

# Mathematics Essential Concepts K-6

Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
<p><b>Numbers and Operations</b> Count sets of objects of up to 30 using one-to-one correspondence and strategies to keep track of which objects have been counted and not yet counted. Represent numbers to 30 using concrete (objects), pictorial (pictures), and symbolic (written numerals) representations (written numerals). Recognize and write numerals to 30. Order sets of up to 10 objects. Identify ordinal numbers to 10. Compose and decompose numbers (Break apart and put back together sets. i.e., 5 is 3 and 2, 1 and 4, etc.) Identify which of two groups of objects has more, the same, or fewer objects. Estimate quantities using multiples of 10 as benchmarks. Recognize that 5 and 10 are important parts of numbers that help us recognize and count quantities. Demonstrate the joining and separating of sets up to 10 with objects and pictures.</p> <p><b>Algebra</b> Sort a group of objects in multiple ways and identify which attributes were used. Identify, describe, duplicate, extend repeating patterns with numbers and shapes. Describe simple growing patterns with shapes. Identify simple patterns in the environment.</p> <p><b>Geometry</b> Identify, name, describe, and draw circles, triangles, squares, and rectangles in various sizes and orientations. Combine shapes to create two-dimensional objects. Use words to describe position and distance. Investigate hexagons, trapezoids, spheres, cubes, cones, and other two- and three- dimensional shapes.</p> <p><b>Measurement</b> Identify clocks and calendars as tools that measure time and identify a day, week, and month on a calendar. Name the days of the week in order. Identify pennies, nickels, dimes, and quarters as units of money. Compare two objects by length and weight. Order several objects by length and weight.</p> <p><b>Data Analysis and Probability</b> Pose questions and gather data about self and surroundings. (i.e., surveys, class pictographs, question of the day, yes/no graphs) Organize data from sorting and classifying objects. (i.e. real graphs)</p>	<p><b>Numbers and Operation</b> Count, read and write whole numbers up to 100. Model and represent whole numbers using number lines, and number sentences. Model and represent whole numbers greater than 10 in groups of tens and ones, using objects, pictures and expanded notation. Compare and order sets of objects and numbers using greater than, less than, and equal to. Make reasonable estimates of the difference between two sets of objects. Identify one more, one less, 10 more, and 10 less than a given number. Identify missing numbers from a counting sequence. Represent part-whole relationships using the number line. Use a variety of models, including objects, length-based models, the number line and ten frames to describe part-whole, combine, separate, and comparing problems. Use the properties of addition and relationships between addition and subtraction to solve problems. Compute basic addition facts up to <math>10 + 10</math> and related subtraction facts. Find the sum of three one-digit numbers.</p> <p><b>Algebra</b> Sort and classify objects using more than one attribute. Use objects, pictures and symbolic notation to identify, create and label repeating and growing patterns. Use patterns to establish skip counting by twos, fives, and tens. Recognize that “=” indicates that the two sides of an equation are expressions of the same number. Write and solve number sentences from problem situations involving addition and subtraction using symbolic notation for the missing value. Create problem situations from given number sentences involving addition and subtraction.</p> <p><b>Geometry</b> Name, create and sort circle, triangle, rectangle, square, trapezoid, rhombus, parallelogram, and hexagon. Identify plane and solid figures (cube, sphere, cone) in students’ environment. Compose and decompose plane and solid figures using part-whole relationships, attributes, and similarities and differences.</p> <p><b>Measurement</b> Identify the appropriate tools for measuring length, weight, capacity, temperature, and time. Measure the length of an object using nonstandard units using groups of tens and ones. Identify the value of a penny, nickel, dime, quarter, and dollar. Determine the value of a set of coins that total 25 cents or less. Tell time to the hour and half-hour. Name the months of the year and the seasons in order. Use a calendar to determine the day of week and date.</p> <p><b>Data Analysis and Probability</b> Collect and represent data using tables, tally marks, pictographs, and bar graphs. Describe and interpret data.