ARKANSAS
MATHEMATICS STANDARDS

Grades K-8
Algebra I
Geometry

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KINDERGARTEN MATH STANDARDS

Number & Place Value

Counting & Number Foundations
Students know the number names and count sequence while exploring the relationships between numbers.

K.NPV.1:	Count to 100 by ones and tens; count forward by ones from any given number up to 100.
K.NPV.2:	Count a set of objects up to 20 using one-to-one correspondence, demonstrating that the last number stated indicates the number of objects in the set regardless of the arrangement.
K.NPV.3:	Identify the position of objects in a set using ordinal numbers (first, second, third, etc.).
K.NPV.4:	Identify quickly a number of items in a set from 0 to 10 without counting.

Place Value
Students understand the base ten place value system.

K.NPV.5:	Read, write, and represent whole numbers from 0 to 20.
K.NPV.6:	Show equivalent forms of whole numbers up to 20 as groups of tens and ones, using manipulatives and drawings.

Comparison
Students use place value understanding to compare numbers.

K.NPV.7:	Use matching and counting strategies to compare the number of objects in one group to the number of objects in another group (0 to 10) using the terms greater than, less than, or equal.
K.NPV.8:	Compare two whole numbers, using the terms greater than, less than, or equal.

Computation & Algebraic Reasoning

Operations & Properties
Students perform operations using place value understanding and properties of operations.

K.CAR.1.:	Use objects, fingers, mental images, drawings, sounds, acting out situations, or verbal explanations to represent addition and subtraction from 0 to 10.
K.CAR.2:	Use objects or drawings to decompose numbers less than or equal to 10 into pairs in more than one way, recording each decomposition.
K.CAR.3:	Use a drawing or equation to find the number that makes 10 when added to a given number.
K.CAR.4:	Use manipulatives and various strategies to fluently add and subtract within 10.

Problem Solving
Students solve real-world problems.

K.CAR.5:	Solve real-world problems involving addition and subtraction within 10, using objects, drawings, or equations to represent the problem.

Geometry & Measurement
Shapes
Students analyze attributes of shapes to develop generalizations about their properties.

K.GM.1:   Describe the positions of objects and geometric shapes in the environment.
- Terms include: inside, outside, between, above, below, near, far, under, over, up, down, behind, in front of, next to, to the left of, and to the right of

K.GM.2:   Name shapes correctly regardless of their orientation or overall size.
- Shapes include: squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres

K.GM.3:   Identify two-dimensional attributes of three-dimensional objects.

K.GM.4:   Analyze and sort a variety of two and three-dimensional shapes using informal language to describe their similarities, differences, and other attributes.

K.GM.5:   Compose and draw shapes found in the world using objects (e.g., straws, toothpicks, clay balls).

Measurement Concepts
Students develop understanding of measurement terms and concepts.

K.GM.6:   Make direct comparisons of the length, capacity, weight, and temperature of objects, recognizing which object is shorter/longer, lighter/heavier, warmer/cooler, or holds more.

Time & Money
Students explore time and money values and concepts.

K.GM.7:   Understand concepts of time, recognizing that clocks and calendars are tools that measure time.
- Concepts of time include: morning, afternoon, evening, today, yesterday, tomorrow, day, week, month, and year

K.GM.8:   Identify pennies and dimes by name and value.

Data Analysis
Charts, Graphs, & Tables
Students organize and analyze data.

K.DA.1:   Collect, sort, and organize data into two or three categories, using real-object graphs and picture graphs.

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GRADE 1 MATH STANDARDS

Number & Place Value

Counting

Students extend the counting sequence.

1.NPV.1: Count forward and back within 120 by ones and tens from any given whole number.
1.NPV.2: Skip count forward by multiples of fives within 120.

Place Value

Students understand the base ten place value system.

1.NPV.3: Explain the place value of ones and tens in two-digit numbers, using concrete models, diagrams, numbers, or words.
1.NPV.4: Read, write, and represent whole numbers up to 120, using concrete models or drawings, word form, base ten numerals, and expanded form.
1.NPV.5: Use concrete models or drawings to subtract multiples of 10 from multiples of 10 (within the range of 10-90), relate the strategy to a written expression or equation, and explain the reasoning used to solve.
1.NPV.6: Use mental strategies to find 10 more or 10 less than a given two-digit number.

Comparison

Students use place value understanding to compare numbers.

1.NPV.7: Compare two two-digit numbers using symbols (<, =, >) based on the value of tens and ones in the given numbers.

Fraction Foundations

Students build a conceptual understanding of fractions.

1.NPV.8: Partition circles and rectangles into two and four equal shares, describing the shares using the words halves, fourths, and quarters; understand that decomposing into more equal pieces creates smaller pieces.

Computation & Algebraic Reasoning

Operations & Properties

Students perform operations using place value understanding and properties of operations.

1.CAR.1: Add and subtract fluently within 10 with mastery by the end of first grade.
1.CAR.2: Use computational fluency to add and subtract within 20 using manipulatives and/or a variety of strategies.
1.CAR.3: Apply properties of operations to add and subtract within 20.
1.CAR.4: Use concrete models or drawings to add within 100, including a two-digit number and a one-digit number as well as a two-digit number and a multiple of ten; relate strategy used to a written expression or equation and explain reasoning.

1.CAR.5:   Demonstrate the relationship between addition and subtraction by solving problems, using an inverse operation.

Problem Solving
Students solve real-world problems.

1.CAR.6:   Solve real-world problems involving addition and subtraction within 20.
- Problem types include: adding to, taking from, putting together, taking apart, and comparing with unknowns present throughout the addition and subtraction problem.

1.CAR.7:   Solve real-world problems involving addition of three whole numbers whose sum is less than or equal to 20.

Algebraic Concepts
Students develop and apply understanding of foundational algebraic concepts.

1.CAR.8:   Apply understanding of the equal sign to determine if equations involving addition and subtraction are true or false.

1.CAR.9:   Determine the unknown whole number in an addition or subtraction equation relating three whole numbers.

Geometry & Measurement
Shapes
Students analyze attributes of shapes to develop generalizations about their properties.

1.GM.1:   Understand the difference between defining attributes (e.g., triangles are closed and three-sided shapes) and non-defining attributes (e.g., color, orientation, overall size), using that understanding to build and draw shapes that exhibit defining attributes.

1.GM.2:   Create a composite shape using two-dimensional or three-dimensional shapes.
- Two-dimensional include: rectangle, square, trapezoid, triangle, hexagon, half circle, and quarter circle
- Three-dimensional include: cube, rectangular prism, cone, and cylinder

Length & Width
Students investigate measurement with non-standard units.

1.GM.3:   Express the length of an object as a whole number of units by laying multiple copies of a shorter object end-to-end, understanding that the length of one object is equal to the number of same-size units that span the object with no gaps or overlaps.

1.GM.4:   Order three objects by their length, indirectly comparing the lengths of two objects by using a third object.

Time & Money
Students explore time and money values and concepts.

1.GM.5:   Tell and write time to the nearest hour and half hour using analog clocks; understand how to read hours and minutes using digital clocks.

1.GM.6:   Identify coins by name and value, including penny, nickel, dime, and quarter.

1.GM.7:   Count collections of like coins including pennies, nickels, and dimes to determine their total value up to 100 cents.

Data Analysis
Charts, Graphs, & Tables

Students organize and analyze data.

1.DA.1:   Organize, represent, and interpret data with up to three categories (e.g., tally tables, picture graphs, bar graphs).

1.DA.2:   Ask and answer questions about the total number represented such as how many in each category and how many more or less in one category compared to another.

