**Mathematical Processes Standard

Students use mathematical processes and knowledge to solve problems. They apply the mathematical processes as they learn content from the other mathematical standards.

Grade 2 Indicators	Grade 3 Indicators	Grade 4 Indicators
Problem Solving 1. Apply and adapt a variety of appropriate strategies to solve problems: • create a mathematical model • draw a picture • act it out • look for a pattern • guess and check • make an organized list **Reasoning and Proof** 1. Use models and logic to make conclusions. 2. Adjust models as needed. 3. Reason inductively by identifying patterns. 4. Evaluate and analyze the mathematical thinking and strategies of others orally. **Communication** 1. Use developmentally appropriate mathematical vocabulary. 2. Respond to instructions orally, visually and in writing as appropriate; e.g., tell, share, describe, demonstrate, compare, discuss, write. 3. Respond clearly with sufficient detail so that thinking can be understood. 4. Present thinking in a logical and organized in manner and explain to others how a problem was solved. **Connections** 1. Use learning from one area of mathematics to understand another. 2. Relate new and prior knowledge to make sense of new concepts being learned. 3. Make connections between mathematics and everyday life. 4. Apply a strategy or reference system that draws on	**Problem Solving** 1. Apply and adapt a variety of appropriate strategies to solve problems: • create a mathematical model • draw a picture • act it out • look for a pattern • guess and check • make an organized list • make a simpler but similar problem **Reasoning and Proof** 1. Use models and logic to make conclusions. 2. Adjust models as needed. 3. Reason inductively by identifying patterns. 4. Evaluate and analyze the mathematical thinking and strategies of others, orally and in writing. 5. Include enough detail and clarity that the reader/listener can follow the explanation. **Communication** 1. Use developmentally appropriate mathematical language and vocabulary. 2. Respond to instructions orally, visually and in writing as appropriate; e.g., tell, share, describe, demonstrate, compare, discuss, write. 3. Respond clearly with sufficient detail so that thinking can be understood. 4. Present thinking in a logical and organized in manner and explain to others how a problem was solved. 5. Read and reread all of the given information and instructions to ensure understanding; e.g., identify key information needed to solve the problem. **Connections** 1. Use learning from one area of mathematics to	**Problem Solving** 1. Apply and adapt a variety of appropriate strategies to solve problems: • create a mathematical model • draw a picture • act it out • look for a pattern • guess and check • make an organized list • make a simpler but similar problem • work backwards 2. Understand when estimation, mental arithmetic, or paper and pencil calculation is more appropriate than technology. **Reasoning and Proof** 1. Use models and logic to make conclusions. 2. Adjust models as needed. 3. Reason inductively by identifying patterns. 4. Evaluate and analyze the mathematical thinking and strategies of others, orally and in writing. 5. Include enough detail and clarity that the reader/listener can follow the explanation. 6. Make multiple trials using manipulatives, drawings or paper and pencil. **Communication** 1. Use developmentally appropriate mathematical language and vocabulary. 2. Respond to instructions orally, visually and in writing as appropriate; e.g., tell, share, describe, demonstrate, compare, discuss, write. 3. Respond clearly with sufficient detail so that thinking can be understood. 4. Present thinking in a logical and organized in manner and explain to others how a problem was

