit equations shown on scatterplots to compare expected values and solve problems (8.4.1.2)
- Identifies most or least reasonable conclusions in context from scatterplots and/or lines of best fit (8.4.1.3)
- Explains why a prediction in context is reasonable or not from scatterplots with various scales and/or lines of best fit (8.4.1.3)
- Consistently makes predictions for values that extend past the given scatterplot (8.4.1.3)

Meets the Standards

- Describes how adding data to scatterplots increases or decreases the strength of the correlation (8.4.1.1)
- Identifies various scatterplots containing reasonable lines of best fit (8.4.1.1)
- Matches real-world descriptions of data with correct type of correlation (e.g., strong positive, weak negative) (8.4.1.1)
- Adds appropriate titles and labels to scatterplots based on real-world descriptions (8.4.1.1)
- Uses lines of best fit equations and/or lines of best fit shown on scatterplots to predict expected values on the drawn line with positive or negative correlations, beyond a drawn line but on the graph with positive correlations, and sometimes off of the provided graph with positive slopes (8.4.1.2)
- Identifies most reasonable conclusions (e.g., slope, prediction) in context from scatterplots and/or lines of best fit, including estimating a line of best fit, all within the bounds of the graph (8.4.1.3)
- Identifies why a prediction in context is reasonable or not from scatterplots and/or lines of best fit (8.4.1.3)

Partially Meets the Standards

- Explains in context the meaning of a positive or negative line of best fit (8.4.1.1)
- Determines when scatterplots show no relationship between variables (8.4.1.1)
- Identifies most reasonable line of best fit based on the shape of the data set, when given multiple scatterplots containing lines (8.4.1.1)
- Uses lines of best fit shown on scatterplots to estimate y-values given specific *x*-values when one or both values are not along grid lines (8.4.1.2)
- Estimates rate of change of best fit lines (8.4.1.2)
- Identifies most reasonable conclusions in context from scatterplots or lines of best fit, including situations with very low correlations (8.4.1.3)
- Released Example: 284663

Does Not Meet the Standards

- Explains in context the general relationships shown on scatterplots (8.4.1.1)
- Determines whether scatterplots have positive or negative correlations/slopes (8.4.1.1)
- Creates scatterplots by plotting data points (8.4.1.1)
- Uses lines of best fit shown on scatterplots to estimate x-values along grid lines given specific y-values when both values are within the given grid (8.4.1.2)
- Identifies basic information about data in a scatterplot such as type of correlation, questions the data can answer, and simple predictions of the next point on the graph when the data have a high positive correlation (8.4.1.3)
- Released Examples: 286059 & 286145

Grade 7

7.4.2

Display and interpret data in a variety of ways, including circle graphs and histograms.

Exceeds the Standards

- Uses fractional proportions to solve problems (7.4.2.1)
- Designs and creates histograms based on data that includes decimals, fractions, and mixed numbers (7.4.2.1)

Meets the Standards

- Uses proportional reasoning to determine or estimate values in circle graphs (7.4.2.1)
- Solves multi-step problems using histograms and circle graphs in context (7.4.2.1)
- Plots data on histograms originally displayed in lists, tables, circle graphs, or from proportional information (7.4.2.1)

Partially Meets the Standards

- Reads values from histograms and circle graphs (7.4.2.1)
- Solves one-step problems using data from a circle graph (7.4.2.1)
- Graphs bars on histograms from small data lists (7.4.2.1)

Does Not Meet the Standards

- Identifies a circle graph by viewing relative proportions or based on a stated data set (7.4.2.1)
- Makes basic comparisons of categories in a circle graph when provided the percents as well (7.4.2.1)

Grade 7

7.4.3

Calculate probabilities and reason about probabilities using proportions to solve real-world and mathematical problems.

Exceeds the Standards

- Calculates probabilities of complements of events and compound events (using sample space) (7.4.3.2)
- Calculates probabilities of random selection from geometric areas (e.g., concentric circles or rectangles) written as a fraction, percent, or decimal (7.4.3.2)
- Uses experimental frequencies of a situation to make predictions using proportional reasoning (7.4.3.3)

Meets the Standards

- Calculates probabilities of mutually exclusive events (e.g., sums from rolling two dice) written as a fraction, percent, or decimal in real-world situations (7.4.3.2)
- Calculates probabilities of random selection from simple area models and writes them as a fraction, percent, or decimal (7.4.3.2)
- Uses probabilities to determine most likely outcomes (7.4.3.3)
- Uses proportional reasoning to find theoretical expected values and to predict future outcomes (7.4.3.3)
- Compares experimental frequencies to expected frequencies (7.4.3.3)
- Released Example: 273047

Partially Meets the Standards

- Calculates probabilities of up to 3 related mutually exclusive events (e.g., rolls a 2 or a 5) written as a fraction or decimal in real-world situations (7.4.3.2)
- Determines the size of a sample space, up to 100 objects in the space (7.4.3.2)
- Uses proportional reasoning to predict future outcomes using simple values (e.g., multiples of 10) (7.4.3.3)

Does Not Meet the Standards

- Knows that probabilities can be written as percents between 0% and 100% or as fractions between 0 and 1 (7.4.3.2)
- Uses proportional reasoning to predict future outcomes using multiples of 100 (7.4.3.3)

Grade 11

9.4.1

Display and analyze data; use various measures associated with data to draw conclusions, identify trends and describe relationships.

