

Building the Language of Mathematics for Students

Mathematics can be thought of as a language that must be meaningful if students are to communicate mathematically and apply mathematics productively. Communication plays an important role in helping children construct links between their formal, intuitive notions and the abstract language and symbolism of mathematics; it also plays a key role in helping children make important connections among physical, pictorial, graphic, symbolic, verbal, and mental representations of mathematical ideas.

Curriculum and Evaluation Standards for School Mathematics, the National Council of Teachers of Mathematics (p. 26)

Mathematical vocabulary however should not be taught in isolation where it is meaningless and just becomes memorization. We know from research that meaningless memorization is not retained nor will it help build the deep understanding of the mathematical content. The students must be provided adequate opportunities to develop vocabulary in meaningful ways such as mathematical explorations and experiences. Students should be immersed into the mathematical language as they experience rich high-level tasks. As students communicate their thoughts, ideas, and justify the reasonableness of their solutions the mathematical language will begin to evolve. Students will then build the depth of understanding needed with mathematical vocabulary and content to empower them to be successful in mathematics.

Kindergarten

Counting and Cardinality	Operations and Algebraic Thinking	Number and Operations in Base Ten	Measurement and Data	Geometry
<p>Know number names and the count sequence. number</p> <p>Count to tell the number of objects. How many?</p> <p>Compare numbers. greater than less than equal to compare</p>	<p>Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from. putting together adding to taking apart taking from</p>	<p>Work with numbers 11–19 to gain foundations for place value. tens ones</p>	<p>Describe and compare measurable attributes. putting together adding to compose taking apart taking from ones tens</p> <p>Classify objects and count the number of objects in categories. compare length weight height taller, shorter, longer heavier, lighter big, small</p>	<p>Identify and describe shapes. Above Below Beside in front of behind, next to flat solid</p> <p>Analyze, compare, create, and compose shapes. sides corners equal alike different</p>

First Grade

Operations and Algebraic Thinking	Number and Operations in Base Ten	Measurement and Data	Geometry
<p>Represent and solve problems involving addition and subtraction. add, putting together, adding to, counting on, making ten, subtract, taking apart, taking from, compare, sum, unknown, equal, equation</p> <p>Understand and apply properties of operations and the relationship between addition and subtraction. addition, add, putting together, adding to, counting on, making ten, subtraction, subtract, taking apart, taking from</p> <p>Add and subtract within 20. add, putting together, adding to, counting on, making ten, subtract, taking apart, taking from, equivalent, sum, unknown, equal, equation</p> <p>Work with addition and subtraction equations. add, putting together, adding to, counting on, making ten, subtract, taking apart, taking from, sum, unknown, equal, equation</p>	<p>Extend the counting sequence. number</p> <p>Understand place value. ones, tens, compare, greater than, less than, equal to, $<$, $>$, $=$</p> <p>Use place value understanding and properties of operations to add and subtract. ones, tens, add, subtract, reason</p>	<p>Measure lengths indirectly and by iterating length units. measure, length, gap, overlap</p> <p>Tell and write time. time, hour, half-hour</p> <p>Represent and interpret data. how many more, how many less</p>	<p>Reason with shapes and their attributes. three-sided, color, 2-dimensional shapes, rectangle, square, trapezoid, triangle, half circle, quarter circle, 3-dimensional shapes, cube, rectangular prism, cone, cylinder, partition circles and rectangles; halves, fourths, quarters, half of, fourth of, quarter of, equal shares</p> <p>From previous grade: circle, hexagon, cube, cone, cylinder, sphere</p>

Second Grade

Operations and Algebraic Thinking	Number and Operations in Base Ten	Measurement and Data	Geometry
<p>Represent and solve problems involving addition and subtraction. addition, subtraction, adding to, taking from, putting together, taking apart, comparing, unknown</p> <p>Add and subtract within 20. add, subtract, sum</p> <p>Work with equal groups of objects to gain foundations for multiplication. odd, even, equation, addition/add, sum, addend, rectangular array, row, column, equation, equal</p>	<p>Understand place value. ones, tens, hundreds, equals, skip-count, greater than, less than, equal to, $<$, $>$, $=$, compare</p> <p>Use place value understanding and properties of operations to add and subtract. ones, tens, hundreds, addition/add, subtraction/subtract, compose, decompose, strategies, (properties)-rules about how numbers work</p>	<p>Measure and estimate lengths in standard units. measure, estimate, standard units, customary, metric, tools, ruler, yardstick, meter stick, measuring tape, units, inches, feet, centimeters, meters, sums, differences</p> <p>Relate addition and subtraction to length. addition, subtraction, length, unknown, sums, differences, measure, estimate, standard units, customary, metric, ruler, yardstick, meter stick, measuring tape, units, inches, feet, centimeters, meters, sums, differences</p> <p>Work with time and money. time, clock, hour, minute, half hour, quarter hour, five-minutes, a.m., p.m., dollar bill, \$ and ¢ symbol, quarter, dime, nickel, penny</p> <p>Represent and interpret data. measure, length, line plot, picture graph, bar graph</p>	<p>Reason with shapes and their attributes. number of angles, number equal faces, shapes, triangle, quadrilateral, pentagon, hexagon, cube, partition into rows and columns, partition circles and rectangles into two, three, and four equal shares, halves, thirds, fourths, a half of, a third of, a fourth of, two halves, three thirds, four fourths</p> <p>From previous grades: trapezoid, square, half/quarter circle, circle, cone, cylinder, sphere</p>

