

KEY LEARNINGS: MATH

2009-2011

Standards of problem solving, reasoning, communications and representation are embedded in teaching the standards listed below.

KINDERGARTEN

Number and Operations

- Count and understand numbers to 20
- Write numbers 0 to 10
- Use one-to-one correspondence with numbers and objects
- Understand and represent adding two numbers with sums to ten
- Add and subtract two numbers using objects to ten

Algebra

- Recognize and explain how objects can be classified
- Sort, classify and order objects by time, size, number and other properties
- Compare and contrast objects
- Identify, create, copy, describe and extend sequences e.g. sounds, shapes, motions, numbers
- Model a mathematical problem situation using manipulatives

Geometry

- Compare, sort and arrange similar and different objects by size, color and shape
- Identify triangles, squares and circles
- Describe relative position of objects in space
- Identify and fit pieces of puzzles or shapes that go together
- Construct 3-dimensional objects

Measurement

- Compare the weight of two objects and the capacity of two containers
- Compare and describe length, size, distance, temperature e.g. long, longer, longest, same length
- Measure length by counting non-standard units
- Recognize how a thermometer denotes hot, cold and medium temperatures
- Measure area using concrete objects
- Order events by time e.g. before, after
- Identify that clocks, watches and calendars are used to measure time
- Tell time to the hour
- Know and name the seven days of the week in order (relate to Sabbath)

Data Analysis and Probability

- Discuss events as likely or unlikely
- Pose questions and gather data about themselves and their surroundings

FIRST GRADE

Number and Operations

- Count, write and understand numbers 0 to 100
- Count by twos, fives, tens and twenty-fives to 100
- Skip count by tens e.g. 17, 27, 37 ...
- Connect numbers to the qualities they represent using various models and representations
- Understand place value of tens and ones
- Explore the concept of zero
- Compare numbers using symbols $>$, $<$ and $=$
- Understand the meaning of addition and subtraction and relate to appropriate symbols
- Understand basic addition and subtraction fact families
- Develop a counting strategy for addition and subtraction facts to 20
- Memorize addition with sums to 12 and related subtraction facts
- Add and subtract 1- and 2-digit numbers, with no renaming
- Understand basic fractions, e.g. halves, thirds and fourths
- Read number words to ten
- Understand and use a number line

Algebra

- Recognize and express expanding and repeating math patterns - orally and with manipulatives
- Identify properties of patterns; create and describe using letters and symbols
- Use variables and open sentences to express relationships e.g. missing numbers in number sentences using symbols to represent missing numbers
- Use the commutative property and solve number sentences with numbers and symbols

Geometry

- Describe attributes and parts of 2- and 3-dimensional objects
- Describe shapes from different perspectives, e.g. front, back, top, bottom and side
- Apply ideas about direction and space
- Recognize and apply slides, flips and turns
- Recognize rectangles and spheres
- Recognize sides and corners of shapes
- Recognize geometric shapes and structures in the environment
- Recognize and draw a line of symmetry in objects
- Copy figures and draw simple 2-dimensional shapes from memory

Measurement

- Identify and recognize various measurable attributes of an object
- Estimate and measure length, weight, volume and mass using nonstandard and standard units
- Compare objects in terms of length, area, capacity and weight
- Recognize and explain the need for measuring tools and fixed units
- Order sequence of events with respect to time, e.g. seasons; morning, afternoon, night; o'clock
- Know the number of minutes in an hour
- Tell time to the hour and half hour using both digital and analog clocks
- Identify pennies, nickels, dimes, quarters, half-dollars and dollars
- Determine the value of a set of coins to \$1.00
- Determine the equivalent value of coins to \$1.00 e.g. 10 dimes, 4 quarters, etc.
- Know and name the twelve months of the year

Data Analysis and Probability

- Use whole number units to construct graphic representations
- Understand information represented in simple bar graphs, line graphs and pictographs
- Collect first-hand information by conducting surveys, measuring and performing simple experiments
- Collect and organize data into charts using tally marks