Exceeds the Standards

- Calculates summary statistics, including standard deviation, to analyze and interpret data given in box-and-whisker plots, stem-and-leaf plots, tables, bar graphs, and lists (9.4.1.1)
- Solves problems using the relationship between quartiles and percentages within data sets (9.4.1.1)
- Understands the effects of outliers on means and medians, and from that decides which measure of center is best to use in situations (9.4.1.1)
- Creates a box-and-whisker plot of given data (9.4.1.1)
- Calculates or explains how multiple summary statistics change when data is removed and/or additional data is added to a data set (9.4.1.2)
- Knows that adding the same constant to all values of a data set does not change measures of spread (9.4.1.2)
- Understands the relationship between standard deviation and range (9.4.1.2)
- Uses technology to identify the regression line from data given in a table or scatterplot (9.4.1.3)
- Identifies how removal of a data point could affect the correlation coefficient, the reliability of the data, and/or the slope of the line of regression (9.4.1.3)
- Describes how the value of the correlation coefficient affects the reliability of a prediction based on a regression line (9.4.1.3)
- Knows and applies the "68-95-99.7 Rule" to estimate percentages, number of data points, and data intervals when given the sample size, mean, and standard deviation of a normally distributed data set (9.4.1.4)
- Calculates the standard deviation of a data set when given the mean, normal distribution intervals, and/or percentages for normally distributed data (9.4.1.4)
- Estimates the area under a normal curve (9.4.1.4)
- Released Example: 790792

Meets the Standards

- Calculates, describes, and compares summary statistics (9.4.1.1)
- Creates a basic data set with specified measures of center and spread (9.4.1.1)
- Demonstrates understanding of the meaning of interquartile range compared to other measures of center, location, and spread in a box-and-whisker plot (9.4.1.1)
- Calculates additional data values that could be added to a given data set to obtain a specific mean (9.4.1.2)

- Knows that multiplying the same constant to all values of a data set does not change percentile standings (9.4.1.2)
- Calculates or explains how the mean, median, or range change when additional data is added to a data set (9.4.1.2)
- Finds the slope of a line of best fit displayed on a scatterplot (9.4.1.3)
- Describes a possible correlation coefficient, including direction and strength, from a graph and describes the relationship between the two variables in context based on the correlation coefficient (9.4.1.3)
- Identifies the type of function modeled by the data in the scatterplot (e.g., linear, quadratic, exponential) (9.4.1.3)
- Identifies 1 standard deviation below and above the mean (9.4.1.4)

Partially Meets the Standards

- Understands the meanings of mean, median, and quartile values (9.4.1.1)
- Identifies the mean, median, maximum, minimum, quartiles, and range from data with up to 10 whole-number values to find solutions (9.4.1.1)
- Finds requested values for median and quartile values from box-and-whisker plots (9.4.1.1)
- Uses the structure of a box-and-whisker plot to answer questions (9.4.1.1)
- Calculates a new mean when additional data is added to a data set (9.4.1.2)
- Describes the relationship between variables in context displayed in a scatterplot (9.4.1.3)
- Uses a line of best fit to make predictions in context (9.4.1.3)
- Identifies the mean when given a normal distribution (bell-shaped curve) (9.4.1.4)
- Released Example: 503502

Does Not Meet the Standards

- Identifies the minimum and maximum values from a labeled box-and-whisker plot (9.4.1.1)
- Knows that measures of center can change with the removal or addition of data (9.4.1.2)
- Makes predictions in context within a range of reasonable values (9.4.1.3)
- Calculates mean of a small data set when given in a list or table with whole numbers or decimals to the hundredths place (9.4.1.4)

Grade 11

9.4.2

Explain the uses of data and statistical thinking to draw inferences, make predictions, and justify conclusions.

Exceeds the Standards

- Understands and explains when data sets show a relationship or no relationship between correlation and/or causation (9.4.2.2)
- Describes how a sampling method can be changed to avoid measurement errors (9.4.2.3)

Meets the Standards

- Identifies how changes in vertical and horizontal scales can affect presentation of the data (9.4.2.2)
- Understands the difference between causation and correlation (9.4.2.2)
- Identifies bias in survey questions (9.4.2.3)
- Understands that representative samples are needed to reduce bias and that random selection from a population reduces bias (9.4.2.3)

Partially Meets the Standards

- Knows that a break in an axis on a graph can mislead the reader (9.4.2.2)
- Identifies that a larger sample size reduces margin of error (9.4.2.3)

Does Not Meet the Standards

- Knows that comparing heights in a bar graph should only be done if the axis starts at 0 (9.4.2.2)
- Knows data gathered from a subgroup cannot necessarily generalize to a larger population (9.4.2.2)
- Understands that increasing sample size can make survey results more reliable (9.4.2.3)

Grade 11

9.4.3

Calculate probabilities and apply probability concepts to solve real-world and mathematical problems.

