

K-12 Mathematics Benchmarks

By the end of the K-2 program:

Number, Number Sense and Operations Standard		
A. Use place value concepts to represent whole numbers using numerals, words and physical models. http://www.arcytech.org/java/b10blocks/description.html		
B. Recognize, classify, compare and order whole numbers. http://illuminations.nctm.org/LessonDetail.aspx?ID=U57		
C. Represent commonly used fractions using words and physical models. http://illuminations.nctm.org/LessonDetail.aspx?ID=U113		
D. Determine the value of a collection of coins and dollar bills. http://www.utdanacenter.org/mathtoolkit/instruction/lessons/1_bargains.php		
E. Make change using coins for values up to one dollar. http://illuminations.nctm.org/LessonDetail.aspx?ID=U67		
F. Count, using numerals and ordinal numbers. http://illuminations.nctm.org/LessonDetail.aspx?ID=U57		
G. Model, represent and explain addition as combining sets and counting on. http://illuminations.nctm.org/LessonDetail.aspx?ID=L26		
H. Model, represent and explain subtraction as comparison, take-away and part-to-whole. http://illuminations.nctm.org/LessonDetail.aspx?ID=L76		
I. Model, represent and explain multiplication as repeated addition, rectangular arrays and skip counting. http://illuminations.nctm.org/LessonDetail.aspx?ID=L614		
J. Model, represent and explain division as sharing equally, repeated subtraction and rectangular arrays.		

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http://www.utdanacenter.org/mathtoolkit/instruction/lessons/1_half.php		
K. Demonstrate fluency in addition facts with addends through 9 and corresponding subtractions. http://illuminations.nctm.org/LessonDetail.aspx?ID=L57		
L. Demonstrate fluency in adding and subtracting multiples of 10, and recognize combinations that make 10. http://illuminations.nctm.org/LessonDetail.aspx?ID=U67		
M. Add and subtract two-digit numbers with and without regrouping. http://www.utdanacenter.org/mathtoolkit/instruction/lessons/3_hundred.php		

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By the end of the K-2 program:

Measurement		
A. Explain the need for standard units of measure. http://illuminations.nctm.org/LessonDetail.aspx?ID=L205		
B. Select appropriate units for length, weight, volume (capacity) and time, using: <ul style="list-style-type: none"> • objects; i.e., non-standard units; • U.S. customary units: inch, foot, yard, ounce, pound, cup, quart, gallon, minute, hour, day, week and year; • metric units: centimeter, meter, gram and liter. http://www.sciencenetlinks.com/lessons.cfm?DocID=243		
C. Develop common referents for units of measure for length, weight, volume (capacity) and time to make comparisons and estimates. http://illuminations.nctm.org/LessonDetail.aspx?ID=L126		
D. Apply measurement techniques to measure length, weight and volume (capacity). http://illuminations.nctm.org/LessonDetail.aspx?ID=L69		
E. Recognize that using different units of measurement will yield different numbers for the same measurement. http://illuminations.nctm.org/LessonDetail.aspx?ID=L68		

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By the end of the K-2 program:

Geometry		
A. Describe and create plane figures: circle, rectangle, square, triangle, hexagon, trapezoid, parallelogram and rhombus, and identify them in the environment. http://illuminations.nctm.org/LessonDetail.aspx?ID=L233		
B. Describe solid objects: cube, rectangular prism, sphere, cylinder, cone and pyramid, and identify them in the environment. http://illuminations.nctm.org/LessonDetail.aspx?ID=L237		
C. Sort and compare two-dimensional figures and three-dimensional objects according to their characteristics and properties. http://illuminations.nctm.org/LessonDetail.aspx?ID=U52		
D. Identify, explain and model (superposition, copying) the concept of shapes being congruent and similar. http://illuminations.nctm.org/LessonDetail.aspx?ID=L152		
E. Recognize two- and three-dimensional objects from different positions. http://illuminations.nctm.org/LessonDetail.aspx?ID=L168		
F. Describe location, using comparative (before, after), directional (above, below), and positional (first, last) words. http://illuminations.nctm.org/LessonDetail.aspx?ID=L71		
G. Identify and draw figures with line symmetry. http://www.lessonplanspage.com/MathSymmetryByFoldingShapesAndLetters1.htm		

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By the end of the K-2 program:

Patterns, Functions and Algebra		
A. Sort, classify and order objects by size, number and other properties, and describe the attributes used. http://illuminations.nctm.org/LessonDetail.aspx?ID=L493		
B. Extend sequences of sounds and shapes or simple number patterns, and create and record similar patterns. http://illuminations.nctm.org/LessonDetail.aspx?ID=L155		
C. Create and extend patterns, and describe the rule in words. http://illuminations.nctm.org/LessonDetail.aspx?ID=L495		
D. Model problem situations, using objects, pictures, numbers and other symbols. http://illuminations.nctm.org/LessonDetail.aspx?ID=L104		
E. Solve open sentences and explain strategies. http://illuminations.nctm.org/LessonDetail.aspx?ID=L167		
G. Represent an unknown quantity as a variable using a symbol, such as \square , Δ , O . http://illuminations.nctm.org/LessonDetail.aspx?ID=U47		
H. Describe and compare qualitative and quantitative changes. http://www.pbs.org/teachers/mathline/lessonplans/atmp/tree/tree_procedure.shtml		