SECOND GRADE**Number and Operations**

- Count and understand numbers with 3-digits
- Skip count by two, e.g. 23, 25, 27...
- Understand and use ordinals 1-20
- Understand even and odd numbers
- Understand the place value of hundreds, tens, ones
- Given a math fact, construct the other three in the fact family
- Know addition and subtraction facts through 20 by recall
- Add and subtract 2-digit numbers with renaming
- Add and subtract 3-digit numbers with no renaming
- Add a series of three numbers
- Using a number line, explain rounding to the nearest ten
- Write, add and subtract money using appropriate symbols
- Understand situations that entail multiplication and division, i.e. equal groupings of objects and sharing equally

Algebra

- Use patterns to make generalizations and predictions
- Analyze patterns in tables and graphs
- Describe qualitative and quantitative changes involving addition and subtraction
- Understand equivalence concepts using symbols

Geometry

- Investigate and predict results of assembling and disassembling 2- and 3- dimensional shapes
- Find locations using simple coordinates
- Recognize prisms, pyramids, cylinders and cones
- Relate ideas in geometry to number and measurement

Measurement

- Select and use appropriate measuring tools
- Select and use appropriate units of measurement
- Use different units to measure the same thing
- Use nonstandard units to compare weight of real objects and capacity of real containers
- Estimate the weight of an object
- Apply and use measurements in problems and “real life” situations
- Tell time to the nearest minute (digital) and the nearest 5 minutes (analog)
- Use and compare A.M. and P.M. time designations
- Count coins and dollars to \$5.00
- Determine correct change to \$1.00 by counting
- Estimate to the nearest dollar
- Use correct symbols in writing money amounts
- Understand one hour of elapsed time
- Identify days and dates on a calendar and one week before and after a certain date on a calendar

Data Analysis and Probability

- Construct and interpret data using a simple bar graph
- Interpret data as represented in a simple table or chart
- Make predictions, test validity and do a probability study with a 50/50 chance

THIRD GRADE**Number and Operations**

- Understand and describe place value to the ten-thousands place
- Design and label number lines appropriate to the situation
- Compare and order numbers through 10,000
- Skip count by threes, e.g. 1, 18, 21, 24...
- Understand the commutative property of addition and multiplication
- Understand the zero property of multiplication
- Understand the meaning of the decimal point
- Understand the concept of tenths written as a decimal
- Understand the meaning of multiplication and division
- Know the multiplication and division fact families
- Know multiplication and corresponding division facts
- Add and subtract numbers up to four digits with and without renaming
- Multiply mentally by 10 and 100
- Multiply and divide 2-digit number by a 1-digit number
- Divide a 2-digit number by a 1-digit number with remainder
- Understand the meaning and structure of fractions between zero and one
- Understand and write simple mixed numbers
- Compare fractions with like denominators
- Add and subtract fractions with like denominators
- Add and subtract money
- Use strategies to estimate the results of whole number computations

Algebra

- Analyze mathematical sequences with and without a calculator
- Use patterns to make predictions, solve problems and identify relationships
- Understand and explain mathematical relationships in equations and inequalities
- Solve equations and inequalities
- Identify such properties as commutative, and associative - use to compute with whole numbers
- Understand and use grouping symbols e.g. $8 + 6 = 8 + (2 + 4)$

Geometry

- Explore congruence and similarity
- Add to find perimeter
- Count squares to find area
- Count cubes to determine volume
- Create models of 2-dimensional objects
- Investigate simple nets
- Analyze/describe 2- and 3-dimensional objects using terms: vertex, edge, angle, side, face
- Find and name locations on a labeled grid or coordinate system
- Identify shapes that can be put together to make a given shape, e.g. tangrams