Grade 2 Indicators	Grade 3 Indicators	Grade 4 Indicators
previous learning in another context. **Representation** 1. Select an appropriate representation of a mathematical idea or situation: • physical model/manipulative • picture/drawing/diagram • numerical • geometric • graphical • table/chart 2. Understand that more than one representation can be used to appropriately represent the same mathematical idea or situation. 3. Use multiple representations, as required; e.g., table/chart, graph. **Reflection** 1. Reflect on mathematical concepts that have been learned using drawings, pictures and/or words: e.g., as a class group discussion and activity, create a simple chart to show what has been learned. 2. In a math journal reflect on mathematical concepts that have been learned using drawings, pictures and/or words given writing prompts such as: • What did you do in math today? • What did you learn in math today? • Was what you learned easy or difficult? • What did you like or dislike about today's lesson? • What are some of the math words you used today?	understand another. 2. Relate new and prior knowledge to make sense of new concepts being learned. 3. Make connections between mathematics and everyday life. 4. Apply a strategy or reference system that draws on previous learning in another context. 5. Make connections between different representations; e.g., numeric, graphical, and/or algebraic. **Representation** 1. Select an appropriate representation of a mathematical idea or situation: • physical model/manipulative • picture/drawing/diagram • numerical • geometric • graphical • table/chart • graphical organizers/Venn diagram 2. Understand that more than one representation can be used to appropriately represent the same mathematical idea or situation. 3. Use multiple representations, as required; e.g., table/chart, graph. **Reflection** 1. Reflect on mathematical concepts that have been learned using drawings, pictures and/or words: e.g., as a class group discussion and activity, create a simple classroom chart to show what has been learned. 2. In a math journal reflect on mathematical concepts that have been learned using drawings, pictures, math symbols, vocabulary, and language appropriate to the topic. Use writing prompts such as: • What did you do in math today? • What did you learn in math today? • Was what you learned easy or difficult? • What did you like or dislike about today's	solved. 5. Read and reread all of the given information and instructions to ensure understanding; e.g., identify key information needed to solve the problem. 6. Interpret and summarize information from charts and graphs providing appropriate detail; e.g., describe patterns and contrasts. **Connections** 1. Use learning from one area of mathematics to understand another. 2. Relate new and prior knowledge to make sense of new concepts being learned. 3. Make connections between mathematics and everyday life. 4. Apply a strategy or reference system that draws on previous learning in another context. 5. Make connections between different representations; e.g., numeric, graphical, and/or algebraic. **Representation** 1. Select an appropriate representation of a mathematical idea or situation: • physical model/manipulative • picture/drawing/diagram • numerical • geometric • graphical • table/chart • graphical organizers/Venn diagram 2. Understand that more than one representation can be used to appropriately represent the same mathematical idea or situation. 3. Use multiple representations, as required; e.g., table/chart, graph. 4. Understand that there may be different variations of one representation; e.g., $4s$ is the same as $s + s + s + s$. **Reflection**

Grade 2 Indicators	Grade 3 Indicators	Grade 4 Indicators
	lesson? • What are some of the math words you used today? • Describe uses for what you learned in math today.	1. Reflect on mathematical concepts that have been learned using drawings, pictures and/or words: e.g., as a class group discussion and activity, create a simple classroom chart to show what has been learned. 2. In a math journal reflect on mathematical concepts that have been learned using drawings, pictures, math symbols, vocabulary, and language appropriate to the topic. Use writing prompts such as: • What did you do in math today? • What did you learn in math today? • Was what you learned easy or difficult? • What did you like or dislike about today's lesson? • What are some of the math words you used today? • What did you not understand in math today? • Describe uses for what you learned in math today.

Numbers, Number Sense and Operations Standard

Students demonstrate number sense, including an understanding of number systems and operations and how they relate to one another. Students compute fluently and make reasonable estimates using paper and pencil, technology-supported and mental methods.