GRADE 2 MATH STANDARDS

Number & Place Value

Counting
Students extend the counting sequence.

2.NPV.1:   Count within 1,000 forwards and backwards by ones, tens, and hundreds from any given number.

Place Value
Students understand the base ten place value system.

2.NPV.2:   Identify the value of hundreds, tens, and ones place in a three-digit number.

2.NPV.3:   Read, write, and represent whole numbers up to 1,000 using concrete models or drawings, number names, and a variety of expanded forms.

2.NPV.4:   Mentally add 10 or 100 to a given number in the range of 100-900 and mentally subtract 10 or 100 from a given number in the range of 100-900.

Comparison
Students use place value understanding to compare numbers.

2.NPV.5:   Compare two three-digit numbers using symbols (<, =, >) based on the value of hundreds, tens, and ones in the given numbers.

Fraction Foundations
Students build a conceptual understanding of fractions.

2.NPV.6:   Partition circles and rectangles into two, three, or four equal shares, describing the shares using the words halves, thirds, and fourths (or quarters).

2.NPV.7:   Recognize that equal shares of identical wholes need not have the same shape.

Computation & Algebraic Reasoning

Operations & Properties
Students perform operations using place value understanding and properties of operations.

2.CAR.1:   Use mental strategies to fluently add and subtract within 20 with mastery by the end of second grade.

2.CAR.2:   Use computational fluency to add and subtract within 100 using strategies based on place value, properties of operations, or the relationship between addition and subtraction.

2.CAR.3:   Add up to four two-digit numbers with sums not exceeding 100 using strategies based on place value and properties of operations.

2.CAR.4:   Use a number line to solve addition and subtraction problems within 100.

2.CAR.5:   Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends.

2.CAR.6: Use concrete models, drawings, or equations to solve addition and subtraction problems within 1000.

Problem Solving
Students solve real-world problems.

2.CAR.7: Solve one and two-step real-world problems involving addition and subtraction within 100 in situations of adding to, taking from, putting together, taking apart, and comparing unknowns in all positions.

Algebraic Concepts
Students develop and apply understanding of foundational algebraic concepts.

2.CAR.8: Determine whether a group of objects up to 20 has an odd or even number of members; write an equation to express an even number as a sum of two equal addends.

Geometry & Measurement
Shapes
Students analyze attributes of shapes to develop generalizations about their properties.

2.GM.1: Identify, describe, and draw two-dimensional shapes.
- Shapes include: triangles, regular pentagons, regular hexagons, and quadrilaterals (square, rectangle, trapezoid, parallelogram, rhombus)

2.GM.2: Identify and describe three-dimensional shapes based on the shape, number of faces, number of edges, and number of vertices.
- Shapes include: rectangular prisms, cubes, and square-based pyramids

Length & Width
Students investigate measurement using rulers.

2.GM.3: Select appropriate measurement tools to estimate and measure the length of an object to the nearest whole inch or whole centimeters.

2.GM.4: Demonstrate how the length of an object does not change, regardless of the units used to measure it, by measuring the length of an object twice; use two different length units, describing how the two measurements relate to the size of the chosen unit.

2.GM.5: Measure to determine how much longer or shorter one object is than another, expressing the length difference in terms of a standard length whole unit.

2.GM.6: Solve real-world problems involving lengths of the same units, using addition and subtraction within 100.

Perimeter, Area, & Volume
Students explore the perimeter and area of shapes.

2.GM.7: Solve real-world and mathematical problems to find the perimeter of polygons.

2.GM.8: Partition a rectangle into rows and columns of same-size squares, counting the total number of squares to find the area.

Time & Money

Students explore time and money values and concepts.

2.GM.9:   Using an analog clock, tell and write time to the nearest five minutes using colon notation and indicate a.m. or p.m.

2.GM.10:   Describe relationships of time.

- Times include: seconds in a minute; minutes in an hour; hours in a day; days in a week; and days, weeks, and months in a year

2.GM.11:   Solve real-world problems involving addition and subtraction of time intervals in half hours or hours.

2.GM.12:   Count collections of mixed coins and solve real-world problems involving quarters, dimes, nickels, and pennies within 99¢ and whole dollar amounts.

Data Analysis

Charts, Graphs, & Tables

Students organize and analyze data.

2.DA.1:   Use bar graphs, picture graphs, and line plots to organize and represent data, interpreting data with up to four categories.

2.DA.2:   Ask and answer simple put together, take apart, and compare problems, using information presented in the bar graphs, picture graphs, and line plots.

GRADE 3 MATH STANDARDS

Number & Place Value
Place Value
Students understand the base ten place value system.

3.NPV.1:   Round four-digit whole numbers to the nearest 10 or 100, using place value understanding.

3.NPV.2:   Identify the value of thousands, hundreds, tens, and ones place in a four-digit number.

3.NPV.3:   Read and write whole numbers up to 10,000, using base ten numerals, word form, and a variety of expanded forms.

Comparison
Students use place value understanding to compare numbers.

3.NPV.4:   Compare two four-digit numbers using symbols (<, =, >) based on the value of thousands, hundreds, tens, and ones in the given numbers.

3.NPV.5:   Compare two fractions with the same numerator or denominator by reasoning about their size based on the same whole; use symbols (<, =, >) and justify the conclusion using visual fraction models, concrete objects, or words.

Fraction Foundations
Students build a conceptual understanding of fractions.

3.NPV.6:   Identify fractions as parts of a whole and parts of a collection or set.
- Fractions include: denominators 2, 3, 4, 6, and 8

3.NPV.7:   Partition squares, regular hexagons, and equilateral triangles into parts with equal shares, explaining the shares of each part as a unit fraction of the whole.
- Fractions include: denominators 2, 3, 4, 6, and 8

3.NPV.8:   Identify and represent a unit fraction as a number on the number line.
- Fractions include: denominators 2, 3, 4, 6, and 8

3.NPV.9:   Identify and represent a non-unit fraction as a number on the number line, including fractions greater than one.
- Fractions include: denominators 2, 3, 4, 6, and 8

3.NPV.10:   Decompose and compose a non-unit fraction a/b as the quantity formed by the sum of unit fractions.
- Fractions include: denominators 2, 3, 4, 6, and 8

Equivalent Fractions
Students develop and apply equivalent fraction understanding.

3.NPV.11:   Use number lines and visual models to recognize and generate equivalent fractions, explaining how they are equivalent in real-world and mathematical situations.
- Fractions include: denominators 2, 3, 4, 6, and 8

Computation & Algebraic Reasoning

Operations & Properties

Students perform operations using place value understanding and properties of operations.

3.CAR.1:   Use computational fluency to add and subtract three-digit whole numbers, using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.

3.CAR.2:   Use basic fact fluency to multiply and divide whole numbers with mastery by the end of third grade.
- Knowing all products with factors up to and including 12 and the corresponding division facts from the products with factors up to and including 12.
- Using strategies such as the relationship between multiplication and division (e.g., Knowing that $8 \cdot 5 = 40$, one knows $40 \div 5 = 8$) or properties of operations.

3.CAR.3:   Apply properties of operations as strategies to multiply and divide.
- Properties include: Distributive, Commutative, and Associative Properties of Multiplication

3.CAR.4:   Use strategies to multiply one-digit numbers by multiples of 10 ranging from 10-90; strategies are based on place value and properties of operations (e.g., $9 \cdot 80, 5 \cdot 60$).

3.CAR.5:   Identify arithmetic patterns including, but not limited to, patterns in an addition or multiplication table, explaining use of properties of operations appropriate to the pattern.

Problem Solving

Students solve real-world problems.

