# Building the Language of Mathematics for Students

Mathematically proficient students communicate precisely by engaging in discussions about their reasoning using appropriate mathematical language.  The terms students should learn to use at each grade level with increasing precision are included in this document.

Mathematics can be thought of as a language that must be meaningful if students are to communicate mathematically and apply mathematic 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 student communicate their thoughts, ideas, and justify the reasonableness of their solutions the mathematical language will begin to evolve. Student will then build the depth of understanding needed with mathematical vocabulary and content to empower them to be successful in mathematics.

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# Kindergarten

| Counting and Cardinality | Operations and Algebraic Thinking | Number and Operations in Base Ten | Measurement and Data | Geometry |
|---|---|---|---|---|
| **Know number names and the count sequence.** Introduce written number words zero, one, two…ten (students are not responsible for being able to read these words, but they should be introduced)<br><br>Know digits and orally count to one hundred<br><br>**Count to tell the number of objects.** number, zero, one, two…thirteen, fourteen…nineteen How many? count on **Compare numbers.** greater than, more, less than, fewer equal to, same amount as, compare | **Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.** join, putting together, add, adding to, separate, subtract, taking apart, taking from, and same amount as, equal, less than, more than, total, count on | **Work with numbers 11–19 to gain foundations for place value.** ones, number, leftovers<br><br>(Know digits and recognize number words when spoken orally to twenty) | **Describe and compare measurable attributes.** compare, attribute, length, weight, heavy(ier), light(er), long(er), big, small(er), more of, less of, tall(er), short(er) **Classify objects and count the number of objects in categories.** compare, sort, category, color words (blue, green, red, etc.), descriptive words (small, big, rough, smooth, bumpy, round, flat, etc.), more, less, same amount | **Identify and describe shapes.** Square, circles, triangle, rectangles, hexagon, cubes, cones, cylinder, sphere, flat, solid, side, corner, angle, edge, face, Above, below, beside, in front of , behind, next to, same, different, straight lines, curved (curvy) lines **Analyze, compare, create, and compose shapes.** compare, compose, attributes, sides, vertices/corners, vertex, two-and three-dimensional, same, different |

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# First Grade

| Operations and Algebraic Thinking | Number and Operations in Base Ten | Measurement and Data | Geometry |
|---|---|---|---|
| **Represent and solve problems involving addition and subtraction.** add, adding to, taking from, putting together, comparing, unknown, sum, less than, equal to, minus, subtract, the same amount as, counting on, making ten, doubles, equation **Understand and apply properties of operations and the relationship between addition and subtraction.** add, subtract, unknown addend, order, first, second, **Add and subtract within 20.** addition, putting together, adding to, counting on, making ten, subtraction, taking apart, taking from, equivalent, sum, unknown, equal, equation, counting all, counting on, counting back **Work with addition and subtraction equations.** equation, equal, the same amount/quantity as, true, false, addition, putting together, adding to, counting on, making ten, subtract, taking apart, taking from, sum, unknown | **Extend the counting sequence.** number, zero, one, two…thirteen, fourteen…nineteen...one hundred twenty **Understand place value.** ones, tens, bundle, left-overs, singles, groups, compare, greater than, less than, equal to, ‹, ›, = **Use place value understanding and properties of operations to add and subtract.** ones, tens, add, subtract, reason, more, less | **Measure lengths indirectly and by iterating length units.** compare, measure, order, length, height, more, less, longer than, shorter, than, first, second, third, gap, overlap, about , a little less than, a little more than **Tell and write time.** time, hour, half-hour, about, o'clock, past, analog clock, digital clock **Represent and interpret data.** Data, how many more, how many less, least, same, different, category, question, collect | **Reason with shapes and their attributes.** shape, closed, open, side, attribute, feature, two-dimensional, rectangle, square, trapezoid, triangle, half-circle, and quarter-circle, three-dimensional, rectangular prism cube, cone, prism, cylinder, partition, equal shares, halves, fourths, quarters, half of, fourth of, quarter of From previous grades: circle, rectangle, hexagon, sphere From previous grade: circle, hexagon, cube, cone, cylinder, sphere |