</p>	<p><b>Numbers and Operation</b> Represent whole numbers up to 1,000 in groups of hundreds, tens, and one using base ten models. Write the numeral representing a set in standard and expanded form. Identify the place and value of a given digit in a three-digit numeral. Represent the composition and decomposition of numbers in a variety of ways. Compare and order numbers using the terms and symbols for greater than, less than, or equal to. Identify and describe even and odd whole numbers. Divide geometric shapes into two, three or four equal parts. Divide sets of objects into two, three, or four parts of equal number of objects. Identify parts and sets as halves, thirds, or fourths. Represent the unit fractions <math>\frac{1}{2}</math>, <math>\frac{1}{3}</math>, and <math>\frac{1}{4}</math> with objects, pictures, words, and symbols. Demonstrate quick recall of addition and subtraction facts up to <math>10+10</math>. Model addition and subtraction of two- and three-digit whole numbers in a variety of ways. Write a story problem that relates to a given addition or subtraction equation. Write a number sentence to solve a story problem that is related to the environment. Demonstrate fluency with two- and three-digit addition and subtraction problems using a variety of strategies. Use the properties of addition to model and solve problems. Represent multiplication with equal groups using concrete objects and skip counting by twos, fives, and tens. Represent division as fair shares using concrete objects or pictures.</p> <p><b>Algebra</b> Determine the next term in linear patterns. Construct models and skip count by twos, threes, fives, tens, and relate to repeated addition. Recognize that “<math>\neq</math>” indicates a relationship in which the two sides of the inequality are expressions of different numbers. Recognize that symbols such as X, A, or <math>\Delta</math> in an addition or subtraction equation represent a number that will make the statement true. Use the commutative and associative properties of addition to simplify calculations.</p> <p><b>Geometry</b> Describe and classify plane and solid figures according to the number of sides and angles, or faces, edges, and vertices. Compose and decompose shapes and figures and describe the part-whole relationships, similarities and differences.</p> <p><b>Measurement</b> Identify and use measurement units to measure, to the nearest unit, length, weight in pounds, and capacity in cups. Estimate and measure length by repeating a nonstandard or standard unit of measure. Use different units to measure the length of the same object and recognize that the smaller the unit, the more units needed to cover a given length. Determine the value of a set of up to five coins that total \$1.00 or less. Tell time to the quarter-hour and sequence a series of daily events by time.</p> <p><b>Data Analysis and Probability</b> Collect and record data using a variety of strategies. Organize and represent data in more than one way. Organize, display, and label information, including keys, using pictographs, tallies, bar graphs, and organized tables. Describe data represented on charts and graphs and answer simple questions related to the data.</p>	<p><b>Number and Operations</b> Model, read and write whole numbers to 10,000 in a variety of ways including standard and expanded form. Identify the place and the value of a given digit in a four-digit numeral and round numbers to the nearest ten, hundred and thousand. Order and compare whole numbers on a number line and use the symbols when comparing whole numbers. Identify factors and multiples of whole numbers. Identify the denominator and numerator of a fraction. Name and write a fraction to represent a portion of a unit whole for halves, thirds, fourths, sixths and eighths. Compare and order fractions on a number line. Find equivalent fractions. Model problems involving addition, subtraction, multiplication and division. Use a variety of strategies and tools, such as repeated addition or subtraction, equal jumps on the number line and counters to model multiplication and division. Demonstrate, using objects, that multiplication and division by the same number are inverse operations. Write a story problem that relates to a given addition, subtraction or multiplication equation and write a number sentence to solve the problem. Compute and solve problems involving addition and subtraction of 3-and 4-digit numbers and basic facts of multiplication and division. Use a variety of methods to facilitate computation. Find the sum or difference of numbers including monetary amounts. Compute basic multiplication facts (0-10) and related division facts using a variety of strategies based on properties of addition and multiplication.</p> <p><b>Algebra</b> Create, represent and analyze growing patterns. Represent numerical relationships as expressions, equations and inequalities. Solve equations involving equivalent expressions. Use symbols to compare two expressions involving addition and subtraction. Recognize and use the commutative, associative, distributive and identity properties of addition and multiplication and the zero property of multiplication.</p> <p><b>Geometry</b> Describe and compare attributes of two-dimensional shapes. Identify, describe and classify polygons. Identify attributes for classifying triangles, and quadrilaterals. Identify right angles in geometric figures, or in appropriate objects. Determine whether other angles are greater or less than a right angle. Demonstrate the meaning of congruence through applying transformations.