3.CAR.6:   Solve real-world problems using multiplication and division within 100 involving equal groups, arrays, partitive and measurement division.

3.CAR.7:   Solve two-step real-world situations using addition, subtraction, multiplication, and division, representing these problems using equations with a symbol standing for an unknown quantity.

Algebraic Concepts

Students develop and apply an understanding of foundational algebraic concepts.

3.CAR.8:   Determine the unknown whole number in a multiplication or division equation relating three whole numbers.

3.CAR.9:   Understand division as an unknown-factor problem.

Geometry & Measurement

Shapes

Students analyze attributes of shapes to develop generalizations about their properties.

3.GM.1:   Understand that quadrilaterals in different categories may share attributes; those attributes (e.g., four equivalent sides) can define a larger category (e.g., quadrilaterals) or subcategory (e.g., rhombus and square).

3.GM.2:   Identify perpendicular and parallel lines, as well as right angles in two-dimensional shapes and real-world surroundings or objects.

3.GM.3:   Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, identifying and/or drawing examples of quadrilaterals that do not belong to any of these subcategories.

Length & Width
Students investigate measurement using rulers.

3.GM.4:   Measure lengths of objects to the nearest half and quarter inch, using a ruler.

Area & Volume
Students calculate the area of rectangles and liquid volume.

3.GM.5:   Describe area as the number of unit squares that cover a plane figure without gaps and overlaps.
3.GM.6:   Find the area of a rectangle with whole number side lengths by modeling with unit squares and multiplying the side lengths to show the results are the same.
3.GM.7:   Multiply side lengths to find areas of rectangles with whole number side lengths in the context of solving real-world and mathematical problems.
3.GM.8:   Measure and estimate liquid volumes and masses of objects using standard units.
3.GM.9:   Solve one-step real-world problems involving liquid volumes and masses of objects in the same units, using all four operations.

Time
Students tell time and solve problems about elapsed time.

3.GM.10:   Tell and write time to the nearest minute, using analog clocks.
3.GM.11:   Solve word problems involving addition and subtraction of time intervals in minutes.

Data Analysis
Charts, Graphs, & Tables
Students organize and analyze data.

3.DA.1:   Represent a data set with multiple categories, using a scaled picture graph, scaled bar graph, and a line plot.
3.DA.2:   Solve one and two-step problems, using categorical data represented with a scaled picture graph, scaled bar graph, and a line plot.

GRADE 4 MATH STANDARDS

Number & Place Value

Place Value
Students understand the base ten place value system.

4.NPV.1: Recognize that a digit in a given place represents ten times what it represents in the place to its right.

4.NPV.2: Read and write whole numbers up to 1,000,000 using base ten numerals, word form, and a variety of expanded forms.

4.NPV.3: Use place value understanding to round five-digit and six-digit whole numbers to any place.

Comparison
Students use place value understanding to compare numbers.

4.NPV.4: Compare two five-digit whole numbers and six-digit whole numbers, using symbols (<, =, >) to record the results of comparisons.

4.NPV.5: Compare two fractions with different numerators and different denominators using symbols (<, =, >) to record the results of comparisons (e.g., by creating common denominators or numerators or by comparing to a benchmark of 0, ½, 1).

4.NPV.6: Compare two decimals to the hundredths place, using symbols (<, =, >) to record the results of comparisons.

Fraction Foundations
Students develop a conceptual understanding of fractions.

4.NPV.7: Decompose fractions, including fractions greater than one and mixed numbers, into unit fractions, using concrete models, drawings, and/or the number line.
- Fractions include denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100.

Equivalent Fractions
Students develop and apply equivalent fraction understanding.

4.NPV.8: Explain why a fraction a/b is equivalent to a fraction $(n \cdot a)/(n \cdot b)$, using visual fraction models, generating equivalent fractions using the principle $a/b = (n \cdot a)/(n \cdot b)$.
- Fractions include denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100.

4.NPV.9: Add two fractions with denominators of 10 and 100 by expressing the denominator of 10 as an equivalent fraction with a denominator of 100.

4.NPV.10: Apply decimal notation for fractions with denominators 10 or 100.

Computation & Algebraic Reasoning

Operations & Properties
Students perform operations, using place value understanding and properties of operations.

4.CAR.1: Find the factor pairs for a given number in the range of 1-100, identifying whether a number is prime or composite; determine whether a given whole number in the range of 1-100 is a multiple of a given one-digit number.

4.CAR.2: Use computational fluency to add and subtract whole numbers up to 1,000,000 by using strategies and algorithms, including the standard algorithm, with mastery by the end of fourth grade.

4.CAR.3: Use strategies based on place value and the properties of operations to multiply four-digit by one-digit whole numbers and two two-digit whole numbers.

4.CAR.4: Use strategies based on place value, the properties of operations, and the relationship between multiplication and division to divide whole numbers with four-digits by one-digit divisors; quotients should be with and without whole number remainders.

4.CAR.5: Add and subtract fractions, including mixed numbers, with like denominators, using visual fraction models and equations.
- Fractions include: denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100

4.CAR.6: Multiply a fraction by a whole number using visual fraction models and equations.
- Fractions include: denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100

Problem Solving
Students solve real-world problems.

4.CAR.7: Solve real-world problems involving multiplicative comparison, using drawings and/or equations with a symbol for the unknown number, and distinguish between multiplicative comparison and additive comparison.

4.CAR.8: Solve multi-step, real-world problems posed with whole numbers and having whole-number answers, using addition, subtraction, multiplication, and division; include problems in which remainders must be interpreted and represent these problems using equations with symbols standing for the unknown quantity.

4.CAR.9: Solve real-world problems involving the addition and subtraction of fractions; include mixed numbers with like denominators, using visual fraction models or equations.
- Fractions include: denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100

4.CAR.10: Solve real-word problems involving the multiplication of a fraction by a whole number using visual fraction models or equations.
- Fractions include: denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100

Algebraic Concepts
Students develop and apply an understanding of foundational algebraic concepts.

4.CAR.11: Generate a number or shape pattern that follows a given rule, identifying apparent features of the pattern that are not explicit in the rule itself.

Geometry & Measurement
Shapes
Students expand knowledge of shapes by analyzing sides and angles.

4.GM.1: Identify angles as geometric shapes that are formed where two rays share a common endpoint, understanding that angles are measured with reference to a circle so that an angle that turns through a 1/360 of a circle is

called a "one-degree angle" and an angle that turns through n one-degree angles is said to have an angle measure of n degree.

4.GM.2: Measure angles in whole-number degrees, using a protractor, drawing angles of specified measure.

4.GM.3: Solve real-word problems finding unknown angle measures, using addition and subtraction when an angle is decomposed into non-overlapping parts.

4.GM.4: Identify and draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines, identifying these in quadrilaterals and triangles.

4.GM.5: Classify two-dimensional figures based on the presence or absence of parallel lines, perpendicular lines, or angles of a specified size, involving quadrilaterals and triangles.

- Shapes include: quadrilaterals (trapezoid, parallelogram, rectangle, square, rhombus) and triangles (right, acute, obtuse)

4.GM.6: Identify and/or draw lines of symmetry for a two-dimensional figure.

Perimeter, Area, & Volume

Students calculate the perimeter of polygons, area of rectangles, and liquid volume.

4.GM.7: Apply the area and perimeter formulas for rectangles and figures composed of two or more rectangles in real-world situations.

Time, Money, & Conversions

Students apply measurement knowledge to solve real-world problems.

4.GM.8: Convert measurements of length, weight/mass, and liquid volume within the same system of measurement, metric and customary, expressing measurements from a larger unit in terms of a smaller unit.