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By the end of the K-2 program:

Data Analysis and Probability		
A. Pose questions and gather data about everyday situations and familiar objects. http://illuminations.nctm.org/LessonDetail.aspx?ID=L110		
B. Sort and classify objects by attributes, and organize data into categories in a simple table or chart. http://illuminations.nctm.org/LessonDetail.aspx?ID=L111		
C. Represent data using objects, picture graphs and bar graphs. http://illuminations.nctm.org/LessonDetail.aspx?ID=L196		
D. Describe the probability of chance events as more, less or equally likely to occur. http://illuminations.nctm.org/LessonDetail.aspx?ID=L112		

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By the end of the K-2 program:

Mathematical Processes		
A. Use a variety of strategies to understand problem situations; e.g., discussing with peers, stating problems in own words, modeling problems with diagrams or physical materials, identifying a pattern.		
B. Identify and restate in own words the question or problem and the information needed to solve the problem.		
C. Generate alternative strategies to solve problems.		
D. Evaluate the reasonableness of predictions, estimations and solutions.		
E. Explain to others how a problem was solved.		
F. Draw pictures and use physical models to represent problem situations and solutions.		
G. Use invented and conventional symbols and common language to describe a problem situation and solution.		
H. Recognize the mathematical meaning of common words and phrases, and relate everyday language to mathematical language and symbols.		
I. Communicate mathematical thinking by using everyday language and appropriate mathematical language.		

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By the end of the 3-4 program:

Number, Number Sense and Operations Standard	3 rd - 05 -09	3 rd - 10 test	4 th - 05 -09	4 th - 10 test
A. Use place value structure of the base-ten number system to read, write, represent and compare whole numbers and decimals. http://illuminations.nctm.org/LessonDetail.aspx?ID=L226	3	2	5	1
B. Recognize and generate equivalent representations for whole numbers, fractions and decimals. http://illuminations.nctm.org/LessonDetail.aspx?ID=L339	4	2	4	1
C. Represent commonly used fractions and mixed numbers using words and physical models. http://illuminations.nctm.org/LessonDetail.aspx?ID=L345	3	1	2	1
D. Use models, points of reference and equivalent forms of commonly used fractions to judge the size of fractions and to compare, describe and order them. http://illuminations.nctm.org/LessonDetail.aspx?ID=L337	2	2	3	1
E. Recognize and classify numbers as prime or composite and list factors. http://illuminations.nctm.org/LessonDetail.aspx?ID=L620	3	0	4	2
F. Count money and make change using both coins and paper bills. http://www.funbrain.com/cashreg/index.html	3	1	2	1
G. Model and use commutative and associative properties for addition and multiplication. http://illuminations.nctm.org/LessonDetail.aspx?ID=L301	4	1	0	0
H. Use relationships between operations, such as subtraction as the inverse of addition and division as the inverse of multiplication. http://illuminations.nctm.org/LessonDetail.aspx?ID=L41	3	2	1	0
I. Demonstrate fluency in multiplication facts with factors through 10 and corresponding divisions. http://illuminations.nctm.org/LessonDetail.aspx?ID=U100	2	1	1	1
J. Estimate the results of whole number computations using a variety of strategies, and judge the reasonableness. http://illuminations.nctm.org/LessonDetail.aspx?ID=L243	5	1	5	2
K. Analyze and solve multi-step problems involving addition, subtraction, multiplication and division of whole numbers. http://www.pbs.org/teachersource/mathline/lessonplans/esmp/apple/apple_procedure.shtm	3	1	5	1
L. Use a variety of methods and appropriate tools (mental math, paper and pencil, calculators) for computing with whole numbers. http://illuminations.nctm.org/LessonDetail.aspx?ID=U115	8	0	3	2
M. Add and subtract commonly used fractions with like denominators and decimals, using model and paper and pencil. http://math.rice.edu/~lanius/fractions/index.html	0	0	3	1

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By the end of the 3-4 program:

Measurement	3 rd - 05 -09	3 rd - 10 test	4 th - 05 -09	4 th - 10 test
A. Select appropriate units for perimeter, area, weight, volume (capacity), time and temperature, using: <ul style="list-style-type: none"> • objects of uniform size; • U.S. customary units; e.g., mile, square inch, cubic inch, second, degree Fahrenheit, and other units as appropriate; • metric units; e.g., millimeter, kilometer, square centimeter, kilogram, cubic centimeter, degree Celsius, and other units as appropriate. http://www.pbs.org/teachersource/mathline/lessonplans/esmp/ittakesten/ittakesten_procedure.shtm	7	1	5	2
B. Know that the number of units is inversely related to the size of the unit for any item being measured. http://illuminations.nctm.org/LessonDetail.aspx?ID=L194	0	0	3	1
C. Develop common referents for units of measure for length, weight, volume (capacity) and time to make comparisons and estimates. http://illuminations.nctm.org/LessonDetail.aspx?ID=L203	8	1	5	1
D. Identify appropriate tools and apply counting techniques for measuring side lengths, perimeter and area of squares, rectangles, and simple irregular two-dimensional shapes, volume of rectangular prisms, and time and temperature. http://illuminations.nctm.org/LessonDetail.aspx?ID=L240	13	2	6	3
E. Tell time to the nearest minute. http://www.time-for-time.com/interactive.htm	5	1	0	0

