

TRINITY CATHOLIC ACADEMY

MATHEMATICS CURRICULUM

Trinity Catholic Academy Brockton follows the Massachusetts Mathematics Curriculum Frameworks.



Mission

Trinity Catholic Academy strives to instill the spirit and teachings of the Catholic faith while offering a challenging academic curriculum that is enriched with fine arts, technology and athletics while maintaining the highest standards of excellence for all students.

Grades Pre-K – K

Number Sense and Operations

- ***Students engage in problem solving, communicating, reasoning, connecting, and representing as they:*** Count by ones to at least 20.
- Match quantities up to at least 10 with numerals and words.
- Identify positions of objects in sequences (e.g., first, second) up to fifth.
- Compare sets of up to at least 10 concrete objects using appropriate language (e.g., none, more than, fewer than, same number of, one more than) and order numbers.
- Understand the concepts of whole and half.
- Identify U.S. coins by name.
- Use objects and drawings to model and solve related addition and subtraction problems to ten.

Patterns, Relations, and Algebra

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Identify the attributes of objects as a foundation for sorting and classifying, e.g., a red truck, a red block, and a red ball share the attribute of being red; a square block, a square cracker, and a square book share the attribute of being square shaped.
- Sort and classify objects by color, shape, size, number, and other properties.
- Identify, reproduce, describe, extend, and create color, rhythmic, shape, number, and letter repeating patterns with simple attributes, e.g., ABABAB....
- Count by fives and tens at least up to 50.

Geometry

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Name, describe, sort, and draw simple two-dimensional shapes.
- Describe attributes of two-dimensional shapes, e.g., number of sides, number of corners.
- Name and compare three-dimensional shapes.
- Identify positions of objects in space, and use appropriate language (e.g., beside, inside, next to, close to, above, below, apart) to describe and compare their relative positions.

Measurement

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Recognize and compare the attributes of length, volume/capacity, weight, area, and time using appropriate language, e.g., longer, taller, shorter, same length; heavier, lighter, same weight; holds more, holds less, holds the same amount.
- Make and use estimates of measurements from everyday experiences.
- Use nonstandard units to measure length, area, weight, and capacity.

Data Analysis, Statistics, and Probability

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Collect, sort, organize, and draw conclusions about data using concrete objects, pictures, numbers, and graphs.

Grades 1 & 2

Number Sense and Operations

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Name and write (in numerals) whole numbers to 1000, identify the place values of the digits, and order the numbers.
- Identify and distinguish among multiple uses of numbers, including cardinal (to tell how many) and ordinal (to tell which one in an ordered list), and numbers as labels and as measurements.
- Identify and represent common fractions ($\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$) as parts of wholes, parts of groups, and numbers on the number line.
- Compare whole numbers using terms and symbols, e.g., less than, equal to, greater than ($<$, $=$, $>$).
- Identify odd and even numbers and determine whether a set of objects has an odd or even number of elements.
- Identify the value of all U.S. coins, and \$1, \$5, \$10, and \$20 bills. Find the value of a collection of coins and dollar bills and different ways to represent an amount of money up to \$5. Use appropriate notation, e.g., 69¢, \$1.35.
- Demonstrate an understanding of various meanings of addition and subtraction, e.g., addition as combination (plus, combined with, more); subtraction as comparison (how much less, how much more), equalizing (how many more are needed to make these equal), and separation (how much remaining).
- Understand and use the inverse relationship between addition and subtraction (e.g., $8 + 6 = 14$ is equivalent to $14 - 6 = 8$ and is also equivalent to $14 - 8 = 6$) to solve problems and check solutions.
- Know addition facts (addends to ten) and related subtraction facts, and use them to solve problems.
- Demonstrate the ability to add and subtract three-digit numbers accurately and efficiently.
- Demonstrate in the classroom an understanding of and the ability to use the conventional algorithms for addition (two 3-digit numbers and three 2-digit numbers) and subtraction (two 3-digit numbers).
- Estimate, calculate, and solve problems involving addition and subtraction of two-digit numbers. Describe differences between estimates and actual calculations

Patterns, Relations, and Algebra

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Identify, reproduce, describe, extend, and create simple rhythmic, shape, size, number, color, and letter repeating patterns.
- Identify different patterns on the hundreds chart.
- Describe and create addition and subtraction number patterns, e.g., 1, 4, 7, 10...; or 25, 23, 21....
- Skip count by twos, fives, and tens up to at least 50, starting at any number.
- Construct and solve open sentences that have variables, e.g., $\square + 7 = 10$.
- Write number sentences using $+$, $-$, $<$, $=$, and/or $>$ to represent mathematical relationships in everyday situations.
- Describe functions related to trading, including coin trades and measurement trades, e.g., five pennies make one nickel or four cups make one quart.

Geometry

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Describe attributes and parts of two- and three-dimensional shapes, e.g., length of sides, and number of corners, edges, faces, and sides.
- Identify, describe, draw, and compare two-dimensional shapes, including both polygonal (up to six sides) and curved figures such as circles.
- Recognize congruent shapes.
- Identify shapes that have been rotated (turned), reflected (flipped), translated (slid), and enlarged. Describe direction of translations, e.g., left, right, up, down.
- Identify symmetry in two-dimensional shapes.
- Predict the results of putting shapes together and taking them apart.
- Relate geometric ideas to numbers, e.g., seeing rows in an array as a model of repeated addition.

Measurement

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Identify parts of the day (e.g., morning, afternoon, evening), days of the week, and months of the year. Identify dates using a calendar.
- Tell time at quarter-hour intervals on analog and digital clocks using a.m. and p.m.
- Compare the length, weight, area, and volume of two or more objects by using direct comparison.
- Measure and compare common objects using metric and English units of length measurement, e.g., centimeter, inch.
- Select and correctly use the appropriate measurement tools, e.g., ruler, balance scale, thermometer.
- Make and use estimates of measurement, including time, volume, weight, and area.

Data Analysis, Statistics, and Probability

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Use interviews, surveys, and observations to gather data about themselves and their surroundings.
- Organize, classify, represent, and interpret data using tallies, charts, tables, bar graphs, pictographs, and Venn diagrams; interpret the representations.
- Formulate inferences (draw conclusions) and make educated guesses (conjectures) about a situation based on information gained from data.