Exceeds the Standards

- Consistently applies counting procedures in real-world situations when determining the size of the sample space and probabilities (9.4.3.1)
- Distinguishes situations in which order matters with those in which order does not matter and understands when to use replacement versus non-replacement when computing probabilities or number of possible outcomes (9.4.3.1)
- Calculates experimental probabilities of compound events using simulations or given data frequencies (9.4.3.2)
- Uses results of simulations or experiments and the Law of Large Numbers to estimate actual probabilities and percentages (9.4.3.3)
- Correctly assigns values for random numbers to indicate specific outcomes in simulations (9.4.3.4)
- Recognizes the difference between dependent and independent events and computes conditional probabilities for both independent and dependent events (9.4.3.5)
- Understands that to find the probability for a union of several events requires addition of probabilities or the use of binomial coefficients and uses the probability of the complement to compute unions efficiently (9.4.3.5)
- Uses Venn diagrams to find probabilities of intersections, unions, and complements of events (9.4.3.5)
- Recognizes and uses symbols for union and intersection to determine regions of membership in double or triple Venn diagrams (9.4.3.6)
- Finds probabilities of compound events involving intersections, unions, and/or complements, including for non-disjoint and dependent events (9.4.3.7)
- Finds conditional probabilities and combinations for compound problems (9.4.3.8)
- Finds missing values in contingency tables given conditional probabilities (9.4.3.9)
- Released Example: 790507

Meets the Standards

- Uses the multiplication principle to find the probability of two events (9.4.3.1)
- Distinguishes between theoretical probability and experimental probability (9.4.3.2)
- Calculates experimental probabilities using simulations or given data frequencies (9.4.3.2)
- Explains that the Law of Large Numbers means experimental probabilities will approach theoretical probabilities as the number of trials increases (9.4.3.3)

- Understands that randomly generated numbers are equally likely to occur (9.4.3.4)
- Uses a random digit table to conduct simulations, with and without using repeated values (9.4.3.4)
- Uses random numbers to make decisions about equally likely events (9.4.3.4)
- Recognizes that to compute the probability of an intersection of two events requires multiplying the probabilities (9.4.3.5)
- Understands that a reduction in the size of the sample space has an impact on the computation of probability for compound events (9.4.3.5)
- Creates a probability model that models stated probabilities for compound events (9.4.3.5)
- Uses multiple relational words AND, OR, and NOT to solve problems involving Venn diagrams (9.4.3.6)
- Finds the probability of two simple independent events by multiplying individual probabilities (uses the multiplication principle) (9.4.3.7)
- Uses data in a table or Venn diagram to compute experimental probabilities, including probabilities involving unions and intersections, to make decisions in real-world situations (9.4.3.8)
- Identifies and computes conditional probabilities as a fraction or decimal, using contingency tables when totals are not provided (9.4.3.9)

Partially Meets the Standards

- Uses the multiplication principle to find the size of the sample space of compound events (9.4.3.1)
- Computes theoretical probability for simple, familiar, real-world situations (9.4.3.2)
- Computes experimental probabilities using frequency tables with 6 or fewer categories and uses these to make predictions (9.4.3.2)
- Knows that experimental probabilities improve with more trials (9.4.3.3)
- Follows instructions to use random digits to conduct a simulation (9.4.3.4)
- Finds the probability of a single event that meets two conditions (9.4.3.5)
- Completes a double Venn diagram when given sufficient information (9.4.3.6)
- Understands objects outside of both circles on a Venn diagram as meaning not a member of either set (9.4.3.6)
- Finds probabilities of complements of simple events (9.4.3.7)
- Computes expected values from given probabilities or percentages (9.4.3.8)
- Computes conditional probabilities using contingency tables when totals are provided (9.4.3.9)
- Released Examples: 45327, 501380 & 503175

Does Not Meet the Standards

- Uses the addition principle to find the size of the sample space (9.4.3.1)
- Multiplies number of outcomes to find the size of the sample space in simple problems (9.4.3.1)
- Knows that experimental probability is the number of successes divided by the total number of trials (9.4.3.2)
- Calculates the experimental and theoretical probabilities of an event (9.4.3.3)

- Uses random numbers from simple simulations to provide experimental probabilities (9.4.3.4)
- Knows to disregard random numbers outside range of values needed to conduct a simulation (9.4.3.4)
- Finds the probability of a simple independent event (9.4.3.5)
- Understands the overlap in a Venn diagram with two circles as meaning membership in both sets (9.4.3.6)
- Knows how to compute theoretical probabilities of simple events as a ratio (9.4.3.7)
- Calculates the experimental probability of an event (9.4.3.8)
- Understands that the sample size is reduced when computing a conditional probability (9.4.3.9)