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By the end of the 3-4 program:

Geometry and Spatial Sense	3 rd - 05 -09	3 rd - 10 test	4 th - 05 -09	4 th - 10 test
A. Provide rationale for groupings and comparisons of two-dimensional figures and three-dimensional objects. http://illuminations.nctm.org/LessonDetail.aspx?ID=L350	6	1	4	1
B. Describe and identify points, lines and planes in the environment.	0	0	4	2
C. Describe and identify intersecting, parallel and perpendicular lines or segments in the environment.	0	0	0	1
D. Identify and draw right, obtuse, acute and straight angles. http://www.figurethis.org/challenges/c10/challenge.htm	6	2	1	1
E. Use attributes to describe, classify and sketch plane figures and build solid objects. http://www.pbs.org/teachersource/mathline/lessonplans/esmp/mirror/mirror_procedure.shtm	9	3	3	1
F. Develop definitions of classes of shapes. http://illuminations.nctm.org/LessonDetail.aspx?ID=L350	0	0	3	1
G. Find and name locations in coordinate systems. http://illuminations.nctm.org/LessonDetail.aspx?ID=L280	2	1	3	1
H. Identify and describe line and rotational symmetry in two-dimensional shapes and designs. http://illuminations.nctm.org/LessonDetail.aspx?ID=L307	3	2	1	0
I. Describe, identify and model reflections, rotations and translations, using physical materials. http://illuminations.nctm.org/LessonDetail.aspx?ID=L310	1	0	1	0
J. Describe a motion or series of transformations that show two shapes are congruent. http://standards.nctm.org/document/eexamples/chap4/4.4/index.htm	0	0	3	1

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By the end of the 3-4 program:

Patterns, Functions and Algebra	3 rd - 05 - 09	3 rd - 10 test	4 th - 05 - 09	4 th - 10 test
A. Analyze and extend patterns, and describe the rule in words. http://illuminations.nctm.org/LessonDetail.aspx?ID=L303	9	2	6	3
B. Use patterns to make predictions, identify relationships, and solve problems. http://www.pbs.org/teachersource/mathline/lessonplans/atmp/lens351/lens351_procedure.shtm	4	1	5	1
C. Write and solve open sentences and explain strategies. http://www.pbs.org/teachersource/mathline/lessonplans/atmp/lens351/lens351_procedure.shtm	6	1	2	1
D. Represent an unknown quantity as a variable using a symbol, including letters. http://www.pbs.org/teachersource/mathline/lessonplans/atmp/lens351/lens351_procedure.shtm	3	0	2	0
E. Use variables to create and solve equations representing problem situations. http://www.pbs.org/teachersource/mathline/lessonplans/atmp/lens351/lens351_procedure.shtm	5	2	3	1
F. Construct and use a table of values to solve problems associated with mathematical relationships. http://illuminations.nctm.org/LessonDetail.aspx?ID=L317	5	1	3	1
G. Describe how a change in one variable affects the value of a related variable. http://www.pbs.org/teachersource/mathline/lessonplans/msmp/fillerup/fillerup_procedure.shtm	2	1	4	1

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By the end of the 3-4 program:

Data Analysis and Probability	3 rd - 05 - 09	3 rd - 10 test	4 th - 05 - 09 test	4 th - 10 test
A. Gather and organize data from surveys and classroom experiments, including data collected over a period of time. http://illuminations.nctm.org/LessonDetail.aspx?ID=L368	0	1	3	1
B. Read and interpret tables, charts, graphs (bar, picture, line, line plot), and timelines as sources of information, identify main idea, draw conclusions, and make predictions. http://illuminations.nctm.org/LessonDetail.aspx?ID=L297	5	1	6	2
C. Construct charts, tables and graphs to represent data, including picture graphs, bar graphs, line graphs, line plots and Venn diagrams. http://illuminations.nctm.org/LessonDetail.aspx?ID=L24	3	1	3	1
D. Read, interpret and construct graphs in which icons represent more than a single unit or intervals greater than one; e.g., each Ⓢ = 10 bicycles or the intervals on an axis are multiples of 10. http://illuminations.nctm.org/LessonDetail.aspx?ID=L198	4	2	3	1
E. Describe data using mode, median and range. http://illuminations.nctm.org/LessonDetail.aspx?ID=L522	3	1	5	1
F. Conduct a simple probability experiment and draw conclusions about the likelihood of possible outcomes. http://www.pbs.org/teachersource/mathline/lessonplans/esmp/chances/chances2_procedure.shtm	4	1	5	1
G. Identify and represent possible outcomes, such as arrangements of a set of up to four members and possible combinations from several sets, each containing 2 or 3 members. http://illuminations.nctm.org/LessonDetail.aspx?ID=L320	2	0	3	0
H. Use the set of possible outcomes to describe and predict events. http://illuminations.nctm.org/LessonDetail.aspx?ID=L296	2	1	1	1

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By the end of the 3-4 program:

Mathematical Processes		
A. Apply and justify the use of a variety of problem-solving strategies; e.g., make an organized list, guess and check.		
B. Use an organized approach and appropriate strategies to solve multi-step problems.		
C. Interpret results in the context of the problem being solved; e.g., the solution must be a whole number of buses when determining the number of buses necessary to transport students.		
D. Use mathematical strategies to solve problems that relate to other curriculum areas and the real world; e.g., use a timeline to sequence events; use symmetry in artwork.		
E. Link concepts to procedures and to symbolic notation; e.g., model 3×4 with a geometric array, represent one-third by dividing an object into three equal parts.		
F. Recognize relationships among different topics within mathematics; e.g., the length of an object can be represented by a number.		
G. Use reasoning skills to determine and explain the reasonableness of a solution with respect to the problem situation.		
H. Recognize basic valid and invalid arguments, and use examples and counter examples, models, number relationships, and logic to support or refute.		
I. Represent problem situations in a variety of forms (physical model, diagram, in words or symbols), and recognize when some ways of representing a problem may be more helpful than others.		
J. Read, interpret, discuss and write about mathematical ideas and concepts using both everyday and mathematical language.		
K. Use mathematical language to explain and justify mathematical ideas, strategies and solutions.		

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By the end of the 5-7 program:

Number, Number Sense and Operations Standard	05-09 5 th	10 test 5 th	05-09 6 th	10 test 6 th	05-09 7 th	10 test 7 th
A. Represent and compare numbers less than 0 through familiar applications and extending the number line. http://www.funbrain.com/linejump/index.html	4	1	0	0	0	0
B. Compare, order and convert among fractions, decimals and percents. http://illuminations.nctm.org/LessonDetail.aspx?ID=L252	6	1	0	0	0	0
C. Develop meaning for percents, including percents greater than 100 and less than 1. http://illuminations.nctm.org/LessonDetail.aspx?ID=L249	0	0	3	1	0	0
D. Use models and pictures to relate concepts of ratio, proportion and percent. http://illuminations.nctm.org/LessonDetail.aspx?ID=L249	6	1	6	3	0	0
E. Use order of operations, including use of parenthesis and exponents to solve multi-step problems, and verify and interpret the results. http://math.rice.edu/~lanius/pro/power.html	7	2	5	1	7	2
F. Apply number system properties when performing computations.	2	1	0	0	0	0
G. Apply and explain the use of prime factorizations, common factors, and common multiples in problem situations. http://illuminations.nctm.org/LessonDetail.aspx?ID=L274	0	0	5	2	0	0
H. Use and analyze the steps in standard and non-standard algorithms for computing with fractions, decimals and integers. http://www.nytimes.com/learning/teachers/lessons/20021003thursday.html http://math.rice.edu/~lanius/fractions/index.html	3	1	5	1	13	1
I. Use a variety of strategies, including proportional reasoning, to estimate, compute, solve and explain solutions to problems involving integers, fractions, decimals and percents. http://illuminations.nctm.org/LessonDetail.aspx?ID=L264 http://illuminations.nctm.org/LessonDetail.aspx?ID=L367	12	4	12	3	15	5

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By the end of the 5-7 program:

Measurement	05-09 5 th	10 test 5 th	05-09 6 th	10 test 6 th	05-09 7 th	10 test 7 th
<p>A. Select appropriate units to measure angles, circumference, surface area, mass and volume, using:</p> <ul style="list-style-type: none"> • U.S. customary units; e.g., degrees, square feet, pounds, and other units as appropriate; • metric units; e.g., square meters, kilograms and other units as appropriate. <p>http://www.pbs.org/teachersource/mathline/lessonplans/atmp/blazing/blazing_procedure.shtm</p>	4	1	0	1	4	2
<p>B. Convert units of length, area, volume, mass and time within the same measurement system.</p> <p>http://illuminations.nctm.org/LessonDetail.aspx?ID=U115</p> <p>http://www.pbs.org/teachersource/mathline/lessonplans/msmp/noses/noses_procedure.shtm</p>	7	2	0	0	3	1
<p>C. Identify appropriate tools and apply appropriate techniques for measuring angles, perimeter or circumference and area of triangles, quadrilaterals, circles and composite shapes, and surface area and volume of prisms and cylinders.</p> <p>http://illuminations.nctm.org/LessonDetail.aspx?ID=L240</p>	6	1	8	1	5	2
<p>D. Select a tool and measure accurately to a specified level of precision.</p> <p>http://www.pbs.org/teachersource/mathline/lessonplans/atmp/newheights/newheights_procedure.shtm</p>	2	0	0	0	4	2
<p>E. Use problem solving techniques and technology as needed to solve problems involving length, weight, perimeter, area, volume, time and temperature.</p> <p>http://illuminations.nctm.org/LessonDetail.aspx?ID=L278</p>	3	2	3	1	2	0
<p>F. Analyze and explain what happens to area and perimeter or surface area and volume when the dimensions of an object are changed.</p> <p>http://illuminations.nctm.org/LessonDetail.aspx?ID=L194</p>	0	0	6	2	5	1
<p>G. Understand and demonstrate the independence of perimeter and area for two-dimensional shapes and of surface area and volume for three-dimensional shapes.</p> <p>http://www.shodor.org/interactivate/lessons/sa_vol.html</p>	3	1	5	1	3	1