Grade 2 Indicators	Grade 3 Indicators	Grade 4 Indicators
1. Represent whole numbers 100-1,000 and describe their place value using physical models, numerals, words, and expanded notation. 2. Compare and order numerals to 100 to 1,000, using mathematical language and symbols: greater than, less than, equal to, >, <, =. 3. Recognize and classify numbers as even or odd: (0-100). 4. Identify patterns on a 100's chart and orally skip count by 10's, 5's and 2's starting from any single digit number: e.g. 1, 11, 21, 31…, 5, 15, 25, 35… 1, 6, 11, 16 …, 2, 7, 12, 17… 5. Round 2-digit and 3-digit numbers to the nearest 10 and 100. 6. Model, represent and explain addition and subtraction using manipulatives, a number line, drawing pictures and a calculator. 7. Use strategies for learning the basic addition and subtraction facts for sums to 18; e.g., counting on or counting backwards, one more or one less, two more or two less, doubles, doubles plus or minus 1, making 10, adding zero, missing addends. 8. Demonstrate fluency with addition and subtraction facts, sums to 18. 9. Add and subtract 2-digit numbers with and without regrouping. 10. Model and use the commutative property of addition using number sentences.	1. Represent whole numbers to hundred thousands place using physical models, numerals, words, and expanded notation. 2. Compare and order numbers 1,000 to 1,000,000, using mathematical language and symbols: greater than, less than, equal to, >, <, =. 3. Round 2, 3, and 4-digit numbers to the nearest 10, 100, or 1,000. 4. Add and subtract 3-digit whole numbers with and without regrouping. 5. Estimate the results of whole number addition and subtraction problems using rounding, and front end estimation, and judge the reasonableness. 6. Model, represent and explain the meaning of multiplication; e.g., repeated addition, skip counting, rectangular arrays. 7. Model, represent and explain the meaning of division; e.g., repeated subtraction, separating a large group of items into smaller equal groups. 8. Develop multiplication and division facts to the 12's. 9. Explain and use relationships between operations such as addition and subtraction are inverse operations, and multiplication and division are inverse operations; e.g., fact families. 10. Mentally compute with multiples of 10; e.g., 30 x 5, 40 x 60, 200 x 9 11. Multiply 2-digit numbers by a single digit number.	1. Represent whole numbers to hundred millions place using numerals, words, and expanded notation. 2. Compare and order numbers 1,000,000 to 100,000,000, using mathematical language and symbols: greater than, less than, equal to, >, <, =. 3. Round whole numbers to a given place up to hundred millions. 4. Add and subtract 4-digit whole numbers with and without regrouping. 5. Estimate the results of whole number addition and subtraction problems using rounding, and front end estimation, and judge the reasonableness. 6. Develop fluency multiplication and division facts to the 12's. 7. Identify and represent factors and multiples of whole numbers 1 - 100. 8. Multiply whole numbers by powers of 10 and multiples of 10. 9. Multiply whole numbers by 1 and 2-digit multipliers. 10. Divide 2, 3 and 4-digit numbers by a single digit number and by multiples of 10. 11. Interpret the meaning of remainders. 12. Estimate the results of whole number multiplication and division using rounding and compatible numbers.