Third Grade

Operations and Algebraic Thinking	Number and Operations in Base Ten	Number and Operations-Fractions	Measurement and Data	Geometry
<p>Represent and solve problems involving multiplication and division. operations, multiplication, division, factor, product, quotient, partitioned equally, equal shares, number of groups, number in the groups, array, equation, unknown</p> <p>Understand properties of multiplication and the relationship between multiplication and division. operation, multiply, divide, factor, product, quotient, strategies, (properties)-rules about how numbers work</p> <p>Multiply and divide within 100. operation, multiply, divide, factor, product, quotient, unknown, strategies, reasonableness, mental computation, property</p> <p>Solve problems involving the four operations, and identify and explain patterns in arithmetic. operation, multiply, divide, factor, product, quotient, subtract, add, addend, sum, difference, equation, unknown, strategies, reasonableness, mental computation, estimation, rounding, patterns, (properties)-rules about how numbers work</p>	<p>Use place value understanding and properties of operations to perform multi-digit arithmetic. place value, round, addition, add, addend, sum, subtraction, subtract, difference, strategies, (properties)-rules about how numbers work</p>	<p>Develop understanding of fractions as numbers. partition(ed), equal parts, fraction, equal distance (intervals), equivalent, equivalence, reasonable, denominator, numerator, comparison, compare, $<$, $>$, $=$, justify</p>	<p>Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects. estimate, time, time intervals, minute, hour, elapsed time, measure, liquid volume, mass, standard units, metric, gram (g), kilogram (kg), liter (L)</p> <p>Represent and interpret data. scale, scaled picture graph, scaled bar graph, line plot, data</p> <p>Geometric measurement: understand concepts of area and relate area to multiplication and to addition. attribute, area, square unit, plane figure, gap, overlap, square cm, square m , square in., square ft, nonstandard units, tiling, side length, decomposing</p> <p>Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures. attribute, perimeter, plane figure, linear, area, polygon, side length</p>	<p>Reason with shapes and their attributes. attributes, properties, quadrilateral, open figure, closed figure , three-sided, 2-dimensional, 3-dimensional, rhombi, rectangles, and squares are subcategories of quadrilaterals, cubes, cones, cylinders, and rectangular prisms are subcategories of 3-dimensional figures shapes: polygon, rhombus/rhombi, rectangle, square, partition, unit fraction</p> <p>From previous grades: triangle, quadrilateral, pentagon, hexagon, cube, trapezoid, half/quarter circle, circle, cone, cylinder, sphere</p>