Measurement

- Use correct measurement vocabulary
- Explain and measure temperature using Celsius and Fahrenheit scales
- Read and understand a simple time line
- Measure length, weight, volume using metric and US customary units to nearest $\frac{1}{2}$ unit as appropriate
- Using appropriate tools, draw a line or shape with specified measurements
- Count money up to \$10.00
- Understand attributes of second, minute, hour
- Tell time to the minute, before or after the hour, using analog and digital clocks
- Measure elapsed time using a calendar or clock
- Read and understand a calendar using day, week, month and year
- Count weeks before and after certain dates on the calendar

Data Analysis and Probability

- Organize and interpret data using line graphs
- Construct graphs using data from a table
- Discover patterns in tables and graphs by creating, organizing, recording and analyzing data
- Formulate questions and categories for data collection and actively collect first-hand information
- Describe the shape and important features of a set of data and compare related data sets, with an emphasis on how the data are distributed

FOURTH GRADE**Number and Operations**

- Understand place value through millions
- Understand concept and representation of numbers between zero - one, i.e. fractions - decimals
- Recognize representations for equivalent numbers
- Read, write and compare decimals to the hundredths
- Know equivalents in counting money, e.g. 5 nickels equal 1 quarter
- Know how to count up to make change
- Understand how multiplication and division relate to each other to solve problems
- Interpret the meaning of a remainder in a division problem
- Memorize multiplication and division facts through 12
- Multiply a 3- and 4-digit number by a 1-digit number
- Divide using 1-digit divisor and 1- 2- or 3-digit dividend
- Multiply two 2-digit numbers
- Understand simple equivalent fractions

- Convert improper fractions to mixed numbers and vice versa
- Add and subtract fractions and mixed numbers with common denominators
- Estimate solutions involving whole number, fraction and decimal computations
- Understand basic concepts of least common multiple (LCM) and greatest common factor (GCF)
- Reduce simple fractions to lowest terms
- Explore numbers less than zero by extending the number line and through familiar applications

Algebra

- Construct a table of values to solve problems in a mathematical relationship
- Understand how a change in one variable affects the value of another variable
- Use distributive properties to simplify and perform computations
- Make and justify predictions using numerical and non-numerical patterns

Geometry

- Describe points, lines and planes
- Use columns and rows to determine position on a grid
- Use coordinate systems to specify locations
- Identify line symmetry in 3-dimensional shapes
- Create models of 3-dimensional objects
- Multiply to find area of rectangles
- Make and test conjectures about geometric properties and relationships, then develop logical arguments to justify conclusions
- Compare similarities and differences of quadrilaterals

Measurement

- Measure length to the nearest $\frac{1}{4}$ inch
- Use measures less than one unit
- Solve multi-step problems involving measurement
- Estimate and measure the perimeter of irregular shapes
- Compare the number of units to the size of units, e.g. number of feet compared to number of yards in a given length, estimating/determining cups in a 2-liter container
- Draw a simple time line
- Determine elapsed time by the hour and half-hour
- Understand time zones and read timetables
- Read a Celsius thermometer knowing the significance of 0 and 100 degrees; and read a Fahrenheit thermometer knowing the significance of 32 and 212 degrees
- Know equivalent measures for simple metric and customary units of length, capacity, weight/mass and time e.g. inches to feet, meters to kilometers
- Convert simple metric and customary units of length, capacity, weight/mass, and time, e.g. inches to feet, kilograms to grams, quarts to gallons

Data Analysis and Probability

- Collect and organize data into tables and graphs using different scales
- Read and interpret data presented in circle graphs
- Conduct simple probability experiments
- Interpret and construct Venn diagrams
- Evaluate the process of data collection

FIFTH GRADE**Number and Operations**

- Understand place value through billions
- Be proficient in counting money and making change
- Develop and use number sense for whole numbers, fractions and decimals
- Develop and apply number theory concepts, e.g. multiples, primes and factors in real world and mathematical situations
- Determine pairs of numbers given a relation or rule, and determine the relation or rule of given pairs of numbers