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Grade 2 Indicators	Grade 3 Indicators	Grade 4 Indicators
11. Explain the relationship between operations such as subtraction is the inverse of addition; e.g., fact families to 18. 12. Model, and represent multiplication as combining equal groups and as repeated addition. 13. Model and represent division as sharing equally, and as repeated subtraction. 14. Estimate the results of whole number addition and subtraction problems, using rounding and front end estimation, and judge the reasonableness. 15. Use a variety of methods and tools to compute, including objects, mental computation, estimation, paper and pencil, and calculators. 16. Represent commonly used fractions using physical models, pictures, numerals and words: halves, thirds, fourths, sixths, eighths. 17. Identify and illustrate fractions as parts of a whole, and parts of a set of objects. 18. Compare and describe commonly used fractions using models: halves, thirds, fourths, eighths. 19. Count coin sets using any combination of coins consisting of pennies, nickels, dimes, quarters and half dollars, and write the values using a cent sign and in decimal form using a dollar sign. 20. Count money sets consisting of coins and bills up to $5.00. 21. Make change using coins and a dollar bill.	12. Divide numbers with remainders; e.g. 12 ÷ 5 =, 25 ÷ 6 (digit single quotients). 13. Divide 2 digit numbers by a single digit number, without remainders. 14. Model and use the commutative and associative properties for addition and multiplication using number sentences. 15. Represent fractions and mixed numbers using physical models, numerals, and words: 16. Compare and order commonly used fractions using physical or visual models; e.g. fraction circles or bars, number lines. 17. Explore equivalent forms of fractions found by using physical models and visual models. 18. Represent decimal numbers for tenths and hundredths using physical or visual models, numerals and words, and be able to write the fraction equivalents; e.g., 0.2, 2/10, two tenths. 19. Count money using coins and bills to ten dollars. 20. Make change using coins and bills for amounts up to $5.00. 21. Add and subtract decimals and amounts of money. 22. Explore numbers less than 0 by extending the number line and through familiar applications; e.g., temperature.	13. Identify and explain, in oral and written form, the commutative and associative properties of addition and multiplication. 14. Identify and use the distributive property to mentally find a multiplication answer; e.g., 5 x 47= (5 x 40) + (5 x 7) = 200 + 35 = 235. 15. Identify equivalent forms of fractions using visual models, and by multiplying or dividing by a fractional form of one whole; e.g. 2/3 x 4/4 = 8/12 or 16/24 ÷ 8/8 = 2/3. 16. Use models and points of reference to compare commonly used fractions; e.g., "Is 1/3 closer to 0 or 1 on a number line?" 17. Add and subtract fractions with like denominators, sums less than 1. 18. Represent decimal numbers for tenths, hundredths, and thousandths using physical or visual models, numerals, and words, and be able to identify and write the fraction equivalents; e.g., 0.235, 235/100, two hundred thirty-five thousandths. 19. Explain that ten tenths is the same as one whole in both fraction and decimal form. 20. Add and subtract decimal numbers up to thousandths place and explain how place value is related to the proper alignment of the numerals. 21. Explore numbers less than 0 by extending the number line, and through familiar applications; e.g. temperature, and owing money. 22. Solve problems involving counting money and making change using coins and bills for amounts up to $50.00. 23. Estimate the results of computations involving fractions and decimals using a variety of strategies.

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Measurement Standard

Students estimate and measure to a required degree of accuracy and precision by selecting and using appropriate units, tools and technologies.