4.GM.9: Solve real-world problems involving time intervals that may cross the hour.

4.GM.10: Solve real-world problems involving addition and subtraction of money, including the ability to make change.

4.GM.11: Solve real-world problems involving distances, liquid volume, and masses of objects, including problems that require expressing measurements given in a larger unit in terms of a smaller unit.

Data Analysis

Charts, Graphs, & Tables

Students organize and analyze data.

4.DA.1: Collect and interpret data from observations, surveys, and experiments; represent data using frequency tables and scaled bar graphs.

4.DA.2: Use a line plot to display a data set of measurements in fractions of a unit, solving problems involving addition and subtraction of fractions with like denominators using data presented in line plots.

GRADE 5 MATH STANDARDS

Number & Place Value

Place Value

Students understand the base ten place value system.

5.NPV.1: Recognize that, in a multi-digit number, a digit in a given place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.

5.NPV.2: Explain patterns in the number of zeros and/or the decimal point when multiplying or dividing a number by a power of 10, using whole-number exponents to denote powers of 10.

5.NPV.3: Read and write decimals to thousandths, using base-ten numerals, word form, and a variety of expanded forms.

5.NPV.4: Apply place value understanding to round decimals to any place up to the thousandths.

Comparison

Students use place value understanding to compare numbers.

5.NPV.5: Compare two decimals to thousandths based on the value of the digits in each place, using symbols (<, =, >) to record the results of comparisons.

Fraction Foundations

Students build a conceptual understanding of fractions.

5.NPV.6: Use visual models to explain the product of multiplying a whole number by a fraction greater than and less than one.

Computation & Algebraic Reasoning

Operations & Properties

Students perform operations using place value understanding and properties of operations.

5.CAR.1: Use computational fluency to multiply multi-digit whole numbers by using strategies and algorithms, including the standard algorithm, with mastery by the end of fifth grade.

5.CAR.2: Calculate whole number quotients of whole numbers with up to four-digit dividends and two-digit divisors using strategies based on place value, properties of operations, divisibility rules, and the relationship between multiplication and division.

5.CAR.3: Add and subtract decimals to the hundredths using concrete models or drawings and strategies based on place value, properties of operations, or the relationship between addition and subtraction.

5.CAR.4: Multiply and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, or the relationship between multiplication and division.

5.CAR.5: Add and subtract fractions with like and unlike denominators by using equivalent fractions $\{a/b = (n \cdot a)/(n \cdot b)\}$ to create common denominators; include real-world problems.
- Fractions include: mixed numbers

5.CAR.6: Interpret and solve fractions as division problems, $(a/b = a \div b)$, where a and b are natural numbers.

5.CAR.7:   Use visual models and equations to multiply whole numbers by fractions and fractions by fractions, including mixed numbers and fractions greater than one.

5.CAR.8:   Apply previous understanding of division to divide unit fractions by whole numbers and whole numbers by unit fractions.

Problem Solving

Students solve real-world problems.

5.CAR.9:   Solve and create real-world problems involving multiplication of fractions and mixed numbers.

5.CAR.10:   Solve real-world problems involving the division of natural numbers leading to answers in the form of fractions or mixed numbers using visual models and equations.

5.CAR.11:   Solve real-world problems involving the division of unit fractions by whole numbers and whole numbers by unit fractions, using visual fraction models and equations.

Algebraic Concepts

Students develop and apply an understanding of foundational algebraic concepts.

5.CAR.12:   Evaluate numerical expressions with parentheses or brackets and exponents with the base of ten, using the Order of Operations.

5.CAR.13:   Write simple expressions that record calculations with numbers, interpreting numerical expressions without evaluating them.

5.CAR.14:   Generate two numerical patterns given two rules, identifying the relationship between the corresponding terms by graphing the terms in the first quadrant of the coordinate grid.

Geometry & Measurement

Shapes

Students expand knowledge of shapes by analyzing sides and angles.

5.GM.1:   Classify two-dimensional figures in a hierarchy based on properties with the focus on quadrilaterals and triangles when teaching hierarchies.
- Shapes to include: quadrilaterals (trapezoid, parallelogram, rectangle, square, rhombus, kite) and triangles (right, acute, obtuse, scalene, isosceles, equilateral)

Area & Volume

Students solve the area of rectangles and volume of rectangular prisms.

5.GM.2:   Find the area of a rectangle with fractional and/or mixed number side lengths by using models and multiplying the fractional side lengths showing that both strategies produce the same area.

5.GM.3:   Measure volumes by counting unit cubes using cubic cm (cm^3), cubic in (in^3), cubic ft (ft^3), and improvised units (u^3).

5.GM.4:   Solve real-world and mathematical problems involving the volume of rectangular prisms with whole number side lengths by applying the formulas ($V = l \cdot w \cdot h$ or $V = B \cdot h$) and the properties of operations.

5.GM.5:   Solve real-world problems by calculating volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts.

Conversions

Students apply measurement knowledge to solve real-world problems.

5.GM.6:   Convert among different-sized standard measurement units within the same system, including both the metric and customary systems, and solve multi-step, real-world problems using conversions.

Coordinate Plane System

Students develop an understanding of the coordinate system.

5.GM.7:   Graph points with whole number coordinates on a coordinate plane in the first quadrant, explaining how the coordinates relate to the horizontal and vertical axes to describe the location of points in the plane.

5.GM.8:   Represent real-world and mathematical problems by graphing points in the first quadrant on a coordinate plane, interpreting coordinate values of points in the context of the situation.

Data Analysis

Charts, Graphs, & Tables

Students organize and analyze data.

5.DA.1:   Collect and interpret data from observations, surveys, and experiments; represent data using frequency tables, scaled bar graphs, and scaled line graphs.

5.DA.2:   Use a line plot to display a data set of measurements in fractions of a unit solving problems involving all four operations with fractions (excluding division of a fraction by fraction) using data presented in line plots.

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GRADE 6 MATH STANDARDS

Number Concepts & Computations

Rational Numbers

Students use fractions, decimals, integers, and absolute values to represent real-world situations.

6.NCC.1: Explain positive and negative integers as being opposite values or directions and the meaning of 0 in a real-world context.

6.NCC.2: Find and plot rational numbers on horizontal and vertical number lines in real-world and mathematical problems.

6.NCC.3: Compare rational numbers, using inequalities ($<, >, \leq, \geq, \neq$) and order on a number line.

6.NCC.4: Interpret the absolute value of numbers for positive or negative quantities in a real-world context.

6.NCC.5: Convert between fractions, decimals, and percents in real-world and mathematical problems.

Rational Number Operations

Students extend previous knowledge of operations to decimals and fractions, involving positive rational numbers.

6.NCC.6: Interpret and represent quotients of fractions.
- Fractions include all forms of fractions.

6.NCC.7: Solve problems involving the division of fractions in real-world and mathematical problems.
- Fractions include all forms of fractions.

6.NCC.8: Divide multi-digit numbers fluently in real-world and mathematical problems.

6.NCC.9: Use any standard algorithm to fluently add and subtract multi-digit decimals and fractions in real-world and mathematical problems.

6.NCC.10: Use any standard algorithm to fluently multiply and divide multi-digit decimals and fractions in real-world and mathematical problems.

Common Factors and Multiples

Students use factors and multiples to solve problems.

6.NCC.11: Solve real-world and mathematical problems with the greatest common factor of two whole numbers less than or equal to 100.

6.NCC.12: Solve real-world and mathematical problems with the least common multiple of two whole numbers less than or equal to 12.

6.NCC.13: Use the distributive property and the greatest common factor to rewrite the sum of two whole numbers, 1 through 100.