- Understand how basic mathematical operations are related
- Develop, analyze and explain procedures for computation and techniques for estimation
- Select appropriate methods and tools for computing with whole numbers, fractions and decimals from among mental computation, estimation, calculator and paper/pencil
- Round whole numbers to the designated place value
- Identify and generate equivalent forms of fractions, decimals and percents
- Recognize, model and describe multiples, factors, composites and primes
- Determine the greatest common factor (GCF) and least common multiple (LCM) of two numbers
- Convert fractions to the least common denominator (LCD)
- Reduce fractions to simplest form (lowest terms)
- Add and subtract time using renaming

Algebra

- Graph linear equations with one variable
- Use calculators, computers, tables and graphs to develop and interpret patterns
- Understand and use formulas
- Develop skill in solving and writing linear equations using informal and formal methods
- Investigate inequalities and nonlinear equations
- Apply order of operation rules

Geometry

- Learn the relationship between radius and diameter
- Classify angles according to the measure
- Identify and select appropriate units to measure angles (degrees)
- Understand and use linear, square and cubic units
- Count faces, vertices and edges
- Create perspective drawings
- Describe ray, segment, interior and exterior of an angle
- Recognize and create patterns with tessellations

Measurement

- Identify the paths between points on a grid or coordinate plane and compare the lengths of the paths, e.g. shortest path, paths of equal lengths
- Demonstrate and describe the difference between covering the faces (surface area), and filling the interior (volume), of 3-dimensional objects
- Use standard angles (45° , 90° , 120°) to estimate the measure of angles and use a protractor to measure and draw angles
- Convert one metric unit to one customary unit and one customary unit to one metric unit
- Understand that measurement is not exact, e.g. when measured multiple times, measurements may give slightly different numbers
- Understand and explain how differences in units affect precision
- Measure length to the nearest cm and $\frac{1}{8}$ of an inch

Data Analysis and Probability

- Collect and organize data, then determine appropriate method and scale to display data
- Find the mean, median, mode and range of a given set of data and use these measures to describe the set of data
- Use calculators to simplify computations and use computers to assist in generating and analyzing information
- Sample and analyze data, making predictions and conjectures based on samples
- Distinguish between a population and a sample
- Discuss the reasonableness of the data and the results
- List all possible outcomes of an event
- Read, construct and interpret frequency tables
- Make predictions based on experimental and theoretical probabilities

SIXTH GRADE**Number and Operations**

- Understand the meaning and use of exponents
- Understand the associative property of addition and multiplication
- Extend understanding of whole number operations to fractions, decimals, percents and mixed numbers
- Understand and apply divisibility rules
- Round decimals to the nearest thousandths
- Understand the concepts of ratio, percent and percentage
- Compare and order improper fractions, mixed numbers and decimal fractions to thousandths
- Develop meaning for integers and use integers to represent and compare quantities
- Add, subtract, multiply and divide integers
- Give the prime factorization of a number
- Use factor trees to give the prime factorization of a number
- Convert fractions to decimals to percents and vice versa
- Convert fractions to terminating, repeating or rounded decimals
- Solve proportions with an unknown
- Understand and use mathematical vocabulary appropriately
- Write a remainder as a fraction or decimal
- Find the percent of a number
- Find the percent one number is of another and find the original number when the percent is given
- Use percents to determine sales tax, commission, discount and simple interest

Algebra

- Write, solve and graph linear equations
- Use two-step operations to solve linear equations
- Write and solve inequalities
- Infer and use a rule to determine a missing number
- Use appropriate mathematical vocabulary and properties
- Compare integers on a number line

Geometry

- Define and use appropriate geometrical vocabulary
- Use strategies to develop formulas for determining perimeter and area of triangles, rectangles and parallelograms and volume of rectangular prisms
- Find the area of parallelograms and triangles
- Find the circumference and area of circles
- Find the volume and surface area of prisms
- Classify triangles according to the angles and sides
- Understand parallel, intersecting, and perpendicular lines
- Measure an angle using a protractor
- Draw similar figures that model proportional relations
- Explore fractal patterns
- Do geometric construction, e.g. bisect a segment