Grade 3

Number Sense and Operations

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Exhibit an understanding of the values of the digits in the base ten number system by reading, modeling, writing, comparing, and ordering whole numbers through 9,999.
- Represent, order, and compare numbers through 9,999. Represent numbers using expanded notation (e.g., $853 = 8 \times 100 + 5 \times 10 + 3$), and written out in words (e.g., eight hundred fifty-three).
- Identify and represent fractions (between 0 and 1 with denominators through 10) as parts of unit wholes and parts of groups. Model and represent a mixed number (with denominator 2, 3, or 4) as a whole number and a fraction, e.g., $1 \frac{2}{3}$, $3 \frac{1}{2}$.
- Locate on the number line and compare fractions (between 0 and 1 with denominators 2, 3, or 4, e.g., $\frac{2}{3}$).
- Recognize classes to which a number may belong (odd numbers, even numbers, and multiples of numbers through 10). Identify the numbers in those classes, e.g., the class of multiples of 7 between 1 and 29 consists of 7, 14, 21, 28.
- Select, use, and explain various meanings and models of multiplication (through 10×10). Relate multiplication problems to corresponding division problems, e.g., draw a model to represent 5×6 and $30 \div 6$.
- Use the commutative (order) and identity properties of addition and multiplication on whole numbers in computations and problem situations, e.g., $3 + 4 + 7 = 3 + 7 + 4 = 10 + 4$.
- Select and use appropriate operations (addition, subtraction, multiplication, and division) to solve problems, including those involving money.
- Know multiplication facts through 10×10 and related division facts, e.g., $9 \times 8 = 72$ and $72 \div 9 = 8$. Use these facts to solve related problems, e.g., 3×5 is related to 3×50 .
- Add and subtract (up to four-digit numbers) and multiply (up to two-digit numbers by a one-digit number) accurately and efficiently.
- Round whole numbers through 1,000 to the nearest 10, 100, and 1,000.
- Understand and use the strategies of rounding and regrouping to estimate quantities, measures, and the results of whole-number computations (addition, subtraction, and multiplication) up to two-digit whole numbers and amounts of money to \$100, and to judge the reasonableness of the answer.
- Use concrete objects and visual models to add and subtract (only when the answer is greater than or equal to zero) common fractions (halves, thirds, fourths, sixths, and eighths) with like denominators.

Patterns, Relations, and Algebra

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Create, describe, extend, and explain symbolic (geometric) patterns and addition and subtraction patterns, e.g., 2, 6, 10, ...; and 50, 45, 40....
- Determine which symbol ($<$, $>$, or $=$) is appropriate for a given number sentence, e.g., 7×8 .?. $49 + 6$.
- Determine the value of a variable (through 10) in simple equations involving addition, subtraction, or multiplication, e.g., $2 + \square = 9$; $5 \times [\text{insert upside down capital delta here}] = 35$.
- Write number sentences using $+$, $-$, \times , \div , $<$, $=$, and/or $>$ to represent mathematical relationships in everyday situations.

Geometry

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Compare and analyze attributes and other features (e.g., number of sides, corners, diagonals, and lines of symmetry) of two-dimensional geometric shapes.
- Describe, model, draw, compare, and classify two-dimensional shapes, e.g., circles, triangles, and quadrilaterals.
- Identify and describe simple three-dimensional shapes, e.g., cubes, spheres, and pyramids.
- Identify angles as right angles, less than a right angle, and greater than a right angle.
- Identify and draw parallel lines, perpendicular lines, and other intersecting lines.
- Using ordered pairs of whole numbers and/or letters, locate and identify points on a grid.
- Identify and draw lines of symmetry in two-dimensional shapes.
- Predict and explain the results of taking apart and combining two-dimensional shapes.

Measurement

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Demonstrate an understanding of the attributes length, area, and weight, and select the appropriate type of unit for measuring each attribute using both the U.S. Customary (English) and metric systems.
- Carry out simple unit conversions within a system of measurement, e.g., hours to minutes, cents to dollars, yards to feet or inches, etc.
- Identify time to the minute on analog and digital clocks using a.m. and p.m. Compute elapsed time, using a clock for times less than one hour (i.e., minutes since), and using a calendar (e.g., days since).
- Estimate and find area and perimeter of a rectangle, using diagrams and grids, or by measuring.
- Identify and use appropriate metric and U.S. Customary (English) units and tools (e.g., ruler, scale, thermometer, clock) to estimate, measure, and solve problems involving length, area, weight, temperature, and time.

Data Analysis, Statistics, and Probability

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Collect and organize data using observations, measurements, surveys, or experiments, and identify appropriate ways to display the data.
- Match representations of a data set in the forms of tables, line plots, pictographs, tallies, or bar graphs with the actual data set.
- Construct and draw conclusions from representations of data sets in the forms of tables, line plots, pictographs, tallies, and bar graphs.
- List and count the number of possible combinations of objects from two sets, e.g., how many different outfits can one make from a set of two sweaters and a set of three skirts?

Grade 4

Number Sense and Operations

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Exhibit an understanding of the base ten number system by reading, modeling, writing, and interpreting whole numbers to at least 100,000; demonstrating an understanding of the values of the digits; and comparing and ordering the numbers.
- Represent, order, and compare large numbers (to at least 100,000) using various forms, including expanded notation, e.g., $853 = 8 \times 100 + 5 \times 10 + 3$.
- Demonstrate an understanding of fractions as parts of unit wholes, as parts of a collection, and as locations on the number line.
- Select, use, and explain models to relate common fractions and mixed numbers ($\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{8}$, $\frac{1}{10}$, $\frac{1}{12}$, and $1\frac{1}{2}$), find equivalent fractions, mixed numbers, and decimals, and order fractions.
- Identify and generate equivalent forms of common decimals and fractions less than one whole (halves, quarters, fifths, and tenths).
- Exhibit an understanding of the base ten number system by reading, naming, and writing decimals between 0 and 1 up to the hundredths.
- Recognize classes (in particular, odds, evens; factors or multiples of a given number; and squares) to which a number may belong, and identify the numbers in those classes. Use these in the solution of problems.
- Select, use, and explain various meanings and models of multiplication and division of whole numbers. Understand and use the inverse relationship between the two operations.
- Select, use, and explain the commutative, associative, and identity properties of operations on whole numbers in problem situations, e.g., $37 \times 46 = 46 \times 37$, $(5 \times 7) \times 2 = 5 \times (7 \times 2)$.
- Select and use appropriate operations (addition, subtraction, multiplication, and division) to solve problems, including those involving money.
- Know multiplication facts through 12×12 and related division facts. Use these facts to solve related multiplication problems and compute related problems, e.g., 3×5 is related to 30×50 , 300×5 , and 30×500 .
- Add and subtract (up to five-digit numbers) and multiply (up to three digits by two digits) accurately and efficiently.
- Divide up to a three-digit whole number with a single-digit divisor (with or without remainders) accurately and efficiently. Interpret any remainders.
- Demonstrate in the classroom an understanding of and the ability to use the conventional algorithms for addition and subtraction (up to five-digit numbers), and multiplication (up to three digits by two digits).
- Demonstrate in the classroom an understanding of and the ability to use the conventional algorithm for division of up to a three-digit whole number with a single-digit divisor (with or without remainders).
- Round whole numbers through 100,000 to the nearest 10, 100, 1000, 10,000, and 100,000.
- Select and use a variety of strategies (e.g., front-end, rounding, and regrouping) to estimate quantities, measures, and the results of whole-number computations up to three-digit whole numbers and amounts of money to \$1000, and to judge the reasonableness of the answer.
- Use concrete objects and visual models to add and subtract common fractions.