Proportional Relationships

Ratio & Rates

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

6.PR.1:   Use precise ratio language and notation to describe a ratio as a relationship between two quantities.

6.PR.2:   Calculate unit rates to include unit pricing and constant speed.

6.PR.3:   Give examples of unit rates as a ratio that compares two quantities with different units of measure, limited to non-complex fractions.

6.PR.4:   Create various representations to compare ratios and find missing values to solve real-world and mathematical problems.

6.PR.5:   Find a percent of a quantity as a rate per 100 and solve problems involving finding the whole when given a part and the percent.

Algebra

Expressions

Students extend their understanding of arithmetic to algebraic expressions.

6.ALG.1:   Read and write expressions in real-world or mathematical problems in which letters stand for numbers.

6.ALG.2:   Use mathematical terms to identify parts of an expression, including the names of operations, terms, factors, coefficients, variables, and constants.

6.ALG.3:   Write and evaluate expressions for given values of variables, using order of operations, including expressions with whole number exponents.

6.ALG.4:   Generate equivalent expressions by applying the associative, commutative, distributive, and identity properties.

6.ALG.5:   Identify when two expressions are equivalent by using properties of operations including like terms.

Equations & Inequalities

Students focus on reasoning about and solving equations and inequalities.

6.ALG.6:   Use substitution to determine if a given value in a specified set makes an equation or inequality true.

- Include the following inequality symbols: $<, \ >, \ \leq, \ \geq, \ \neq$

6.ALG.7:   Write and solve one-step equations in real-world and mathematical problems, involving positive rational numbers and zero.

6.ALG.8:   Write, solve, and graph one-step inequalities in real-world and mathematical problems.

Geometry & Measurement

Area, Volume, & Surface Area

Students solve problems involving area, volume, and surface area.

6.GM.1:   Find the area of triangles, quadrilaterals, and polygons by composing or decomposing to solve real-world and mathematical problems.

6.GM.2:   Apply the formulas $V = lwh$ and $V = Bh$ to find the volume of right rectangular prisms with fractional edge lengths to solve real-world and mathematical problems, including solving for an unknown dimension.

6.GM.3:   Construct nets of a rectangular prism, rectangular pyramid, triangular prism, and triangular pyramid, using the nets to find the surface area of these prisms.

Coordinate Plane System

Students graph points in all four quadrants.

6.GM.4: Find and graph pairs of rational numbers in all four quadrants of the coordinate plane in real-world and mathematical problems.

6.GM.5: Draw polygons in the coordinate plane when given coordinates for the vertices.

6.GM.6: Use coordinates to calculate vertical and horizontal distances between points with the same x-coordinate or the same y-coordinate to solve real-world and mathematical problems.

Conversions

Students apply measurement knowledge to solve real-world problems.

6.GM.7: Convert measurements within and between the metric and customary measurement systems to solve real-world and mathematical problems.

Statistics & Probability

Statistical & Nonstatistical

Students recognize that data collected to answer a statistical question can be analyzed by their distributions.

6.SP.1: Identify the difference between statistical and non-statistical questions and write simple statistical questions that allow variable responses.

Measures of Center

Students explore mean, median, and mode.

6.SP.2: Calculate and interpret any measure of center (mean, median, and mode) of a numerical data set.

6.SP.3: Determine which measure of center (mean or median) is more appropriate to describe the center of data and justify the choice.

6.SP.4: Describe how the mean or median is affected by outliers of a numerical data set.

Measures of Variation

Students explore range and interquartile range.

6.SP.5: Calculate and interpret the measure of variation [range and interquartile range (IQR)] of a numerical data set.

6.SP.6: Determine which measure of variation (range or interquartile range) is more appropriate to describe the shape; justify the choice.

Numerical Data

Students summarize and describe distributions.

6.SP.7: Represent numerical data on a number line, histogram, and box plot.

6.SP.8: Calculate the relative frequency of an interval of data values when given a histogram.

6.SP.9: Interpret a box plot to answer statistical questions about a data set.

GRADE 7 MATH STANDARDS

Number Concepts & Computations

Rational Numbers

Students model and compute with rational numbers.

7.NCC.1:   Represent addition and subtraction of rational numbers in real-world contexts using a variety of forms.
7.NCC.2:   Model and describe additive inverse in real-world situations to show opposite quantities combine to make 0.
7.NCC.3:   Demonstrate in real-world contexts the distance between two rational numbers on the number line as the absolute value of their differences.
7.NCC.4:   Convert a rational number in fraction form to decimal form and recognize that the decimal form of a rational number terminates in 0s or eventually repeats.
7.NCC.5:   Interpret the products and quotients of rational numbers by describing real-world contexts.

Rational Number Operations

Students apply all properties and operations to all rational numbers.

7.NCC.6:   Apply properties of operations as strategies to fluently add, subtract, multiply, and divide rational numbers.
7.NCC.7:   Use addition and subtraction with rational numbers in any form to solve multi-step problems in real-world and mathematical contexts.
7.NCC.8:   Use multiplication and division with rational numbers in any form to solve multi-step problems in real-world and mathematical contexts.
7.NCC.9:   Apply operations with rational numbers involving the order of operations, involving nested grouping symbols.

Proportional Relationships

Ratio & Rates

Students analyze and use unit rates to solve problems.

7.PR.1:   Determine the unit rate (constant of proportionality) from tables, graphs, equations, diagrams, or verbal descriptions of proportional relationships.
7.PR.2:   Calculate unit rates in real-world contexts that include complex fractions.
7.PR.3:   Solve multi-step ratio and percent problems in a real-world context, including percent error and percent increase and decrease.

Constant of Proportionality

Students analyze proportional relationships and solve multi-step ratio and percent problems.

7.PR.4:   Determine whether two quantities represent proportional relationships by using equivalent ratios in a table and by graphing on a coordinate plane.
7.PR.5:   Compare two different proportional relationships represented in different forms.
7.PR.6:   Create equations in the form of $y = mx$ from tables, verbal descriptions, or graphs.

7.PR.7:   Given a graph with a proportional relationship, explain the meaning of a point (x, y) on the graph, including the origin $(0, 0)$ and the unit rate $(1, r)$.

Algebra
Expressions
Students apply properties of operations to create equivalent expressions.

7.ALG.1:   Generate and justify equivalent expressions, using properties of operations to add, subtract, factor, and expand linear expressions with rational coefficients within mathematical and real-world problems.

Equations & Inequalities
Students apply previous knowledge of equations and inequalities to two-step problems.

7.ALG.2:   Model and solve fluently two-step equations in real-world or mathematical problems.
7.ALG.3:   Create, solve, and graph two-step inequalities in real-world and mathematical problems in the forms $px \pm q > r, px \pm q < r, px \pm q \geq r$, and $px \pm q \leq r$.

Relationships between Quantities
Students use understanding of algebraic expressions and equations to represent relationships between two quantities.

7.ALG.4:   Write an equation to express two quantities in terms of the dependent and independent variables.
7.ALG.5:   Describe the relationship between the dependent and independent variables in an equation using tables and graphs, relating these to the equation.

Geometry & Measurement
Area, Volume, & Surface Area
Students solve problems involving area, volume, and surface area.

7.GM.1:   Describe the proportional relationship between the circumference and diameter of a circle.
7.GM.2:   Use area and circumference formulas of a circle to solve real-world and mathematical problems.
7.GM.3:   Apply the formulas for the volume and surface area of right rectangular prisms, rectangular pyramids, triangular prisms, and triangular pyramids to solve real-world and mathematical problems.

Cross Sections
Students describe cross sections of three-dimensional figures.