</p> <p><b>Measurement</b> Describe the part-whole relationships between metric and customary units of length, capacity, and weight. Measure the length of objects to the nearest centimeter, meter, half-and quarter-inch, foot, and yard. Measure capacity using cups and quarts, and measure weight using pounds and ounces. Identify the number of minutes in an hour, number of hours in a day, the number of days and weeks in a year. Describe and solve perimeter as a measurable attribute of two-dimensional figures, with metric and customary units. Determine simple equivalences of measurements. Compare given objects according to measurable attributes. Determine elapsed time in hours.</p> <p><b>Data Analysis and Probability</b> Collect, organize and display data to make predictions. Identify basic concepts of probability to describe the likelihood of a specific outcome.</p>	<p><b>Number and Operations</b> Read and write whole numbers to one million and decimals to hundredths in standard and expanded form. Identify the place and the value of a given digit in a six-digit numeral, including decimals to hundredths. Round to the nearest tenth. Name and write a fraction to represent a portion of a unit whole, length, or set for halves, thirds, fourths, fifths, sixths, eighths, and tenths. Identify and represent square numbers. Order and compare numbers up to six digits, simple fractions, and decimals, and use the symbols <math>&lt;</math>, <math>&gt;</math>, <math>=</math>. Identify equivalences between fractions and decimals. Generate equivalent fractions and simplify fractions. Model the meanings of multiplication and division of whole numbers and addition and subtraction of fractions. Use rectangular arrays to interpret factoring. Demonstrate the mathematical relationship between multiplication and division, and use that relationship to explain that division by 0 is not possible. Use estimation, mental math, paper and pencil, and calculators to perform mathematical calculations. Write a story problem that relates to a given equation, and write a number sentence to solve a problem. Solve problems involving simple fractions and interpret the meaning of the solution. Recall basic multiplication and division facts. Multiply up to a three-digit factor by a 2-digit factor. Divide up to a three-digit dividend by a one-digit divisor. Add and subtract decimals and simple fractions where one-single denominator is 1, 2, or 3 times the other.</p> <p><b>Algebra</b> Analyze growing patterns using objects, pictures, numbers and tables to determine a rule for the pattern. Identify simple relationships in real-life contexts and use mathematical operations to describe the pattern. Use the order of operations to evaluate, simplify, and compare mathematical expressions. Express single-operation problem situations as equations and solve the equation. Recognize that a symbol represents the same number throughout an equation or expression. Describe and use the commutative, associative, distributive, and identity properties of addition and multiplication, and the zero property of multiplication.</p> <p><b>Geometry</b> Identify and describe attributes of two-dimensional geometric shapes. Name and describe lines that are parallel, perpendicular, and intersecting. Identify and describe right, acute, obtuse, and straight angles. Identify and describe figures that have line symmetry and rotational symmetry. Specify location of coordinates or regions using grids and maps. Identify and apply transformations using translations, rotations, or reflections of a geometric shape. Recognize that <math>90^\circ</math>, <math>180^\circ</math>, <math>270^\circ</math>, and <math>360^\circ</math> are associated with <math>\frac{1}{4}</math>, <math>\frac{1}{2}</math>, <math>\frac{3}{4}</math>, and full turns.</p> <p><b>Measurement</b> Describe the relative size among metric units of length, capacity, and weight, and customary units of capacity. Estimate and measure capacity using milliliters, liters, cups, pints, quarts, and gallons and measure weight using grams and kilograms. Recognize that angles are measured in degrees and develop benchmark angles (e.g. <math>45^\circ</math>, <math>60^\circ</math>, <math>120^\circ</math>) using <math>90^\circ</math> angles to estimate angle measurement. Measure angles using a protractor or angle ruler. Describe area as a measurable attribute of two-dimensional shapes and calculate area measurements. Develop and use the area formula for a rectangle, right triangle, and parallelogram. Determine possible perimeters for a rectangle with a fixed area, and determine possible areas when given a rectangle with a fixed perimeter.</p> <p><b>Data Analysis and Probability</b> Collect, organize and display data to answer questions using tables, bar graphs, line plots, and stem and leaf plots. Identify and distinguish between clusters and outliers of a data set. Describe and predict simple random outcomes of experiments using simple ratios (e.g. 4 out of 9, 4/9). Use the results of simple probability experiments, with and without replacement, to describe the likelihood of an outcome.