# Second Grade

| Operations and Algebraic Thinking | Number and Operations in Base Ten | Measurement and Data | Geometry |
|---|---|---|---|
| **Represent and solve problems involving addition and subtraction.**<br>add, subtract, more, less, equal, equation, putting together, taking from, taking apart, addend, comparing, unknown<br>**Add and subtract within 20.**<br>add, subtract, sum, more, less, equal, equation, putting together, taking from, taking apart, addend<br>**Work with equal groups of objects to gain foundations for multiplication.**<br>odd, even, row, column, rectangular array, equal, addend, equation, sum | **Understand place value.**<br>hundreds, tens, ones, skip count, base-ten, *number names to 1,000* (e.g., one, two, thirty, etc.), expanded form, greater than (>), less than (<), equal to (=), digit, compare<br>**Use place value understanding and properties of operations to add and subtract.**<br>fluent, compose, decompose, place value, digit, ten more, ten less, one hundred more, one hundred less, add, subtract, sum, equal, addition, subtraction | **Measure and estimate lengths in standard units.**<br>about, a little less than, a little more than, longer, shorter, measure, standards units, units, customary, metric, inch, foot, centimeter, tools, ruler, meter, centimeter, ruler, yardstick, meter stick, measuring tape, estimate, sums, differences<br>**Relate addition and subtraction to length.**<br>inch, foot, yard, centimeter, meter, ruler, yardstick, meter stick, measuring tape, estimate, length, equation, number line, equally spaced, point, addition, subtraction, unknown, sums, differences, measure, standard units, customary, metric, units, sums, differences<br>**Work with time and money.**<br>time, hour hand, minute hand, hour, minute, a.m., p.m., o'clock, *multiples of 5* (e.g., five, ten, fifteen, etc.), analog clock, digital clock, quarter 'til, quarter after, half past, quarter hour, half hour, thirty minutes before, 30 minutes after, 30 minutes until, 30 minutes past, quarter, dime, nickel, dollar, cent(s), $, ¢, heads, tails<br>**Represent and interpret data.**<br>collect, organize, display, show, data, attribute, sort, line plot, picture graph, bar graph, question, category, chart, table, most, least, more than, less than, about, same, different, measure, inch, foot, yard, centimeter, meter, length | **Reason with shapes and their attributes.**<br>attribute, feature, angle, side, triangle, quadrilateral, square, rectangle, trapezoid, pentagon, hexagon, cube, face, edge, vertex, surface, figure, shape, closed, open, partition, equal size, equal shares, half, halves, thirds, half of, a third of, whole, two halves, three thirds, four fourths, rows, columns<br>From previous grades: circle, square, sphere, half-circle, quarter-circle, cone, prism, cylinder, trapezoid |

# Third Grade

| Operations and Algebraic Thinking | Number and Operations in Base Ten | Number and Operations-Fractions | Measurement and Data | Geometry |
|---|---|---|---|---|
| **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, expression **Understand properties of multiplication and the relationship between multiplication and division.** operation, multiply, divide, factor, product, quotient, dividend, divisor, strategies, unknown, (properties)-rules about how numbers work **Multiply and divide within 100.** operation, multiply, divide, factor, product, quotient, unknown, strategies, reasonableness, mental computation, property **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, expression, unknown, strategies, reasonableness, mental computation, estimation, rounding, patterns, (properties)-rules about how numbers work, input and output table | **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 | **Develop understanding of fractions as numbers.** partition(ed), equal parts, fraction, equal distance ( intervals), equivalent, equivalence, reasonable, denominator, numerator, comparison, compare, ‹, ›, = , justify, inequality | **Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.** estimate, time, time intervals, a.m, p.m, digital clock, analog clock, minute, hour, elapsed time, measure, liquid volume, mass, standard units, metric, gram (g), kilogram (kg), liter (L), milliliter (mL) **Represent and interpret data.** scale, scaled picture graph, scaled bar graph, line plot, data **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 **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 | **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, kite, parallelogram example and non-example From previous grades: triangle, quadrilateral, pentagon, hexagon, cube, trapezoid, half/quarter circle, circle, cone, cylinder, sphere, sides, vertices, corners |