7.GM.4:   Describe the two-dimensional figure that results from slicing a three-dimensional figure parallel and perpendicular to the base.
- Three-dimensional figures include: right rectangular prisms, triangular prisms, and cylinders

Triangles & Angles
Students solve problems using various angle properties of lines.

7.GM.5:   Solve multi-step problems involving supplementary, complementary, vertical, and adjacent angles to include solving for an unknown angle in a figure.

Scale

Students understand and use scale factor.

7.GM.6:   Calculate the scale factor, compute the actual lengths from the scale in a drawing, and reproduce a scale drawing using another scale.

Statistics & Probability

Numerical Data

Students interpret and organize data.

7.SP.1:   Interpret data displayed in a histogram and box plot to answer questions about the data.
7.SP.2:   Recognize, create, and interpret categorical data in a circle graph.
7.SP.3:   Graph two numerical data sets and compare their variability.
- Variability includes: range, interquartile range, or mean absolute deviation

7.SP.4:   Select an appropriate measure(s) of center or variability and draw valid comparative inferences for two data sets.

Sampling & Population

Students understand sampling and use samples to make inferences.

7.SP.5:   Distinguish between a random and non-random sample.
7.SP.6:   Use a random sampling of a population to draw valid inferences and generalizations of populations.

Probability

Students understand theoretical and experimental probability for simple experiments.

7.SP.7:   Determine the sample space of a simple experiment and use the sample space to determine the theoretical probability of a given set of outcomes.
- Simple experiments include: tossing a fair coin, spinning a fair spinner, rolling a fair dice, picking a random marble from a bag, and selecting a random card from a deck

7.SP.8:   Recognize that probabilities in a simple experiment can be qualitative descriptors of likelihood: impossible (0), unlikely, neither likely nor unlikely, likely, or certain (1).
7.SP.9:   Determine experimental probabilities in simple experiments and represent as fractions, decimals, and percents.
7.SP.10:   Use theoretical probability of an event in a simple experiment to predict the number of times that an event will occur for a large number of experiments.

GRADE 8 MATH STANDARDS

Number Concepts & Computations

Rational & Irrational Numbers

Students understand relationships among numbers and the real number system.

8.NCC.1: Describe relationships in the real number system (rational and irrational).
- Numbers relationships to include: decimal expansion for rational and irrational numbers, square roots of nonperfect squares, and cube roots of nonperfect cubes

8.NCC.2: Compare the size of irrational numbers and locate them on a number line by finding the rational approximations.

8.NCC.3: Know and apply the properties of integer exponents to generate equivalent numerical expressions.

8.NCC.4: Write very large and very small numbers in scientific notation using positive and negative exponents.

8.NCC.5: Compare numbers written in scientific notation to determine how many times larger or smaller one number is than the other, using real-world and mathematical problems.

8.NCC.6: Solve real-world and mathematical problems by performing operations with numbers written in standard and scientific notation.

Rational Number Operations

Students work with square and cube roots.

8.NCC.7: Solve equations in the form of $x^2 = p$ or $x^3 = p$ where p is a positive rational number.

8.NCC.8: Evaluate square roots of perfect squares and cube roots of perfect cubes.

Functions

Proportional & Linear Relationships

Students understand slope using previous learning of proportional relationships.

8.FN.1: Graph proportional relationships, interpreting the unit rate as the slope of the graph.

8.FN.2: Explain, using similar right triangles, how the slope of a line is the same between two points on a non-vertical line or non-horizontal line.
- Slope includes: positive, negative, horizontal (zero), and vertical (undefined)

Functions

Students understand that a function is a rule that assigns each input exactly one output.

8.FN.3: Determine whether a relation is a function or not when given a function map, table, graph, equation, or set of ordered pairs.

8.FN.4: Compare the rate of change (slope) and y-intercept (initial value) of two linear functions each represented in different forms.
- Functions are represented algebraically, graphically, numerically in tables, or by verbal descriptions.

8.FN.5: Distinguish between linear and nonlinear functions by comparing graphs and equations.

8.FN.6:   Determine the rate of change (slope) and y-intercept (initial value) from tables, graphs, equations, and verbal descriptions of linear relationships.

8.FN.7:   Interpret and explain the meaning of the rate of change (slope) and y-intercept (initial value) of a linear relationship in a real-world context.

8.FN.8:   Analyze a graph by describing the functional relationships between two quantities.

8.FN.9:   Sketch a graph that exhibits qualitative features of a function described verbally.

Algebra

Equations & Inequalities

Students solve linear equations and inequalities.

8.ALG.1:   Analyze and solve one-variable linear equations with rational coefficients containing solutions with one, zero, or infinitely many solutions.

8.ALG.2:   Analyze and solve one-variable linear inequalities with rational coefficients.

Systems of Equations

Students will solve systems of equations.

8.ALG.3:   Analyze and solve systems of linear equations in the form $y = mx + b$ in real-world or mathematical contexts, graphically and algebraically.

Geometry & Measurement

Area, Volume, & Surface Area

Students solve problems involving area, volume, and surface area.

8.GM.1:   Apply the formulas for the volume and surface area of cylinders, cones, and spheres to solve real-world and mathematical problems.

Cross Sections

Students describe cross sections of three-dimensional figures.

8.GM.2:   Describe the two-dimensional figure that results from slicing a three-dimensional figure parallel and perpendicular to the base.

- Three-dimensional figures include: pyramids, cones, and spheres

Pythagorean Theorem

Students explore right triangles and apply the Pythagorean Theorem.

8.GM.3:   Model or explain an informal proof of the Pythagorean Theorem and its converse.

8.GM.4:   Apply the Pythagorean Theorem to determine unknown side lengths in right triangles.

8.GM.5:   Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Transformations & Congruence on a Coordinate Plane

Students use concrete models, diagrams, or geometry to understand congruence and similarity.

8.GM.6:   Given a figure, draw a congruent figure on a coordinate plane resulting from a rotation, reflection, or translation.

8.GM.7:   Identify a single transformation used to transform one figure onto another on a coordinate plane.

- Rotations include: 90°, 180°, and 270°

8.GM.8:   Given two congruent figures, describe a sequence of transformations that maps one figure to another.

8.GM.9:   Perform a given sequence of transformations of a figure on the coordinate plane, including rotations, reflections, translations, and dilations.

- Rotations include: 90°, 180°, and 270°

8.GM.10:   Describe the effects of rotations, reflections, translations, and dilations on two-dimensional figures using coordinates.

- Rotations include: 90°, 180°, and 270°

8.GM.11:   Given two similar two-dimensional figures, describe a sequence of transformations that exhibits similarity, including rotations, reflections, translations, and dilations.

Statistics & Probability

Bivariate Data

Students investigate patterns of association to bivariate data.

8.SP.1:   Construct scatter plots using bivariate data; determine if the data displays a linear or nonlinear pattern and positive, negative, or no association.

8.SP.2:   Construct straight lines to approximately fit data displaying a linear association when presented in scatter plots.

8.SP.3:   Construct and interpret a relative frequency table, using data from two categorical variables collected from the same subject.

Probability

Students understand theoretical and experimental probability for compound experiments using organized lists, tables, or tree diagrams.

8.SP.4:   Determine the sample space and use the sample space to determine the theoretical probability of a given set of outcomes for compound experiments, using organized lists, tables, or tree diagrams.

- Compound experiments include a combination of two different experiments.

8.SP.5:   Determine theoretical and experimental probabilities of compound experiments.

8.SP.6:   Use theoretical probability of an event in a compound experiment to predict the number of times that event will occur for a large number of experiments.