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By the end of the 5-7 program:

Geometry and Spatial Sense	05-09 5 th	10 test 5 th	05-09 6 th	10 test 6 th	05-09 7 th	10 test 7 th
A. Identify and label angle parts and the regions defined within the plane where the angle resides.	4	1	4	3	0	0
B. Draw circles, and identify and determine the relationships among the radius, diameter, center and circumference. http://mathforum.org/alejandre/circles.html	5	1	0	0	0	0
C. Specify locations and plot ordered pairs on a coordinate plane. http://illuminations.nctm.org/LessonDetail.aspx?ID=L280	3	1	0	0	0	0
D. Identify, describe and classify types of line pairs, angles, two-dimensional figures and three-dimensional objects using their properties. http://illuminations.nctm.org/LessonDetail.aspx?ID=L350	5	1	8	2	3	1
E. Use proportions to express relationships among corresponding parts of similar figures. http://www.eduref.org/cgi-bin/printlessons.cgi/Virtual/Lessons/Mathematics/Measurement/MEA0011.html	0	1	0	0	5	1
F. Describe and use the concepts of congruence, similarity and symmetry to solve problems. http://illuminations.nctm.org/LessonDetail.aspx?ID=U125	2	1	4	1	5	1
G. Describe and use properties of triangles to solve problems involving angle measures and side lengths of right triangles. http://cnets.iste.org/students/pf/pf_get_it_right.html	4	1	1	0	5	1
H. Predict and describe results (size, position, orientation) of transformations of two-dimensional figures. http://mathforum.org/pubs/boxer/tess.html	0	0	2	1	4	1
I. Identify and draw three-dimensional objects from different views (top, side, front and perspective). http://illuminations.nctm.org/LessonDetail.aspx?ID=U122	3	1	3	1	2	1
J. Apply properties of equality and proportionality to solve problems involving congruent or similar figures; e.g., create a scale drawing. http://www.pbs.org/teachersource/mathline/lessonplans/msmp/tiling/tiling_procedure.shtm	3	1	2	0	5	2

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By the end of the 5-7 program:

Patterns, Functions and Algebra	05-09 5 th	10 test 5 th	05-09 6 th	10 test 6 th	05-09 7 th	10 test 7 th
A. Describe, extend and determine the rule for patterns and relationships occurring in numeric patterns, computation, geometry, graphs and other applications. http://illuminations.nctm.org/LessonDetail.aspx?ID=L303	3	2	4	1	1	1
B. Represent, analyze and generalize a variety of patterns and functions with tables, graphs, words and symbolic rules. http://www.pbs.org/teachersource/mathline/lessonplans/atmp/call/call_procedure.shtm	3	1	1	0	6	1
C. Use variables to create and solve equations and inequalities representing problem situations. http://www.pbs.org/teachersource/mathline/lessonplans/atmp/call/call_procedure.shtm	6	3	2	2	0	0
D. Use symbolic algebra to represent and explain mathematical relationships. http://illuminations.nctm.org/index_d.aspx?id=276	0	0	2	0	2	1
E. Use rules and variables to describe patterns, functions and other relationships. http://www.pbs.org/teachersource/mathline/lessonplans/atmp/mixitup/mixitup_procedure.shtm	3	1	4	1	3	1
F. Use representations, such as tables, graphs and equations, to model situations and to solve problems, especially those that involve linear relationships. http://www.pbs.org/teachersource/mathline/lessonplans/atmp/hoptoit/hoptoit_procedure.shtm	5	1	1	0	3	1
G. Write, simplify and evaluate algebraic expressions. http://www.bced.gov.bc.ca/careers/aa/lessons/aom6.htm	0	0	2	2	3	1
H. Solve linear equations and inequalities symbolically, graphically and numerically. http://www.pbs.org/teachersource/mathline/lessonplans/hsmp/yoyo/yoyo_procedure.shtm	0	0	3	1	2	1
I. Explain how inverse operations are used to solve linear equations. http://ohiorc.org/orc_redirect.aspx?Url=http%3a%2f%2ffiler.weblogger.com%2fearlyalgebraManilaWebsite%2fclasses%2fLesson02.pdf	0	0	0	0	0	1
J. Use formulas in problem-solving situations. http://www.pbs.org/teachersource/mathline/lessonplans/msmp/awchute/awchute_procedure.shtm	0	0	2	1	4	1
K. Graph linear equations and inequalities. http://math.rice.edu/~lanius/Algebra/rentacar.html	1	1	0	1	4	1
L. Analyze functional relationships, and explain how a change in one quantity results in a change in the other. http://www.pbs.org/teachersource/mathline/lessonplans/atmp/dripdrop/dripdrop_procedure.shtm	2	1	2	1	4	1
M. Approximate and interpret rates of change from graphical and numerical data. http://illuminations.nctm.org/LessonDetail.aspx?ID=L254	0	0	4	1	0	1

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By the end of the 5-7 program:

Data Analysis and Probability	05-09 5 th	10 - 5 th	05-09 6 th	10 - 6 th	05-09 7 th	10 - 7 th
A. Read, create and use line graphs, histograms, circle graphs, box-and-whisker plots, stem-and-leaf plots, and other representations when appropriate. http://illuminations.nctm.org/LessonDetail.aspx?ID=L368	5	1	6	1	6	2
B. Interpret data by looking for patterns and relationships, draw and justify conclusions, and answer related questions. http://www.sciencenetlinks.com/lessons.cfm?DocID=254	0	0	1	0	2	1
C. Evaluate interpretations and conclusions as additional data are collected, modify conclusions and predictions, and justify new findings. http://illuminations.nctm.org/index_d.aspx?id=297	1	0	0	0	1	0
D. Compare increasingly complex displays of data, such as multiple sets of data on the same graph. http://www.pbs.org/teachersource/mathline/lessonplans/msmp/wetheads/wetheads_procedure.shtm	2	1	3	0	0	1
E. Collect, organize, display and interpret data for a specific purpose or need. http://illuminations.nctm.org/LessonDetail.aspx?ID=L370	3	1	5	3	2	2
F. Determine and use the range, mean, median and mode to analyze and compare data, and explain what each indicates about the data. http://www.hsor.org/modules.cfm?name=Torn_Shirts_Inc	4	1	3	1	4	2
G. Evaluate conjectures and predictions based upon data presented in tables and graphs, and identify misuses of statistical data and displays. http://www.sciencenetlinks.com/lessons.cfm?DocID=108	0	0	5	2	3	1
H. Find all possible outcomes of simple experiments or problem situations, using methods such as lists, arrays and tree diagrams. http://www.pbs.org/teachersource/mathline/lessonplans/esmp/chances/chances2_procedure.shtm	2	1	0	0	3	2
I. Describe the probability of an event using ratios, including fractional notation. http://www.pbs.org/teachersource/mathline/lessonplans/esmp/chances/chances_procedure.shtm	2	0	0	0	3	1
J. Compare experimental and theoretical results for a variety of simple experiments. http://www.pbs.org/teachersource/mathline/lessonplans/msmp/smithville/smithville_procedure.shtm	4	1	1	1	1	0
K. Make and justify predictions based on experimental and theoretical probabilities. http://www.pbs.org/teachersource/mathline/lessonplans/msmp/fantasy/fantasy2_procedure.shtm	2	1	2	1	4	1

K-12 Mathematics Benchmarks

By the end of the 5-7 program:

Mathematical Processes		
A. Clarify problem-solving situation and identify potential solution processes; e.g., consider different strategies and approaches to a problem, restate problem from various perspectives.		
B. Apply and adapt problem-solving strategies to solve a variety of problems, including unfamiliar and non-routine problem situations.		
C. Use more than one strategy to solve a problem, and recognize there are advantages associated with various methods.		
D. Recognize whether an estimate or an exact solution is appropriate for a given problem situation.		
F. Use deductive thinking to construct informal arguments to support reasoning and to justify solutions to problems.		
G. Use inductive thinking to generalize a pattern of observations for particular cases, make conjectures, and provide supporting arguments for conjectures.		
H. Relate mathematical ideas to one another and to other content areas; e.g., use area models for adding fractions, interpret graphs in reading, science and social studies.		
I. Use representations to organize and communicate mathematical thinking and problem solutions.		
J. Select, apply, and translate among mathematical representations to solve problems; e.g., representing a number as a fraction, decimal or percent as appropriate for a problem.		
K. Communicate mathematical thinking to others and analyze the mathematical thinking and strategies of others.		
L. Recognize and use mathematical language and symbols when reading, writing and conversing with others.		

Notes:

K-12 Mathematics Benchmarks

By the end of the 8-10 program:

Number, Number Sense and Operations Standard	05 - 09 8 th	2010 8 th	05 - 08 10 th	2009 10 th
A. Use scientific notation to express large numbers and numbers less than one. http://illuminations.nctm.org/LessonDetail.aspx?ID=L376	3	1	3	1
B. Identify subsets of the real number system.	5	1	2	0
C. Apply properties of operations and the real number system, and justify when they hold for a set of numbers.	4	1	1	1
D. Connect physical, verbal and symbolic representations of integers, rational numbers and irrational numbers. http://www.bced.gov.bc.ca/careers/aa/lessons/aom14.htm	0	0	3	0
E. Compare, order and determine equivalent forms of real numbers.	2	0	2	1
F. Explain the effects of operations on the magnitude of quantities. http://standards.nctm.org/document/eexamples/chap6/6.1/index.htm	3	1	2	0
G. Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. http://www.pbs.org/teachersource/mathline/lessonplans/msmp/somethingfishy/somethingfishy_procedure.shtm	9	1	6	2
H. Find the square root of perfect squares, and approximate the square root of non-perfect squares. http://illuminations.nctm.org/LessonDetail.aspx?ID=L620	4	0	2	0
I. Estimate, compute and solve problems involving scientific notation, square roots and numbers with integer exponents. http://school.discovery.com/lessonplans/programs/scale/index.html	3	2	3	1

K-12 Mathematics Benchmarks

By the end of the 8-10 program:

Measurement	05-09 8 th	2010 8 th	05-08 10 th	2009 10 th
A. Solve increasingly complex non-routine measurement problems and check for reasonableness of results. http://www.pbs.org/teachersource/mathline/lessonplans/hsmp/mystery/mystery_procedure.shtm	2	2	2	0
B. Use formulas to find surface area and volume for specified three-dimensional objects accurate to a specified level of precision. http://cnets.iste.org/students/pf/pf_design_bedroom.html	5	2	5	2
C. Apply indirect measurement techniques, tools and formulas, as appropriate, to find perimeter, circumference and area of circles, triangles, quadrilaterals and composite shapes, and to find volume of prisms, cylinders, and pyramids. http://www.figurethis.org/challenges/c03/challenge.htm	7	1	4	2
D. Use proportional reasoning and apply indirect measurement techniques, including right triangle trigonometry and properties of similar triangles, to solve problems involving measurements and rates. http://illuminations.nctm.org/LessonDetail.aspx?ID=L515	8	1	4	1
E. Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision. http://www.shodor.org/interactivate/lessons/estimate.html	5	0	2	1
F. Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions. http://www.hsor.org/modules.cfm?name=Outel_Semiconductor (Click on “student activity.”)	2	1	0	1

Notes:

K-12 Mathematics Benchmarks

By the end of the 8-10 program:

Geometry and Spatial Sense	05 - 09 8 th	2010 8 th	05-08 10 th	2009 10 th
A. Formally define geometric figures. http://math.rice.edu/~lanius/frac/index.html	2	1	1	0
B. Describe and apply the properties of similar and congruent figures; and justify conjectures involving similarity and congruence. http://www.shodor.org/interactivate/lessons/frac1.html	4	1	3	1
C. Recognize and apply angle relationships in situations involving intersecting lines, perpendicular lines and parallel lines.	5	1	3	1
D. Use coordinate geometry to represent and examine the properties of geometric figures. http://www.learner.org/teacherslab/math/geometry/shape/taxicab/index.html	6	4	4	1
E. Draw and construct representations of two- and three-dimensional geometric objects using a variety of tools, such as straightedge, compass and technology. http://www.chevron.com/about/programs/edawards/pdf/ConicSections.pdf	2	1	2	1
F. Represent and model transformations in a coordinate plane and describe the results. http://www.shodor.org/interactivate/lessons/trans.html	3	1	2	2
G. Prove or disprove conjectures and solve problems involving two- and three-dimensional objects represented within a coordinate system. http://www.learner.org/teacherslab/math/geometry/shape/taxicab/index.html	0	0	1	0
H. Establish the validity of conjectures about geometric objects, their properties and relationships by counter-example, inductive and deductive reasoning, and critiquing arguments made by others. http://illuminations.nctm.org/LessonDetail.aspx?ID=U139	2	1	0	0
I. Use right triangle trigonometric relationships to determine lengths and angle measures. http://illuminations.nctm.org/LessonDetail.aspx?ID=L383	0	0	1	1

Notes:

K-12 Mathematics Benchmarks

By the end of the 8-10 program:

Patterns, Functions and Algebra	05-09 8 th	2010 8 th	05-08 10 th	2009 10 th
A. Generalize and explain patterns and sequences in order to find the next term and the n th term. http://standards.nctm.org/document/eexamples/chap7/7.2/index.htm	3	0	3	2
B. Identify and classify functions as linear or nonlinear, and contrast their properties using tables, graphs or equations. http://www.thirteen.org/edonline/lessons/graphing/index.html	5	2	3	0
C. Translate information from one representation (words, table, graph or equation) to another representation of a relation or function. http://illuminations.nctm.org/LessonDetail.aspx?ID=U142	6	1	4	1
D. Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations. http://www.pbs.org/teachersource/mathline/lessonplans/hsmp/toothpicks/toothpicks_procedure.shtm	3	2	3	2
E. Analyze and compare functions and their graphs using attributes, such as rates of change, intercepts and zeros http://illuminations.nctm.org/LessonDetail.aspx?ID=U137	3	1	3	1
F. Solve and graph linear equations and inequalities. http://www.hsor.org/modules.cfm?name=Pizza_Pi	2	1	3	2
G. Solve quadratic equations with real roots by graphing, formula and factoring. http://archives.math.utk.edu/visual.calculus/0/index.html	3	1	1	0
H. Solve systems of linear equations involving two variables graphically and symbolically. http://www.hsor.org/modules.cfm?name=High_Step_Shoes	4	1	3	0
I. Model and solve problem situations involving direct and inverse variation. http://www.pbs.org/teachersource/mathline/lessonplans/hsmp/stressedtobreaking/stressedtobreaking_procedure.shtm	1	0	2	1
J. Describe and interpret rates of change from graphical and numerical data. http://illuminations.nctm.org/LessonDetail.aspx?ID=L572	5	2	2	0

Notes:

K-12 Mathematics Benchmarks

By the end of the 8-10 program:

Data Analysis and Probability	05 - 09 8 th	2010 8 th	05-08 10 th	2009 10 th
A. Create, interpret and use graphical displays and statistical measures to describe data; e.g., box-and-whisker plots, histograms, scatterplots, measures of center and variability. http://www.hsor.org/modules.cfm?name=Frankfurter_High	8	1	2	2
B. Evaluate different graphical representations of the same data to determine which is the most appropriate representation for an identified purpose.	3	1	3	1
C. Compare the characteristics of the mean, median and mode for a given set of data, and explain which measure of center best represents the data. http://standards.nctm.org/document/eexamples/chap6/6.6/index.htm	1	1	2	0
D. Find, use and interpret measures of center and spread, such as mean and quartiles, and use those measures to compare and draw conclusions about sets of data. http://illuminations.nctm.org/LessonDetail.aspx?ID=L449	6	1	3	1
E. Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collection and analysis. http://www.pbs.org/teachersource/mathline/lessonplans/msmp/tunedin/tunedin_procedure.shtm	3	2	1	1
F. Construct convincing arguments based on analysis of data and interpretation of graphs. http://illuminations.nctm.org/LessonDetail.aspx?ID=L300	5	0	2	1
G. Describe sampling methods and analyze the effects of method chosen on how well the resulting sample represents the population.	0	1	3	2
H. Use counting techniques, such as permutations and combinations, to determine the total number of options and possible outcomes. http://illuminations.nctm.org/LessonDetail.aspx?ID=L386	2	1	4	1
I. Design an experiment to test a theoretical probability, and record and explain results. http://illuminations.nctm.org/LessonDetail.aspx?ID=L290	0	1	0	0
J. Compute probabilities of compound events, independent events, and simple dependent events. http://illuminations.nctm.org/LessonDetail.aspx?ID=L377	2	1	4	1
K. Make predictions based on theoretical probabilities and experimental results. http://illuminations.nctm.org/LessonDetail.aspx?ID=L585	4	2	2	1

K-12 Mathematics Benchmarks

By the end of the 8-10 program:

Mathematical Processes		
A. Formulate a problem or mathematical model in response to a specific need or situation, determine information required to solve the problem, choose method for obtaining this information, and set limits for acceptable solution.		
B. Apply mathematical knowledge and skills routinely in other content areas and practical situations.		
C. Recognize and use connections between equivalent representations and related procedures for a mathematical concept; e.g., zero of a function and the x -intercept of the graph of the function, apply proportional thinking when measuring, describing functions, and comparing probabilities.		
D. Apply reasoning processes and skills to construct logical verifications or counter-examples to test conjectures and to justify and defend algorithms and solutions.		
E. Use a variety of mathematical representations flexibly and appropriately to organize, record and communicate mathematical ideas.		
F. Use precise mathematical language and notations to represent problem situations and mathematical ideas.		
G. Write clearly and coherently about mathematical thinking and ideas.		
H. Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner.		

Notes:

K-12 Mathematics Benchmarks

By the end of 11-12 program:

Number, Number Sense and Operations Standard			Measurement		
A. Demonstrate that vectors and matrices are systems having some of the same properties of the real number system.			A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations.		
B. Develop an understanding of properties of and representations for addition and multiplication of vectors and matrices.			B. Apply various measurement scales to describe phenomena and solve problems.		
C. Apply factorials and exponents, including fractional exponents, to solve practical problems.			C. Estimate and compute areas and volume in increasingly complex problem situations.		
D. Demonstrate fluency in operations with real numbers, vectors and matrices, using mental computation or paper and pencil calculations for simple cases and technology for more complicated cases.			D. Solve problem situations involving derived measurements; e.g., density, acceleration.		
E. Represent and compute with complex numbers.					

Notes:

K-12 Mathematics Benchmarks

By the end of the 11-12 program:

Geometry and Spatial Sense			Patterns, Functions and Algebra		
A. Use trigonometric relationships to verify and determine solutions in problem situations.			A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior.		
B. Represent transformations within a coordinate system using vectors and matrices.			B. Use the quadratic formula to solve quadratic equations that have complex roots.		
			C. Use recursive functions to model and solve problems; e.g., home mortgages, annuities.		
			D. Apply algebraic methods to represent and generalize problem situations involving vectors and matrices.		

Notes:

K-12 Mathematics Benchmarks

By the end of the 11-12 program:

Data Analysis and Probability		Mathematical Processes			
A. Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators.			A. Construct algorithms for multi-step and non-routine problems.		
			B. Construct logical verifications or counter-examples to test conjectures and to justify or refute algorithms and solutions to problems.		
B. Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability.			C. Assess the adequacy and reliability of information available to solve a problem.		
			D. Select and use various types of reasoning and methods of proof.		
C. Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions.			E. Evaluate a mathematical argument and use reasoning and logic to judge its validity.		
			F. Present complete and convincing arguments and justifications, using inductive and deductive reasoning, adapted to be effective for various audiences.		
			G. Understand the difference between a statement that is verified by mathematical proof, such as a theorem, and one that is verified empirically using examples or data.		
D. Connect statistical techniques to applications in workplace and consumer situations.			H. Use formal mathematical language and notation to represent ideas, to demonstrate relationships within and among representation systems, and to formulate generalizations.		
			I. Communicate mathematical ideas orally and in writing with a clear purpose and appropriate for a specific audience.		
			J. Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretation of solution within the model, and validation to original problem situation.		

9/7/10

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