Patterns, Relations, and Algebra

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Create, describe, extend, and explain symbolic (geometric) and numeric patterns, including multiplication patterns like 3, 30, 300, 3000, ...
- Use symbol and letter variables (e.g., Δ , x) to represent unknowns or quantities that vary in expressions and in equations or inequalities (mathematical sentences that use $=$, $<$, $>$).
- Determine values of variables in simple equations, e.g., $4106 - \nabla = 37$, $5 = \mu + 3$, and $\square - \mu = 3$.
- Use pictures, models, tables, charts, graphs, words, number sentences, and mathematical notations to interpret mathematical relationships.
- Solve problems involving proportional relationships, including unit pricing (e.g., four apples cost 80¢, so one apple costs 20¢) and map interpretation (e.g., one inch represents five miles, so two inches represent ten miles).
- Determine how change in one variable relates to a change in a second variable, e.g., input-output tables.

Geometry

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Compare and analyze attributes and other features (e.g., number of sides, faces, corners, right angles, diagonals, and symmetry) of two- and three-dimensional geometric shapes.
- Describe, model, draw, compare, and classify two- and three-dimensional shapes, e.g., circles, polygons—especially triangles and quadrilaterals—cubes, spheres, and pyramids.
- Recognize similar figures.
- Identify angles as acute, right, or obtuse.
- Describe and draw intersecting, parallel, and perpendicular lines.
- Using ordered pairs of numbers and/or letters, graph, locate, identify points, and describe paths (first quadrant).
- Describe and apply techniques such as reflections (flips), rotations (turns), and translations (slides) for determining if two shapes are congruent.
- Identify and describe line symmetry in two-dimensional shapes.
- Predict and validate the results of partitioning, folding, and combining two- and three-dimensional shapes.

Measurement

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Demonstrate an understanding of such attributes as length, area, weight, and volume, and select the appropriate type of unit for measuring each attribute.
- Carry out simple unit conversions within a system of measurement, e.g., hours to minutes, cents to dollars, yards to feet or inches, etc.
- Identify time to the minute on analog and digital clocks using a.m. and p.m. Compute elapsed time using a clock (e.g., hours and minutes since...) and using a calendar (e.g., days since...).
- Estimate and find area and perimeter of a rectangle, triangle, or irregular shape using diagrams, models, and grids or by measuring.
- Identify and use appropriate metric and English units and tools (e.g., ruler, angle ruler, graduated cylinder, thermometer) to estimate, measure, and solve problems involving length, area, volume, weight, time, angle size, and temperature.

Data Analysis, Statistics, and Probability

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Collect and organize data using observations, measurements, surveys, or experiments, and identify appropriate ways to display the data.
- Match a representation of a data set such as lists, tables, or graphs (including circle graphs) with the actual set of data.
- Construct, draw conclusions, and make predictions from various representations of data sets, including tables, bar graphs, pictographs, line graphs, line plots, and tallies.
- Represent the possible outcomes for a simple probability situation, e.g., the probability of drawing a red marble from a bag containing three red marbles and four green marbles.
- List and count the number of possible combinations of objects from three sets, e.g., how many different outfits can one make from a set of three shirts, a set of two skirts, and a set of two hats?
- Classify outcomes as certain, likely, unlikely, or impossible by designing and conducting experiments using concrete objects such as counters, number cubes, spinners, or coins.

Grade 5

Number Sense and Operations

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Demonstrate an understanding of (positive integer) powers of ten, e.g., 10^2 , 10^5 .
- Demonstrate an understanding of place value through millions and thousandths.
- Represent and compare large (millions) and small (thousandths) positive numbers in various forms, such as expanded notation without exponents, e.g., $9724 = 9 \times 1000 + 7 \times 100 + 2 \times 10 + 4$.
- Demonstrate an understanding of fractions as a ratio of whole numbers, as parts of unit wholes, as parts of a collection, and as locations on the number line.
- Identify and determine common equivalent fractions (with denominators 2, 4, 5, 10) and mixed numbers (with denominators 2, 4, 5, 10), decimals, and percents (through one hundred percent), e.g., $\frac{3}{4} = 0.75 = 75\%$.
- Find and position whole numbers, positive fractions, positive mixed numbers, and positive decimals on a number line.
- Compare and order whole numbers, positive fractions, positive mixed numbers, positive decimals, and percents.
- Apply the number theory concepts of common factor, common multiple, and divisibility rules for 2, 3, 5, and 10 to the solution of problems. Demonstrate an understanding of the concepts of prime and composite numbers.
- Solve problems involving multiplication and division of whole numbers, and multiplication of positive fractions with whole numbers.
- Demonstrate an understanding of how parentheses affect expressions involving addition, subtraction, and multiplication, and use that understanding to solve problems, e.g., $3 \times (4 + 2) = 3 \times 6$.
- Demonstrate an understanding of the inverse relationship of addition and subtraction, and use that understanding to simplify computation and solve problems.
- Accurately and efficiently add and subtract whole numbers and positive decimals. Multiply and divide (using double-digit divisors) whole numbers. Multiply positive decimals with whole numbers.
- Accurately and efficiently add and subtract positive fractions and mixed numbers with like denominators and with unlike denominators (2, 4, 5, 10 only); multiply positive fractions with whole numbers. Simplify fractions in cases when both the numerator and the denominator have 2, 3, 4, 5, or 10 as a common factor.
- Estimate sums and differences of whole numbers, positive fractions, and positive decimals. Estimate products of whole numbers and products of positive decimals with whole numbers. Use a variety of strategies and judge the reasonableness of the answer.

Patterns, Relations, and Algebra

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Analyze and determine the rules for extending symbolic, arithmetic, and geometric patterns and progressions, e.g., ABCC; 1, 5, 9, 13...; 3, 9, 27...
- Replace variables with given values and evaluate/simplify, e.g., $2(\bigcirc) + 3$ when $\bigcirc = 4$.
- Use the properties of equality to solve problems with whole numbers, e.g., if $\square + 7 = 13$, then $\square = 13 - 7$, therefore $\square = 6$; if $3 \times \square = 15$, then $\square = 15 \div 3$, therefore $\square = 5$.