ALGEBRA I MATH STANDARDS

Expressions
Polynomials, Roots, & Exponent Laws

Students simplify algebraic and numerical expressions.

A1.EX.1: Add, subtract, and multiply polynomials; compare the system of polynomials to the system of integers when performing operations.

A1.EX.2: Simplify and perform operations with radical expressions without variables; rationalizing denominators should not include conjugates.

A1.EX.3: Simplify algebraic expressions using the laws of exponents.

A1.EX.4: Interpret the parts of expressions such as terms, factors, and coefficients in terms of a real-world context.

Functions
Domain & Range, Function Notation

Students understand the concept of a function, domain and range, and use function notation; students use function notation to solve problems.

A1.FN.1: Explain that a function assigns each element in the domain to exactly one element in the range.

A1.FN.2: Use function notation to represent functions, understanding that if f is a function and x is an element of its domain, then $f(x)$ represents the output of f corresponding to the input x.

A1.FN.3: Graph functions given in function notation, understanding that the graph contains the points $(x, f(x))$.

A1.FN.4: Evaluate functions expressed in function notation for one or more elements in their domains (inputs); use function notation to describe a contextual situation.

Construct & Compare

Students construct and compare linear, quadratic, and exponential models and solve problems.

A1.FN.5: Differentiate between real-world scenarios that can be modeled by exponential or linear functions by determining whether the relationship has a common difference or a common ratio.

A1.FN.6: Compare the growth pattern of exponential to linear or quadratic functions using graphs and tables and recognize how exponential growth exceeds other functions.

Linear Functions, Equations, & Inequalities
Create & Solve

Students create and solve equations that model linear relationships.

A1.LFE.1: Represent and solve real-world problems, using linear expressions, equations, and inequalities in one variable.

A1.LFE.2: Construct linear functions from arithmetic sequences with and without context.

A1.LFE.3: Solve linear formulas for a specified variable.

A1.LFE.4:   Solve linear equations, linear inequalities, and absolute value equations in one variable, including those with rational number coefficients, and variables on both sides of the equal or inequality sign; solve them fluently, explaining the process used.

Interpret Key Features
Students interpret key features of equations that model linear relationships.

A1.LFE.5:   Determine the domain and range of linear functions in mathematical problems.

A1.LFE.6:   Determine reasonable domain and range values of linear functions representing real-world situations, both continuous and discrete; interpret the solution as reasonable or unreasonable in context.

A1.LFE.7:   Interpret the key features of a linear and absolute value functions that models a relationship between two quantities in a given context.

A1.LFE.8:   Flexibly use different representations of a linear function, including graphs, tables, and equations.

A1.LFE.9:   Calculate and interpret the rate of change of a linear function represented in a table, graph, or as an equation in context of real-world and mathematical problems.

A1.LFE.10:   Translate among equivalent forms of equations for linear functions, including standard, point-slope, and slope-intercept forms; recognize that each form reveals key features in a given context.

Systems of Equations & Inequalities
Students solve systems of equations and inequalities.

A1.LFE.11:   Solve systems of linear equations by substitution, elimination, and graphing with and without a real-world context; understand that the solutions will be the same regardless of the method for solving.

A1.LFE.12:   Solve a system of equations consisting of a linear equation and a quadratic equation in two variables graphically with the assistance of technology.

A1.LFE.13:   Explain why a solution to the equation $f(x) = g(x)$ is the x-coordinate where the y-coordinate of $f(x)$ and $g(x)$ are the same using graphs, tables, or approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, quadratic, absolute value, and exponential.

A1.LFE.14:   Solve linear inequalities and systems of linear inequalities in two variables by graphing.

Graphing & Transformations
Students graph linear functions, equations, and inequalities.

A1.LFE.15:   Write linear equations that model the relationship between two quantities and produce a graph of the equation.

A1.LFE.16:   Graph linear functions expressed as an equation and show intercepts of the graph without technology.

A1.LFE.17:   Graph absolute value functions expressed as an equation with and without technology, showing intercepts and end behavior.

A1.LFE.18:   Graph and generalize the effect of transformations on linear and absolute value functions.
- Transformations include: stretches, compressions, vertical, and horizontal

A1.LFE.19:   Given the graph of a linear function, explain the effects of the transformation from the parent function, $y = x$.

Statistical Relationships
Students explore linear statistical relationships.

A1.LFE.20:   Write linear functions that provide a reasonable fit to data and use them to make predictions, with and

without technology; interpret the slope and y-intercept in context.

A1.LFE.21:   Calculate, using technology, the correlation coefficient between two quantitative variables and interpret this quantity as a measure of the strength of the linear association.

A1.LFE.22:   Compare and contrast correlation and causation in real-world problems.

Quadratic Functions & Equations

Create & Solve
Students create and solve equations that model quadratic relationships.

A1.QFE.1:   Represent and solve real-world problems using quadratic expressions and equations in one variable.

A1.QFE.2:   Write quadratic equations with real number solutions that model the relationship between two quantities and produce a graph of the equation.

A1.QFE.3:   Solve quadratic equations with real number solutions, containing one variable, including those with variables on both sides of the equal sign. Equations should be solved by:
- Graphing,
- Factoring (including perfect square trinomials and difference of squares binomials),
- Using the quadratic formula,
- Completing the square, or
- Taking the square root.

Interpret Key Features
Students interpret key features of equations that model quadratic relationships.

A1.QFE.4:   Determine the domain and range of quadratic functions in mathematical problems.

A1.QFE.5:   Determine reasonable domain and range values of quadratic functions representing real-world situations, both continuous and discrete; interpret the solution as reasonable or unreasonable in context.

A1.QFE.6:   Interpret the key features of a quadratic function that models a relationship between two quantities in a given context.

A1.QFE.7:   Flexibly use different representations of a quadratic function, including graphs, tables, and equations.

A1.QFE.8:   Explain how each form of a quadratic expression (standard, factored, and vertex form) identifies different key attributes, using the different forms to interpret quantities in context.

A1.QFE.9:   Use factoring and completing the square to create equivalent forms of quadratic functions to reveal key attributes.

Graphing & Transformations
Students graph quadratic functions and explore different transformations of $f(x) = x^2$.

A1.QFE.10:   Graph quadratic functions given as an equation or in function notation, labeling key attributes, without technology.

A1.QFE.11:   Graph and describe the effect of transformations on quadratic functions.
- Transformations include: stretches, compressions, vertical, and horizontal

A1.QFE.12:   Given the graph of a quadratic function, explain the effects of the transformation from the parent function, $y = x^2$.

Statistical Relationships

Students explore quadratic statistical relationships.

A1.QFE.13: Write quadratic functions that provide a reasonable fit to data and use them to make predictions with technology.

Exponential Functions & Equations

Create & Solve

Students create and solve problems that model exponential relationships.

A1.EFE.1: Represent and solve real-world problems, using exponential equations in one variable.
A1.EFE.2: Represent real-world problems (growth, decay, and compound interest), using exponential equations.
A1.EFE.3: Construct exponential equations from geometric sequences with and without context.

Interpret Key Features

Students interpret key features of equations that model exponential relationships.

A1.EFE.4: Determine the domain and range of exponential functions in mathematical problems.
A1.EFE.5: Determine reasonable domain and range values of exponential functions representing real-world situations, both continuous and discrete; interpret the solution as reasonable or unreasonable in context.
A1.EFE.6: Interpret the key features of an exponential function that models a relationship between two quantities in a given context.
A1.EFE.7: Flexibly use different representations of an exponential function, including graphs, tables, and equations.
A1.EFE.8: Interpret the quantities in an exponential equation in the context of a real-world problem, including growth, decay, and compound interest.