Fourth Grade

Operations and Algebraic Thinking	Number and Operations in Base Ten	Number and Operations-Fractions	Measurement and Data	Geometry
<p>Use the four operations with whole numbers to solve problems. multiplication/multiply, division/divide, addition/add, subtraction/subtract, equations, unknown, remainders, reasonableness, mental computation, estimation, rounding</p> <p>Gain familiarity with factors and multiples. multiplication/multiply, division/divide, factor pairs, factor, multiple, prime, composite</p> <p>Generate and analyze patterns. pattern (number or shape), pattern rule</p>	<p>Generalize place value understanding for multi-digit whole numbers. place value, greater than, less than, equal to, $<$, $>$, $=$, comparisons/compare, round</p> <p>Use place Value understanding and properties of operations to perform multi-digit arithmetic. partition(ed), fraction, unit fraction, equivalent, multiple, reason, denominator, numerator, comparison/compare, $<$, $>$, $=$, benchmark fraction</p>	<p>Extend understanding of fraction equivalence and ordering. partition(ed), fraction, unit fraction, equivalent, multiple, reason, denominator, numerator, comparison/compare, $<$, $>$, $=$, benchmark fraction</p> <p>Build fractions from unit fractions by applying and extending previous understanding of operations on whole numbers. operations, addition/joining, subtraction/separating, fraction, unit fraction, equivalent, multiple, reason, denominator, numerator, decomposing, mixed number,(properties)-rules about how numbers work , multiply, multiple,</p> <p>Understand decimal notation for fractions, and compare decimal fractions. fraction, numerator, denominator, equivalent, reasoning, decimals, tenths, hundreds, multiplication, comparisons/compare, $<$, $>$, $=$,</p>	<p>Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit. measure, metric, customary, convert/conversion, relative size, liquid volume, mass, length, distance, kilometer (km), meter (m), centimeter (cm), kilogram (kg), gram (g), liter (L), milliliter (mL), inch (in), foot (ft), yard (yd), mile (mi), ounce (oz), pound (lb), cup (c), pint (pt), quart (qt), gallon (gal), time, hour, minute, second, equivalent, operations, add, subtract, multiply, divide, fractions, decimals, area, perimeter</p> <p>Represent and interpret data. Data, line plot, length, fractions,</p> <p>Geometric measurement: understand concepts of angle and measure angles. measure, point, end point, geometric shapes, ray, angle, circle, fraction, intersect, one-degree angle, protractor, decomposed, addition, subtraction, unknown</p>	<p>Draw and identify lines and angles, and classify shapes by properties of their lines and angles. classify shapes/figures, (properties)-rules about how numbers work, point, line, line segment, ray, angle, vertex/vertices, right angle, acute, obtuse, perpendicular, parallel, right triangle, isosceles triangle, equilateral triangle, scalene triangle, line of symmetry, symmetric figures, two dimensional</p> <p>From previous grades: polygon, rhombus/rhombi, rectangle, square, triangle, quadrilateral, pentagon, hexagon, cube, trapezoid, half/quarter circle, circle, cone, cylinder, sphere</p>

Fifth Grade

Operations and Algebraic Thinking	Number and Operations in Base Ten	Number and Operations- Fractions	Measurement and Data	Geometry
<p>Write and interpret numerical expressions. parentheses, brackets, braces, numerical expressions</p> <p>Analyze patterns and relationships. numerical patterns, rules, ordered pairs, coordinate plane</p>	<p>Understand the place value system. place value, decimal, decimal point, patterns, multiply, divide, tenths, thousands, greater than, less than, equal to, $<$, $>$, $=$, compare/comparison, round</p> <p>Perform operations with multi-digit whole numbers and with decimals to hundredths. multiplication/multiply, division/division, decimal, decimal point, tenths, hundredths, products, quotients, dividends, rectangular arrays, area models, addition/add, subtraction/subtract, (properties)-rules about how numbers work, reasoning</p>	<p>Use equivalent fractions as a strategy to add and subtract fractions. fraction, equivalent, addition/ add, sum, subtraction/subtract, difference, unlike denominator, numerator, benchmark fraction, estimate, reasonableness, mixed numbers</p> <p>Apply and extend previous understanding of multiplication and division to multiply and divide fractions. fraction, numerator, denominator, operations, multiplication/multiply, division/divide, mixed numbers, product, quotient, partition, equal parts, equivalent, factor, unit fraction, area, side lengths, fractional sides lengths, scaling, comparing</p>	<p>Convert like measurement units within a given measurement system. conversion/convert, metric and customary measurement From previous grades: relative size, liquid volume, mass, length, kilometer (km), meter (m), centimeter (cm), kilogram (kg), gram (g), liter (L), milliliter (mL), inch (in), foot (ft), yard (yd), mile (mi), ounce (oz), pound (lb), cup (c), pint (pt), quart (qt), gallon (gal), hour, minute, second</p> <p>Present and interpret data. line plot, length, mass, liquid volume</p> <p>Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition. measurement, attribute, volume, solid figure, right rectangular prism, unit, unit cube, gap, overlap, cubic units (cubic cm, cubic in. cubic ft. nonstandard cubic units), multiplication, addition, edge lengths, height, area of base From previous grades: dimensions, composite</p>	<p>Graph points on the coordinate plane to solve real-world and mathematical problems. coordinate system, coordinate plane, first quadrant, points, lines, axis/axes, x-axis, y-axis, horizontal, vertical, intersection of lines, origin, ordered pairs, coordinates, x-coordinate, y-coordinate</p> <p>Classify two-dimensional figures into categories based on their properties. attribute, category, subcategory, hierarchy, (properties)-rules about how numbers work, two dimensional From previous grades: polygon, rhombus/rhombi, rectangle, square, triangle, quadrilateral, pentagon, hexagon, cube, trapezoid, half/quarter circle, circle</p>