- Represent real situations and mathematical relationships with concrete models, tables, graphs, and rules in words and with symbols, e.g., input-output tables.
- Solve problems involving proportional relationships using concrete models, tables, graphs, and paper-pencil methods.
- Interpret graphs that represent the relationship between two variables in everyday situations.

Geometry

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Identify, describe, and compare special types of triangles (isosceles, equilateral, right) and quadrilaterals (square, rectangle, parallelogram, rhombus, trapezoid), e.g., recognize that all equilateral triangles are isosceles, but not all isosceles triangles are equilateral.
- Identify, describe, and compare special types of three-dimensional shapes (cubes, prisms, spheres, pyramids) based on their properties, such as edges and faces.
- Identify relationships among points and lines, e.g., intersecting, parallel, perpendicular.
- Using ordered pairs of whole numbers (including zero), graph, locate, and identify points, and describe paths on the Cartesian coordinate plane.
- Describe and perform transformations on two-dimensional shapes, e.g., translations, rotations, and reflections.
- Identify and describe line symmetry in two-dimensional shapes, including shapes that have multiple lines of symmetry.
- Determine if two triangles or two quadrilaterals are congruent by measuring sides or a combination of sides and angles, as necessary; or by motions or series of motions, e.g., translations, rotations, and reflections.

Measurement

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Apply the concepts of perimeter and area to the solution of problems involving triangles and rectangles. Apply formulas where appropriate.
- Identify, measure, describe, classify, and draw various angles. Draw triangles given two sides and the angle between them, or given two angles and the side between them, e.g., draw a triangle with one right angle and two sides congruent.
- Solve problems involving simple unit conversions within a system of measurement.
- Find volumes and surface areas of rectangular prisms.
- Find the sum of the measures of the interior angles in triangles by measuring the angles, and without measuring the angles.

Data Analysis, Statistics, and Probability

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Given a set of data, find the median, mean, mode, maximum, minimum, and range, and apply to solutions of problems.
- Construct and interpret line plots, line graphs, and bar graphs. Interpret and label circle graphs.
- Predict the probability of outcomes of simple experiments (e.g., tossing a coin, rolling a number cube) and test the predictions.

Grade 6

Number Sense and Operations

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Demonstrate an understanding of positive integer exponents, in particular, when used in powers of ten, e.g., 10^2 , 10^5 .
- Demonstrate an understanding of place value to billions and thousandths.
- Represent and compare very large (billions) and very small (thousandths) positive numbers in various forms such as expanded notation without exponents, e.g., $9724 = 9 \times 1000 + 7 \times 100 + 2 \times 10 + 4$.
- Demonstrate an understanding of fractions as a ratio of whole numbers, as parts of unit wholes, as parts of a collection, and as locations on the number line.
- Identify and determine common equivalent fractions, mixed numbers, decimals, and percents.
- Find and position integers, fractions, mixed numbers, and decimals (both positive and negative) on the number line.
- Compare and order integers (including negative integers), and positive fractions, mixed numbers, decimals, and percents.
- Apply number theory concepts—including prime and composite numbers, prime factorization, greatest common factor, least common multiple, and divisibility rules for 2, 3, 4, 5, 6, 9, and 10—to the solution of problems.
- Select and use appropriate operations to solve problems involving addition, subtraction, multiplication, division, and positive integer exponents with whole numbers, and with positive fractions, mixed numbers, decimals, and percents.
- Use the number line to model addition and subtraction of integers, with the exception of subtracting negative integers.
- Apply the Order of Operations for expressions involving addition, subtraction, multiplication, and division with grouping symbols (+, −, ×, ÷).
- Demonstrate an understanding of the inverse relationship of addition and subtraction, and use that understanding to simplify computation and solve problems.
- Accurately and efficiently add, subtract, multiply, and divide (with double-digit divisors) whole numbers and positive decimals.
- Accurately and efficiently add, subtract, multiply, and divide positive fractions and mixed numbers. Simplify fractions.
- Add and subtract integers, with the exception of subtracting negative integers.
- Estimate results of computations with whole numbers, and with positive fractions, mixed numbers, decimals, and percents. Describe reasonableness of estimates.

Patterns, Relations, and Algebra

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Analyze and determine the rules for extending symbolic, arithmetic, and geometric patterns and progressions, e.g., ABBCCC; 1, 5, 9, 13 ...; 3, 9, 27,
- Replace variables with given values and evaluate/simplify, e.g., $2(\mu) + 3$ when $\mu = 4$.
- Use the properties of equality to solve problems, e.g., if $\square + 7 = 13$, then $\square = 13 - 7$, therefore $\square = 6$; if $3 \times \square = 15$, then $\frac{1}{3} \times 3 \times \square = \frac{1}{3} \times 15$, therefore $\square = 5$.

- Represent real situations and mathematical relationships with concrete models, tables, graphs, and rules in words and with symbols, e.g., input-output tables.
- Solve linear equations using concrete models, tables, graphs, and paper-pencil methods.
- Produce and interpret graphs that represent the relationship between two variables in everyday situations.
- Identify and describe relationships between two variables with a constant rate of change. Contrast these with relationships where the rate of change is not constant.

Geometry

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Identify polygons based on their properties, including types of interior angles, perpendicular or parallel sides, and congruence of sides, e.g., squares, rectangles, rhombuses, parallelograms, trapezoids, and isosceles, equilateral, and right triangles.
- Identify three-dimensional shapes (e.g., cubes, prisms, spheres, cones, and pyramids) based on their properties, such as edges and faces.
- Identify relationships among points, lines, and planes, e.g., intersecting, parallel, perpendicular.
- Graph points and identify coordinates of points on the Cartesian coordinate plane (all four quadrants).
- Find the distance between two points on horizontal or vertical number lines.
- Predict, describe, and perform transformations on two-dimensional shapes, e.g., translations, rotations, and reflections.
- Identify types of symmetry, including line and rotational.
- Determine if two shapes are congruent by measuring sides or a combination of sides and angles, as necessary; or by motions or series of motions, e.g., translations, rotations, and reflections.
- Match three-dimensional objects and their two-dimensional representations, e.g., nets, projections, and perspective drawings.