# Fourth Grade

| Operations and Algebraic Thinking | Number and Operations in Base Ten | Number and Operations- Fractions | Measurement and Data | Geometry |
|---|---|---|---|---|
| **Use the four operations with whole numbers to solve problems.** multiplication/multiply, division/divide, dividend, divisor, addition/add, subtraction/subtract, equations, unknown, remainders, reasonableness, mental computation, estimation, rounding **Gain familiarity with factors and multiples.** multiplication/multiply, division/divide, factor pairs, factor, multiple, prime, composite **Generate and analyze patterns.** pattern (number or shape), pattern rule | **Generalize place value understanding for multi-digit whole numbers.** place value, greater than, less than, equal to, ‹, ›, =, comparisons/compare, round, inequality, expression **Use place Value understanding and properties of operations to perform multi-digit arithmetic.** add, addend, sum, subtract, difference, equation, strategies, (properties)-rules about how numbers work, rectangular arrays, area model, multiply, divide, factor, product, quotient, reasonableness | **Extend understanding of fraction equivalence and ordering.** partition(ed), fraction, unit fraction, equivalent, expression, multiple, reason, denominator, numerator, comparison/compare, ‹, ›, =, benchmark fraction **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 **Understand decimal notation for fractions, and compare decimal fractions.** fraction, numerator, denominator, equivalent, reasoning, decimals, tenths, hundreds, multiplication, comparisons/compare, ‹, ›, =, | **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, a.m., p.m., clockwise, counter clockwise, hour, minute, second, equivalent, operations, add, subtract, multiply, divide, fractions, decimals, area, perimeter **Represent and interpret data.** data, line plot, length, fractions, **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, obtuse, acute | **Draw and identify lines and angles, and classify shapes by properties of their lines and angles.** classify shapes/figures, properties (attributes, features)**,** defining characteristics and non- defining characteristic, 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, regular and irregular From previous grades: polygon, rhombus/rhombi, rectangle, square, triangle, quadrilateral, pentagon, hexagon, cube, trapezoid, half/quarter circle, circle, cone, cylinder, sphere |

# Fifth Grade

| Operations and Algebraic Thinking | Number and Operations in Base Ten | Number and Operations- Fractions | Measurement and Data | Geometry |
|---|---|---|---|---|
| **Write and interpret numerical expressions.** parentheses, brackets, braces, numerical expressions **Analyze patterns and relationships.** numerical patterns, rules, ordered pairs, coordinate plane | **Understand the place value system.** place value, decimal, decimal point, patterns, multiply, divide, tenths, thousands, greater than, less than, equal to, ‹, ›, =, compare/comparison, round **Perform operations with multi-digit whole numbers and with decimals to hundredths.** multiplication/multiply, division/division, decimal, decimal point, tenths, hundredths, products, quotients, dividends, divisor, rectangular arrays, area models, addition/add, subtraction/subtract, (properties)-rules about how numbers work, reasoning | **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 **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 | **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, a.m., p.m., clockwise, counter clockwise **Present and interpret data.** line plot, length, mass, liquid volume **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 | **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 **Classify two-dimensional figures into categories based on their properties.** attribute, category, subcategory, hierarchy, properties (attributes, features), defining characteristics and non-defining characteristic, , two dimensional From previous grades: polygon, rhombus/rhombi, rectangle, square, triangle, quadrilateral, pentagon, hexagon, cube, trapezoid, half/quarter circle, circle |

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