</p>	<p><b>Number and Operations</b> Use a variety of estimation strategies and mental math techniques. Use technology when appropriate. Model, read, and write numerals from thousandths through one billion and show multiple ways of representing them. Understand prime and composite numbers, exponents, multiples, factors, prime factorization. Identify and generate equivalent fractions, decimals, and percents. Order and compare integers, fractions, mixed numerals, and decimals using a variety of methods and symbols. Use the rules of divisibility. Write a number sentence to solve a two-step equation. Use a variety of strategies to multiply multi-digit whole numbers by two-digit whole numbers and divide multi-digit dividends by a one-digit divisor. Interpret remainders and express them as whole numbers, fractions, and decimals. Add and subtract decimals. Add, subtract, and multiply fractions and express answers in simplest form.</p> <p><b>Algebra</b> Analyze, extend, and determine a rule for patterns with whole numbers, fractions, and decimals using a variety of tools and describe the rule used. Use the order of operations and properties to compute with whole numbers, decimals, and fractions. Write and solve one step equations involving whole numbers with a single variable.</p> <p><b>Geometry</b> Draw, label, and describe line segments, lines, perpendicular and parallel lines, rays, angles, and vertices. Classify triangles and quadrilaterals. Identify nets for, properties and attributes of solids (pyramids, right prisms, cylinders, and cones) by faces, edges, vertices, and types of faces. Identify, write, and graph the ordered pair for a point in all four quadrants.</p> <p><b>Measurement</b> Determine the area of regular and irregular polygons by composing and decomposing them into rectangles, triangles, and parallelograms. Derive and use the formula to determine the surface area of a right prism. Derive and use the formula to determine the volume of a right (not oblique) prism with a triangular or rectangular base.</p> <p><b>Data Analysis and Probability</b> Construct, analyze, and display data using appropriate formats. Identify the minimum, maximum, range, mode, median, and mean for sets of data. Perform and describe the results of simple experiments in probability; predict and express the outcomes in a variety of notations (4/9 or 4 out of 9).</p>	<p><b>Number and Operation</b> Recognize rational numbers as a ratio of two integers; compare and order rational numbers on a number line. Write whole numbers with exponents in standard form and write whole numbers in expanded form using exponents. Recognize that any non-zero number to the zero power equals 1. Express whole numbers in scientific notation using positive powers of ten. Find equivalent forms for common fractions, decimals, percents, fractions, and ratios, including repeating or terminating decimals. Relate percents less than 1% or greater than 100% to equivalent fractions, decimal numbers, and mixed numbers. Add and subtract integers; recognize that the sum of an integer its additive inverse is 0. Determine whether whole numbers to 100 are prime, composite, or neither. Find prime factorizations, least common multiples, and greatest common factors. Add, subtract, multiply and divide fractions and mixed numbers. Multiply and divide a multi-digit number by a two-digit number, including decimals. Give mixed number and decimal solutions to division problems with whole numbers. Solve problems involving ratios and proportions.</p> <p><b>Algebra</b> Analyze algebraic expressions, tables, and graphs to determine patterns, relations, and rules. Solve single variable linear equations. Recognize and write expressions in different equivalent forms. Use substitution to evaluate and simplify expressions and formulas.</p> <p><b>Geometry</b> Identify the midpoint of a line segment and the center and circumference of a circle. Identify angles as vertical, adjacent, complementary, or supplementary. Use properties of complementary and supplementary angles to find an unknown angle in a triangle or quadrilateral. Rotate a polygon about the origin by a multiple of <math>90^\circ</math> and identify location of new vertices. Translate and/or reflect a polygon on a coordinate grid.</p> <p><b>Measurement</b> Describe and find the circumference and area of a circle using a formula. Identify and describe measurable attributes of objects and units of measurement, and solve problems involving measurement. Convert units of measurement with the metric system, and within the customary system. Derive and use the formula to determine the surface area and volume of a cylinder.</p> <p><b>Data Analysis and Probability</b> Design investigations to answer questions. Extend displays of data to scatter plots and circle graphs. Compare similar sets of data on the same graph; compare two graphs representing the same data. Recognize that scale influences the appearance of a display of data. Apply basic concepts of probability, comparing theoretical, experimental, and large group results. Write results as a fraction between zero and one, or as an equivalent percent.</p>