Graphing

Students graph exponential functions.

A1.EFE.9: Graph exponential functions that model real-world problems (growth, decay, and compound interest), showing key attributes.

Statistical Relationships

Students explore exponential statistical relationships.

A1.EFE.10: Write exponential functions that provide a reasonable fit to data and use them to make predictions with technology.

Statistics & Probability

Numerical Data

Students summarize and describe distributions.

A1.SP.1:   Use box plots and histograms to determine the statistics appropriate to the shape of the data distribution; compare the center and spread of two or more data sets.

A1.SP.2:   Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points.

Bivariate Data

Students will investigate patterns of association in bivariate data.

A1.SP.3:   Summarize data from two categorical variables in a frequency table; interpret relative frequencies in the context of the data, recognizing data trends and associations.

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GEOMETRY MATH STANDARDS

Right Triangles

Special Right Triangles & Pythagorean Theorem

Students explore right triangles and apply the Pythagorean Theorem.

G.RT.1: Apply the properties of special right triangles (30°-60°-90° and 45°-45°-90°) to solve real-world and mathematical problems.

G.RT.2: Prove and apply the Pythagorean Theorem and its converse.

Trigonometry Ratios

Students apply trigonometric ratios to solve problems.

G.RT.3: Explain how the definitions for trigonometric ratios are developed by similarity and how the side ratios in right triangles are properties of the angles in the triangle.

G.RT.4: Explain the relationship between the sine and cosine of complementary angles and use them to solve problems.

G.RT.5: Determine the sine, cosine, and tangent ratios of acute angles given the side lengths of right triangles.

G.RT.6: Use trigonometric ratios (sine, cosine, and tangent) to calculate missing side lengths and angle measures in a right triangle, including applications of angles of elevation and depression; include real-world and mathematical problems.

Circles

Circle Relationships

Students explore and use circle relationships to solve problems.

G.CIR.1: Apply the precise definition and standard geometric notation for a circle to understand geometric relationships.

G.CIR.2: Recognize and apply relationships between angles, radii, and chords, tangents, and secants including:
- The relationship between central, inscribed, and circumscribed angles,
- Inscribed angles on a diameter are right angles,
- The radius of a circle is perpendicular to the tangent where the radius intersects the circle, and
- The relationship of angles and segments formed by chords, secants and/or tangents to a circle.

G.CIR.3: Use the proportional relationship between the measure of an arc length of a circle and the circumference of the circle to solve problems.

G.CIR.4: Use the proportional relationship between the measure of the area of a sector of a circle and the area of the circle to solve problems.

G.CIR.5: Explain why the formulas for the area and circumference of a circle work using dissection and informal limit arguments.

Equation of a Circle

Students solve problems involving the equation of a circle.

G.CIR.6:   Write the equation of a circle, given the radius and center, where the center is at the origin or another point.

G.CIR.7:   Identify the center and radius of a circle, given the equation of a circle, where the center is at the origin or another point.

G.CIR.8:   Apply the equation of a circle to solve real-world problems.

Geometric Figures

Three-Dimensional

Students explore and solve problems involving three-dimensional figures.

G.GF.1:   Find the volume and surface area of complex three-dimensional figures composed of prisms, pyramids, cones, cylinders, and spheres.

G.GF.2:   Use three-dimensional geometric figures and their measures to model real-world objects and solve problems.

G.GF.3:   Explain why the formulas for the volume and surface area of a cylinder, pyramid, and cone work.

G.GF.4:   Apply the Pythagorean Theorem to determine missing measurements in a three-dimensional figure.

G.GF.5:   Identify the three-dimensional figure generated by rotating a two-dimensional figure.

Two-Dimensional

Students explore and solve problems involving two-dimensional figures.

G.GF.6:   Apply theorems about quadrilaterals, including those involving angles, diagonals, and sides to solve problems.

G.GF.7:   Prove that a given quadrilateral is a parallelogram, rhombus, rectangle, square, kite, or trapezoid, and apply these relationships to solve problems.

G.GF.8:   Prove and apply theorems about triangles including:
- Angle-Sum Theorem,
- Exterior Angle Theorem,
- Isosceles Triangle Theorem and its converse,
- Midsegment Theorem,
- Proportionality Theorem,
- Inequality Theorem and its converse, and
- Geometric Mean Theorem.

G.GF.9:   Calculate the perimeter of polygons when given the vertices, including using the distance formula.

G.GF.10:   Calculate the area of triangles and rectangles when given the vertices, including using the distance formula and decomposing figures.

G.GF.11:   Describe reflectional and rotational symmetry as they apply to a rectangle, parallelogram, trapezoid, or regular polygon.

Geometric Probability

Students determine probability in geometric contexts.

G.GF.12:   Calculate probabilities as a proportion of area in a geometric context.

Lines & Angles
Define & Construct
Students use precise definitions and various construction tools to create geometric figures.

G.LA.1: Use precise definitions and standard geometric notation for angles, perpendicular lines, parallel lines, and line segments based on the undefined notions of point, line, and distance along a line.

G.LA.2: Make formal geometric constructions with a variety of tools and methods including:
- Congruent segments and angles,
- Segment and angle bisectors,
- Perpendicular lines and perpendicular bisectors of a line segment,
- Parallel lines, and
- An equilateral triangle, a square, and a regular hexagon inscribed in a circle.

Coordinate Geometry
Students reason about geometric figures using the coordinate plane.

G.LA.3: Determine the point that cuts a line segment into a specified ratio on a number line and a coordinate plane, including finding the midpoint.

G.LA.4: Derive the distance and midpoint formulas and use the formulas, including the slope formula, to verify geometric relationships on a coordinate plane.

Parallel & Perpendicular Lines
Students solve problems involving parallel and perpendicular lines.

G.LA.5: Prove and apply slope criteria of parallel and perpendicular lines to solve problems.

G.LA.6: Write an equation of a line that is parallel or perpendicular to a given line and passing through a given point.

G.LA.7: Prove and apply theorems about lines and angles including:
- Vertical angles,
- Angles formed by parallel lines cut by a transversal, and
- Points on a perpendicular bisector.

Transformations
Coordinate Plane
Students transform figures on the coordinate plane.

G.TRF.1: Describe rotations, reflections, and translations as functions that take points in the coordinate plane as inputs and give other points as outputs; write in prime notation.

G.TRF.2: Compare transformations that preserve distance and angle (rotations, reflections, and translations) to those that do not (dilations) to develop definitions for congruence and similarity.

Plane
Students transform figures and make geometric constructions.

G.TRF.3:   Apply understanding of angles, circles, perpendicular lines, parallel lines, and line segments to develop definitions for rotations, reflections, and translations.

G.TRF.4:   Use geometric constructions to represent rotations, reflections, translations, and dilations in the plane with a variety of tools and methods.

G.TRF.5:   Given two congruent figures, identify the sequence of transformations that maps one figure to another.

Similarities & Congruence

Similarity

Students use similarity criteria to solve problems.

G.SC.1:   Given two figures, apply the definition of similarity in terms of a dilation to identify similar figures, proportional sides, and corresponding congruent angles.

G.SC.2:   Develop and apply the criteria of similarity for triangles (AA~, SAS~, and SSS~) to solve problems and prove geometric relationships.

G.SC.3:   Use transformations to prove all circles are similar.

Triangle Congruence

Students apply congruence criteria to solve problems.

G.SC.4:   Explain, using rigid motion transformations, why two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.

G.SC.5:   Develop and apply the criteria for triangle congruence (ASA, SAS, AAS, SSS, and HL) to solve problems and prove geometric relationships.