Measurement

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Apply the concepts of perimeter and area to the solution of problems. Apply formulas where appropriate.
- Identify, measure, describe, classify, and construct various angles, triangles, and quadrilaterals.
- Solve problems involving proportional relationships and units of measurement, e.g., same system unit conversions, scale models, maps, and speed.
- Find areas of triangles and parallelograms. Recognize that shapes with the same number of sides but different appearances can have the same area. Develop strategies to find the area of more complex shapes.
- Identify, measure, and describe circles and the relationships of the radius, diameter, circumference, and area (e.g., $d = 2r$, $\pi = C/d$), and use the concepts to solve problems.
- Find volumes and surface areas of rectangular prisms.
- Find the sum of the angles in simple polygons.

Data Analysis, Statistics, and Probability

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Describe and compare data sets using the concepts of median, mean, mode, maximum and minimum, and range.
- Construct and interpret stem-and-leaf plots, line plots, and circle graphs.
- Use tree diagrams and other models (e.g., lists and tables) to represent possible or actual outcomes of trials. Analyze the outcomes.
- Predict the probability of outcomes of simple experiments (e.g., tossing a coin, rolling a die) and test the predictions.
- Use appropriate ratios between 0 and 1 to represent the probability of the outcome and associate the probability with the likelihood of the event.

Grade 7

Number Sense and Operations

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Compare, order, estimate, and translate among integers, fractions and mixed numbers (i.e., rational numbers), decimals, and percents.
Use ratios and proportions in the solution of problems involving unit rates, scale drawings, and reading of maps.
- Represent numbers in scientific notation (positive powers of ten only) and use that notation in problem situations.
- Demonstrate an understanding of absolute value, e.g., $|-3| = |3| = 3$.
- Apply the rules of positive integer exponents to the solution of problems. Extend the Order of Operations to include positive integer exponents.
- Use the inverse relationships of addition and subtraction, and of multiplication and division, to simplify computations and solve problems, e.g., multiplying by $1/2$ or 0.5 is the same as dividing by 2 .
- Estimate and compute with fractions (including simplification of fractions), integers, decimals, and percents (including those greater than 100 and less than 1).
Determine when an estimate rather than an exact answer is appropriate and apply in problem situations.
- Select and use appropriate operations—addition, subtraction, multiplication, division, and positive integer exponents—to solve problems with rational numbers (including negatives).

Patterns, Relations, and Algebra

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Extend, represent, analyze, and generalize a variety of patterns with tables, graphs, words, and, when possible, symbolic expressions. Include arithmetic and geometric progressions, e.g., compounding.
- Evaluate simple algebraic expressions for given variable values, e.g., $3a^2 - b$ for $a = 3$ and $b = 7$.
- Create and use symbolic expressions for linear relationships and relate them to verbal, tabular, and graphical representations.
- Solve linear equations using tables, graphs, models, and algebraic methods.
- Identify, describe, and analyze linear relationships between two variables. Compare positive rate of change, e.g., $y = 3x + 1$, to negative rate of change, e.g., $y = -3x + 1$.
- Use linear equations to model and analyze problems involving proportional relationships. Use technology as appropriate.

Geometry

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Analyze, apply, and explain the relationship between the number of sides and the sums of the interior angle measures of polygons.
- Classify figures in terms of congruence and similarity, and apply these relationships to the solution of problems.

- Demonstrate an understanding of the relationships of angles formed by intersecting lines, including parallel lines cut by a transversal.
- Graph points and identify coordinates of points on the Cartesian coordinate plane (all four quadrants).²
- Use a ruler, protractor, and compass to draw polygons and circles.
- Predict the results of translations and reflections of figures on unmarked or coordinate planes and draw the transformed figure.
- Identify three-dimensional figures (e.g., prisms, pyramids) by their physical appearance, distinguishing attributes, and spatial relationships such as parallel faces.

Measurement

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Select, convert (within the same system of measurement), and use appropriate units of measurement or scale.
- Given the formulas, convert from one system of measurement to another. Use technology as appropriate..
- Demonstrate an understanding of the concepts and apply formulas and procedures for determining measures, including those of area and perimeter/circumference of parallelograms, trapezoids, and circles.
- Given the formulas, determine the surface area and volume of rectangular prisms and cylinders. Use technology as appropriate.

Data Analysis, Statistics, and Probability

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Select, create, interpret, and utilize the following tabular and graphical representations of data: circle graphs, Venn diagrams, stem-and-leaf plots, tables, and charts.
- Find, describe, and interpret appropriate measures of central tendency (mean, median, and mode) and spread (range) that represent a set of data. Use these notions to compare different sets of data.
- Use tree diagrams, tables, organized lists, and area models to compute probabilities for simple compound events, e.g., multiple coin tosses or rolls of number cubes.

Grades 8

Number Sense and Operations

- Understand numbers, ways of representing numbers, relationships among numbers, and number systems
- Understand meanings of operations and how they relate to one another
- Compute fluently and make reasonable estimates

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Compare, order, estimate, and translate among integers, fractions and mixed numbers (i.e., rational numbers), decimals, and percents.
- Define, compare, order, and apply frequently used irrational numbers, such as $\sqrt{2}$ and π .
- Use ratios and proportions in the solution of problems, in particular, problems involving unit rates, scale factors, and rate of change.
- Represent numbers in scientific notation, and use them in calculations and problem situations.
- Apply number theory concepts, including prime factorization and relatively prime numbers, to the solution of problems.
- Demonstrate an understanding of absolute value, e.g., $|-3| = |3| = 3$.
- Apply the rules of powers and roots to the solution of problems. Extend the Order of Operations to include positive integer exponents and square roots.
- Demonstrate an understanding of the properties of arithmetic operations on rational numbers. Use the associative, commutative, and distributive properties; properties of the identity and inverse elements (e.g., $-7 + 7 = 0$; $3/4 \times 4/3 = 1$); and the notion of closure of a subset of the rational numbers under an operation (e.g., the set of odd integers is closed under multiplication but not under addition).
- Use the inverse relationships of addition and subtraction, multiplication and division, and squaring and finding square roots to simplify computations and solve problems, e.g. multiplying by $1/2$ or 0.5 is the same as dividing by 2 .
- Estimate and compute with fractions (including simplification of fractions), integers, decimals, and percents (including those greater than 100 and less than 1).
- Determine when an estimate rather than an exact answer is appropriate and apply in problem situations.
- Select and use appropriate operations—addition, subtraction, multiplication, division, and positive integer exponents — to solve problems with rational numbers (including negatives).

Patterns, Relations, and Algebra

- Understand patterns, relations, and functions
- Represent and analyze mathematical situations and structures using algebraic symbols
- Use mathematical models to represent and understand quantitative relationships
- Analyze change in various contexts

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Extend, represent, analyze, and generalize a variety of patterns with tables, graphs, words, and, when possible, symbolic expressions. Include arithmetic and geometric progressions, e.g.,

compounding.