Measurement

- Describe how perimeter, area and volume are affected when dimensions of a figure are changed
- Use strategies to develop formulas for finding circumference and area of circles, and area of sectors ($\frac{1}{2}$ circle, $\frac{2}{3}$ circle, $\frac{1}{3}$ circle, $\frac{1}{4}$ circle)
- Express solutions to the nearest unit
- Estimate length, area, volume, perimeter, circumference, area of a circle, various shapes and surfaces using everyday objects, e.g. string, arms, etc.
- Make conversions within the same measurement system while performing computations
- Use indirect measurement such as similar triangles to solve problems

Data Analysis and Probability

- Calculate the probability of independent and dependent events

- Construct a multiple line graph
- Make logical inferences from statistical data
- Calculate the odds
- Design an experiment to test a theoretical probability and explain how the results may vary
- Construct a scatter plot
- Make organized lists and tree diagrams

SEVENTH GRADE**Number and Operations**

- Understand and use scientific notation
- Evaluate powers that have negative and zero exponents
- Use integers to express quantities that occur naturally in problem situations, e.g. representing direction, loss, gain, etc.
- Develop and use number sense for integers, rational and irrational numbers
- Understand and use the additive inverse property
- Understand the principles of the distributive property
- Apply properties of operations with whole numbers, fractions and decimals
- Use proportions to solve problems
- Compute with rational numbers using a calculator to perform difficult computations
- Understand squares and square roots
- Estimate the square root of a number less than 100
- Find the percent of increase and/or decrease

Algebra

- Use and apply ratios, proportions, averages and percentage
- Graph inequalities
- Choose a formula to use in problem solving
- Demonstrate proficiency in using the laws of exponents
- Use the Pythagorean Theorem
- Manipulate simple polynomials

Geometry

- Find the area of a trapezoid
- Find the surface area of a cylinder
- Find the volume of various geometric solids, e.g. pyramids and cones
- Use transformations to explore congruence and create designs
- Explore the angle measures in a triangle
- Understand complementary, supplementary and vertical angles
- Draw and interpret scale diagrams

Measurement

- Use graphs, charts and formulas to convert between a variety of standard/metric measures
- Apply ratios to solve measurement problems
- Use scale models to represent measures of real-life objects
- Relate ancient monetary values to current values, e.g. shekel, denari, mite
- Develop a proportionately correct time line using complex concepts
- Use strategies to develop formulas for finding volume and surface areas of solids
- Explain how time zones are determined

Data Analysis and Probability

- Understand the number of possible permutations
- Predict the number of times an event will occur
- Construct a multiple bar graph
- Construct a circle graph
- Make a histogram
- Make a stem and leaf plot

EIGHTH GRADE**Number and Operations**

- Use appropriate significant digits in calculations
- Extend understanding of number operations to irrational numbers
- Know the definition of real numbers, set notation and set operations

Algebra

- Add and subtract matrices
- Recognize slope and intercept relationships
- Use information to determine whether situations are functions
- Recognize minimum and maximum values
- Understand the properties of arithmetic and geometric sequences
- Develop an initial conceptual understanding of different uses of variables
- Identify functions as linear or nonlinear and contrast their properties from tables, graphs or equations

Geometry

- Find the surface area of various geometric shapes, e.g. pyramids and cones
- Find the volume of spheres using formula
- Define objects by geometric properties
- Recognize sine, cosine and tangent relationships with respect to the right triangle

Measurement

- Draw picture to assist in solving measurement problems
- Find the size of interior and exterior angles of convex polygons using formula and protractor
- Use appropriate significant digits in calculations
- Convert temperature between Fahrenheit and Celsius

Data Analysis and Probability

- Determine the number of combinations from a given set
- Make a box and whisker plot