- Evaluate simple algebraic expressions for given variable values, e.g., $3a^2 - b$ for $a = 3$ and $b = 7$.
- Demonstrate an understanding of the identity $(-x)(-y) = xy$. Use this identity to simplify algebraic expressions, e.g., $(-2)(-x+2) = 2x - 4$.
- Create and use symbolic expressions and relate them to verbal, tabular, and graphical representations.
- Identify the slope of a line as a measure of its steepness and as a constant rate of change from its table of values, equation, or graph. Apply the concept of slope to the solution of problems.
- Identify the roles of variables within an equation, e.g., $y = mx + b$, expressing y as a function of x with parameters m and b .
- Set up and solve linear equations and inequalities with one or two variables, using algebraic methods, models, and/or graphs.
- Explain and analyze—both quantitatively and qualitatively, using pictures, graphs, charts, or equations—how a change in one variable results in a change in another variable in functional relationships, e.g., $C = \pi d$, $A = \pi r^2$
- Use linear equations to model and analyze problems involving proportional relationships. Use technology as appropriate.
- Use tables and graphs to represent and compare linear growth patterns. In particular, compare rates of change and x - and y -intercepts of different linear patterns.

Geometry

- Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships
- Specify locations and describe spatial relationships using coordinate geometry and other representational systems
- Apply transformations and use symmetry to analyze mathematical situations
- Use visualization, spatial reasoning, and geometric modeling to solve problems

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Analyze, apply, and explain the relationship between the number of sides and the sums of the interior and exterior angle measures of polygons.
- Classify figures in terms of congruence and similarity, and apply these relationships to the solution of problems.
- Demonstrate an understanding of the relationships of angles formed by intersecting lines, including parallel lines cut by a transversal.
- Demonstrate an understanding of the Pythagorean Theorem. Apply the theorem to the solution of problems.
- Use a straightedge, compass, or other tools to formulate and test conjectures, and to draw geometric figures.
- Predict the results of transformations on unmarked or coordinate planes and draw the transformed figure, e.g., predict how tessellations transform under translations, reflections, and rotations.
- Identify three-dimensional figures (e.g., prisms, pyramids) by their physical appearance, distinguishing attributes, and spatial relationships such as parallel faces.
- Recognize and draw two-dimensional representations of three-dimensional objects, e.g., nets, projections, and perspective drawings.

Measurement

- Understand measurable attributes of objects and the units, systems, and processes of measurement
- Apply appropriate techniques, tools, and formulas to determine measurements

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Select, convert (within the same system of measurement), and use appropriate units of measurement or scale.
- Given the formulas, convert from one system of measurement to another. Use technology as appropriate.
- Demonstrate an understanding of the concepts and apply formulas and procedures for determining measures, including those of area and perimeter/circumference of parallelograms, trapezoids, and circles. Given the formulas, determine the surface area and volume of rectangular prisms, cylinders, and spheres. Use technology as appropriate.
- Use ratio and proportion (including scale factors) in the solution of problems, including problems involving similar plane figures and indirect measurement.
- Use models, graphs, and formulas to solve simple problems involving rates, e.g., velocity and density.

Data Analysis, Statistics, and Probability

- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them
- Select and use appropriate statistical methods to analyze data
- Develop and evaluate inferences and predictions that are based on data
- Understand and apply basic concepts of probability

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Describe the characteristics and limitations of a data sample. Identify different ways of selecting a sample, e.g., convenience sampling, responses to a survey, random sampling.
- Select, create, interpret, and utilize various tabular and graphical representations of data, e.g., circle graphs, Venn diagrams, scatterplots, stem-and-leaf plots, box-and-whisker plots, histograms, tables, and charts. Differentiate between continuous and discrete data and ways to represent them.
- Find, describe, and interpret appropriate measures of central tendency (mean, median, and mode) and spread (range) that represent a set of data. Use these notions to compare different sets of data.
- Use tree diagrams, tables, organized lists, basic combinatorics (“fundamental counting principle”), and area models to compute probabilities for simple compound events, e.g., multiple coin tosses or rolls of dice.

Algebra I

Number Sense and Operations

- Understand numbers, ways of representing numbers, relationships among numbers, and number systems
- Understand meanings of operations and how they relate to one another
- Compute fluently and make reasonable estimates

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Identify and use the properties of operations on real numbers, including the associative, commutative, and distributive properties; the existence of the identity and inverse elements for addition and multiplication; the existence of n^{th} roots of positive real numbers for any positive integer n ; the inverse relationship between taking the n^{th} root of and the n^{th} power of a positive real number; and the density of the set of rational numbers in the set of real numbers.
- Simplify numerical expressions, including those involving positive integer exponents or the absolute value, e.g., $3(2^4 - 1) = 45$, $4|3 - 5| + 6 = 14$; apply such simplifications in the solution of problems.
- Find the approximate value for solutions to problems involving square roots and cube roots without the use of a calculator, e.g., $\sqrt{3^2 - 1} \approx 2.8$.
- Use estimation to judge the reasonableness of results of computations and of solutions to problems involving real numbers.

Patterns, Relations, and Algebra

- Understand patterns, relations, and functions
- Represent and analyze mathematical situations and structures using algebraic symbols
- Use mathematical models to represent and understand quantitative relationships
- Analyze change in various contexts

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Describe, complete, extend, analyze, generalize, and create a wide variety of patterns, including iterative, recursive (e.g., Fibonacci Numbers), linear, quadratic, and exponential functional relationships.
- Use properties of the real number system to judge the validity of equations and inequalities, to prove or disprove statements, and to justify every step in a sequential argument.
- Demonstrate an understanding of relations and functions. Identify the domain, range, dependent, and independent variables of functions.
- Translate between different representations of functions and relations: graphs, equations, point sets, and tabular.
- Demonstrate an understanding of the relationship between various representations of a line. Determine a line's slope and x- and y-intercepts from its graph or from a linear equation that represents the line. Find a linear equation describing a line from a graph or a geometric description of the line, e.g., by using the "point-slope" or "slope y-intercept" formulas. Explain the significance of a positive, negative, zero, or undefined slope.
- Find linear equations that represent lines either perpendicular or parallel to a given line and through a point, e.g., by using the "point-slope" form of the equation.

- Add, subtract, and multiply polynomials. Divide polynomials by monomials.
- Demonstrate facility in symbolic manipulation of polynomial and rational expressions by rearranging and collecting terms, factoring (e.g., $a^2 - b^2 = (a + b)(a - b)$, $x^2 + 10x + 21 = (x + 3)(x + 7)$, $5x^4 + 10x^3 - 5x^2 = 5x^2(x^2 + 2x - 1)$), identifying and canceling common factors in rational expressions, and applying the properties of positive integer exponents.
- Find solutions to quadratic equations (with real roots) by factoring, completing the square, or using the quadratic formula. Demonstrate an understanding of the equivalence of the methods.
- Solve equations and inequalities including those involving absolute value of linear expressions (e.g., $|x - 2| > 5$) and apply to the solution of problems.

Patterns, Relations, and Algebra

- Solve everyday problems that can be modeled using linear, reciprocal, quadratic, or exponential functions. Apply appropriate tabular, graphical, or symbolic methods to the solution. Include compound interest, and direct and inverse variation problems. Use technology when appropriate.
- Solve everyday problems that can be modeled using systems of linear equations or inequalities. Apply algebraic and graphical methods to the solution. Use technology when appropriate. Include mixture, rate, and work problems.

Data Analysis, Statistics, and Probability

- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them
- Select and use appropriate statistical methods to analyze data
- Develop and evaluate inferences and predictions that are based on data
- Understand and apply basic concepts of probability

Students engage in problem solving, communicating, reasoning, connecting, and representing as they:

- Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table, stem-and-leaf plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.
- Approximate a line of best fit (trend line) given a set of data (e.g., scatterplot). Use technology when appropriate.
- Describe and explain how the relative sizes of a sample and the population affect the validity of predictions from a set of data.

Glossary Sources

Mathematics Curriculum Framework - November 2000

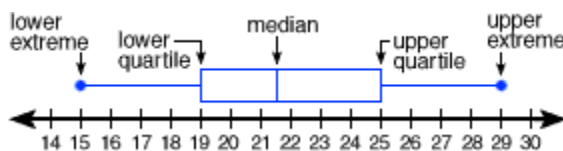
- (H) Harcourt Animated Math Glossary. Referenced February 29–March 2, 2000.
www.hbschool.com/glossary/math/glossary8.html
- (W) Merriam-Webster's Collegiate Dictionary. Referenced February 29–March 2, 2000.
m-w.com/dictionary.htm

Algorithm A finite set of steps for completing a procedure, e.g., long division. (H)

Analog Having to do with data represented by continuous variables, e.g., a clock with hour, minute, and second hands. (W)

Analytic geometry The branch of mathematics that uses functions and relations to study geometric phenomena, e.g., the description of ellipses and other conic sections in the coordinate plane by quadratic equations.

Box-and-whisker plot A method for displaying the median, quartiles, and extremes of a set of data, using the number line. (H)



Calculus The mathematics of change and motion. The main concepts of calculus are limits, instantaneous rates of change, and areas enclosed by curves.

Capacity The maximum amount or number that can be contained or accommodated, e.g., a jug with a one-gallon *capacity*; the auditorium was filled to *capacity*.

Capture-recapture experiment A type of experiment used to estimate a population. On the first day a certain number, M , of the population, N , is captured and tagged or marked. On the second day another sample, n , of the population is captured including the recapture of some R of those already tagged. The population can be estimated using the formula $N = \frac{Mn}{R}$.

Cardinal number A number (as 1, 5, 15) that is used in simple counting and that indicates how many elements there are in a set.

Cartesian plane or Euclidean plane A coordinate plane with perpendicular coordinate axes.

Closure property A set of numbers, such as the integers, is *closed* under a particular operation if performing the operation on numbers in the set results in another number in that set. For example, the set of non-zero integers is closed under multiplication, but is not closed under division: the product of two non-zero integers is again a non-zero integer, but their quotient need not be an integer.

Complex number A number that can be written in the form $a + bi$ where a and b are real numbers and

$$i = \sqrt{-1}.$$

Convenience (haphazard) sampling The collection of data from readily available sources, without emphasis on methodological rigor.

Coordinate plane A plane in which two *coordinate axes* are specified, i.e., two intersecting directed straight lines, usually perpendicular to each other, and usually called the x-axis and y-axis. Every point in a coordinate plane can be described uniquely by an ordered pair of numbers, the *coordinates* of the point with respect to the coordinate axes.

Counting number A number used in counting objects, i.e., a number from the set 1, 2, 3, 4, 5,....

Decimal number Any real number expressed in base 10 notation, such as 2.673.

Deductive reasoning A type of reasoning wherein the conclusion about particulars follows necessarily from general or universal premises. (W)

Digit a) Any of the Arabic numerals 1 to 9 and usually the symbol 0; b) One of the elements that combine to form numbers in a system other than the decimal system.

Digital Having to do with data that is represented in the form of numerical digits; providing a readout in numerical digits, e.g., a digital watch.

Dilation A type of transformation of the plane that fixes a point C (the *center* of the dilation) and maps any other point P to the point P' characterized as follows: the segment CP' has the same direction as the segment CP , and has length k times the length of the segment CP , where k is a positive constant (the *scale factor* of the dilation).

Discrete mathematics The branch of mathematics that includes combinatorics, recursion, Boolean algebra, set theory, and graph theory.

Dot product For vectors $A = \langle x_a, y_a \rangle$ and $B = \langle x_b, y_b \rangle$, the dot product $A \cdot B = (x_a)(x_b) + (y_a)(y_b)$.

Expanded notation A way of representing a number that shows the sum of each digit multiplied by the appropriate positive power of ten and the units digit, e.g., 3451 as $3 \times 1000 + 4 \times 100 + 5 \times 10 + 1$ or as $3 \times 10^3 + 4 \times 10^2 + 5 \times 10 + 1$.

Exponent The number that indicates how many times the base is used as a factor, e.g., in $4^3 = 4 \times 4 \times 4 = 64$, the exponent is 3, indicating that 4 is repeated as a factor three times.

Fibonacci numbers The sequence of numbers beginning with 1, 1, in which each number that follows is the sum of the previous two numbers, i.e., 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144....

Function A mathematical relation that associates each object in a set with exactly one value.

Fundamental Counting Principle If event M can occur in m ways, and after it has occurred, event N can occur in n ways, then event M followed by event N can occur $m \cdot n$ ways.

Fractal A curve or shape so irregular that its dimension (according to the technical definition of dimension) is a *fraction*, rather than an integer. Many interesting examples of fractals have the

property of being *self-similar*, in the sense that portions of the fractal are similar in shape to magnified parts of itself at arbitrarily high rates of magnification.

Geometric or figural pattern A sequence of symbols or geometric figures.

Geometric sequence (progression) An ordered list of numbers that has a common ratio between consecutive terms, e.g., 2, 6, 18, 54....(H)

Inductive reasoning a) The type of reasoning that uses inference to reach a generalized conclusion from particular instances; b) In mathematics, demonstration of the validity of a law concerning all the positive integers by proving that it holds for the integer 1 and that if it holds for an arbitrarily chosen positive integer k it must hold for the integer $k+1$; also called *mathematical induction*. (W)

Integer A number that is either a whole number or the negative of a whole number.

Irrational number A number that cannot be expressed as a quotient of two integers, e.g., $\sqrt{2}$. It can be shown that a number is irrational if and only if it cannot be written as a repeating or terminating decimal.

Iterative pattern or sequence A sequence or pattern formed by repeating the same procedure. For example, the Fibonacci sequence.

Line graph A set of data points on an X-Y grid, possibly with consecutive points connected by line segments.

Line of best fit A straight line drawn through or near to as many data points as possible on a scatterplot.

Line plot A number line with dots or other marks above it to show the number of times an event occurs. (H)

Linear equation Any equation that can be written in the form $Ax + By + C = 0$ where A and B cannot both be 0. The graph of such an equation is a line.

Linear programming A mathematical method of solving practical problems (as the allocation of resources) by means of linear functions where the variables involved are subject to constraints. (W)

Matrix, pl. matrices A rectangular array of numbers or variables.

Measure of central tendency Either the mean, median, or mode of a distribution, i.e., one of the possible notions of an average.

Network a) A figure consisting of vertices and edges that shows how objects are connected, b) A collection of points (vertices), with certain connections (edges) between them.

Numeral A symbol or mark used to represent a number.

Numeric pattern A pattern composed of numerals.

Order of Operations 1. Do all of the operations inside parentheses, and/or above and below a fraction bar in the proper order, 2. Find the value of any powers or roots, 3. Multiply and divide from left to right, 4. Add and subtract from left to right. (H)

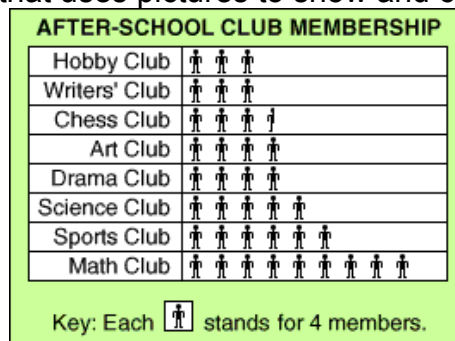
Ordinal number A number designating the place (as first, second, or third) occupied by an item in an ordered sequence. (W)

Partition A process of dividing an object into parts.

Pascal's triangle A triangular arrangement of numbers in which each row starts and ends with 1, and each other number is the sum of the two numbers above it. (H)



Pictogram (pictograph) A graph that uses pictures to show and compare information. (H)



Probability A number between zero and one that describes the likelihood that a given event will take place. For example, the probability of throwing a six with a single throw of one die is $1/6$, and the probability of throwing two sixes with a single throw of two dice is $1/36$.

Proof A method of constructing a valid argument, using deductive reasoning.

Proportion An equation that states that two ratios are equivalent, e.g., $4/8 = 1/2$ or $4 : 8 = 1 : 2$.

Pythagorean theorem For any right triangle, the sum of the squares of the measures of the legs equals the square of the measure of the hypotenuse.

Random sampling A smaller group of people or objects chosen from a larger group or population by a process giving equal chance of selection to all possible people or objects. (H)

Random variable A variable that is itself a function of the result of a statistical experiment in which each outcome has a definite probability of occurrence; also called *variate*. (W)

Ratio A comparison of two numbers or quantities, e.g., 4 to 7 or $4 : 7$ or $4/7$.

Rational number A number that can be written as the ratio of an integer to a counting number; or more formally, a number that can be expressed as a ratio a/b where a and b are integers and $b \neq 0$, e.g., 0.5, $3/5$, -3, 8, $3-9/10$.

Real number A number from the set of numbers consisting of all rational and all irrational numbers.

Recursive pattern or sequence A pattern or sequence wherein each successive term can be computed from some or all of the preceding terms by an algorithmic procedure.

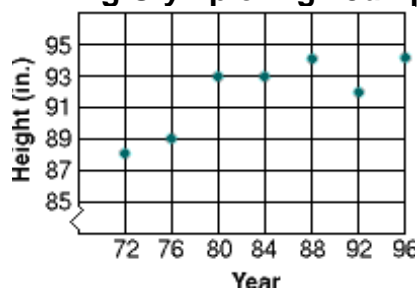
Reflection A type of transformation that flips points about a line, called the *line of reflection*. Taken together, the image and the preimage have the line of reflection as a line of symmetry.

Rotation A type of transformation that turns a figure about a fixed point, called the *center of rotation*.

Sample space In probability, the set of all outcomes of a given experiment, e.g., the sample space for tossing two coins is (H,H), (H,T), (T,H), (T,T). (H)

Scatter plot Two sets of data plotted as ordered pairs in the coordinate plane. (H)

Winning Olympic High Jump



Scientific notation A widely used floating-point system in which numbers are expressed as products consisting of a number between 1 and 10 multiplied by an appropriate power of 10, e.g., $562 = 5.62 \times 10^2$. (W)

Sequence, progression A set of elements ordered so that they can be labeled with consecutive positive integers starting with 1, e.g., 1, 3, 9, 27, 81. In this sequence, 1 is the *first term*, 3 is the *second term*, 9 is the *third term*, and so on. (W)

Transformation A prescription, or rule, that sets up a one-to-one correspondence between the points in a geometric object (the *preimage*) and the points in another geometric object (the *image*). Reflections, rotations, translations, and dilations are particular examples of transformations.

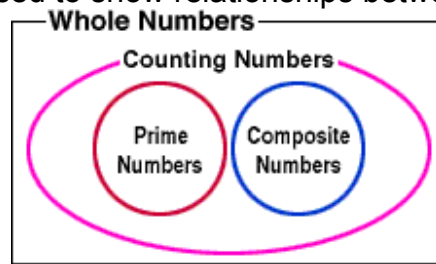
Translation A type of transformation that moves every point by the same distance in the same direction, e.g., in a geographic map, moving a given distance due north.

Valid a) Well-grounded or justifiable; being at once relevant and meaningful, e.g., a *valid* theory; b) Logically correct. (W)

Variable A letter used to represent one or more numbers in an expression, equation, inequality, or matrix. (H)

Vector A quantity that has magnitude and direction. A vector is typically represented by a directed line segment, whose length represents the magnitude and whose orientation in space represents the direction. (W)

Venn diagram A diagram that is used to show relationships between sets. (H)



Vertex-edge graph A graph consisting of points with connections in which the points are called vertices and the line segments are called edges.

Whole number A number that is either a counting number or zero.