Grade 2 Indicators	Grade 3 Indicators	Grade 4 Indicators
1. Identify and select appropriate <u>customary</u> and <u>metric</u> units for measuring <u>length</u>; <u>inches</u>, <u>feet</u>, <u>yards</u>, <u>centimeters</u>, <u>meters</u> and recognize the abbreviations. 2. Use inches and centimeters to measure length; e.g., use a ruler to measure common objects, and to draw line segments using inches, half inches, and centimeters. 3. Identify and select appropriate units of measure for customary and metric <u>capacity</u>; <u>cups</u>, <u>pints</u>, <u>quarts</u>, <u>liters</u> and recognize the abbreviations. 4. Use cups and liters to measure capacity; e.g., use a measuring cup to place 2 cups of rice in a bowl. 5. Identify and select appropriate customary and metric units for measuring weight; <u>ounces</u>, <u>pounds</u>, <u>grams</u> and recognize the abbreviations. 6. Use pounds and grams to measure weight; e.g., use a scale to weigh 50 grams of candy or 1 lb. of candy. 7. Establish personal or common referents for units of measure to make estimates and comparisons; e.g., the width of a pinky finger is about a cm, a large bottle of pop is 2 liters, a small paper clip is weighs about one gram. 8. Estimate the length, capacity and weight of common objects using customary units and metric units. 9. Tell time to <u>5 minute intervals</u> and to the <u>quarter hr</u>. using digital and analog clocks. 10. Read and record <u>temperatures</u> in both <u>Fahrenheit</u> and <u>Celsius</u> degrees.	1. Identify and select appropriate <u>customary</u> and <u>metric</u> units for measuring <u>length</u>; <u>inches</u>, <u>feet</u>, <u>yards</u>, <u>miles</u>, <u>centimeters</u>, <u>decimeters</u>, <u>meters</u> and use abbreviations. 2. Use a ruler to measure length to the nearest inch, ½ in., ¼ in., centimeter, decimeter, meter; e.g., measure common objects; draw a rectangle with a length of 2 ½ in. and a width of 3 in. 3. Identify and select appropriate <u>customary</u> and <u>metric</u> units for measuring <u>capacity</u>; <u>cups</u>, <u>pints</u>, <u>quarts</u>, <u>gallons</u>, <u>centiliters</u>, <u>deciliters</u>, <u>liters</u> and use abbreviations. 4. Use cups, pints, quarts, gallons, centiliters, liters, to measure capacity; e.g., fill a measuring cup to the ¾ cup mark. 5. Identify and select appropriate <u>customary</u> and <u>metric</u> units for measuring <u>weight</u>; <u>ounces</u>, <u>pounds</u>, <u>tons</u>, <u>grams</u>, <u>kilograms</u> and use abbreviations. 6. Use ounces, pounds, grams, and kilograms to measure weight; e.g., use a scale to weigh and compare common objects. 7. Read thermometers in both <u>Fahrenheit</u> and <u>Celsius</u> scales. 8. Establish personal or common referents for units of measure to make estimates and comparisons; a paper clip is approximately one gram, the width of a pinky finger is approximately one cm, four times around a football field is approximately one mile, the width of a doorway is approximately one yard. 9. Tell time to the nearest minute using digital and analog clocks.	1. Identify and use <u>customary</u> units and <u>metric</u> units to measure length; inches, <u>feet</u>, <u>yards</u>, <u>miles</u>, <u>millimeters</u>, <u>centimeters</u>, <u>decimeters</u>, <u>meters</u>, <u>kilometers</u>. 2. Use a ruler to measure objects and draw line segments to the nearest inch, ½ in., ¼ in., and ⅛ in. 3. Use a ruler to measure objects and draw line segments to the nearest centimeter and nearest millimeter. 4. Convert units of length within the same system; e.g., inches to feet, feet to yards, meters to centimeters, meters to millimeters, centimeters to millimeters. 5. Identify and use <u>customary</u> units and <u>metric</u> units to measure <u>capacity</u>; <u>cups</u>, <u>pints</u>, <u>quarts</u>, <u>half</u> <u>gallons</u>, <u>gallons</u>, <u>milliliters</u>, <u>centiliters</u>, <u>deciliters</u>, <u>liters</u>. 6. Convert units of capacity within the same system; e.g., cups to pints, pints to quarts, quarts to gallons, liters to milliliters, liters to centiliters, liters to deciliters. 7. Identify and use <u>customary</u> units, and <u>metric</u> units to measure weight; <u>pounds</u>, <u>ounces</u>, <u>tons</u>, <u>milligrams</u>, <u>grams</u>, <u>kilograms</u>. 8. Convert units of weight with the same system; e.g., pounds to ounces, grams to milligrams, kilograms to grams. 9. Develop and use strategies to find <u>perimeter</u> of simple shapes using string or links. 10. Identify and select appropriate units to measure perimeter – linear units; e.g., inches, feet, centimeters, meters.

Grade 2 Indicators	Grade 3 Indicators	Grade 4 Indicators
	10. Tell time using words; "before" and "after", "quarter to", "quarter after". 11. Calculate elapsed time using a clock (hrs. and half hours), and a calendar (days and weeks). 12. Demonstrate and describe perimeter as distance around a shape; area as covering a two-dimensional shape; volume as filling a three-dimensional shape. 13. Develop strategies for estimating the perimeters, areas, and volumes of regular and irregular shapes; e.g., links, tiles, cubes, grid paper.	11. Develop and use strategies to find area using tiles or a grid (graph paper); e.g., count squares to find the area of regular or irregular shapes on a grid. 12. Identify and select appropriate units to measure area – square units; e.g., square tiles, square inches, square centimeters. 13. Develop and use strategies to find volume using cubes; e.g., layer cubes in a box. 14. Identify and select appropriate units to measure volume – cubic units; e.g., cubes, cubic inches, cubic centimeters. 15. Read, record and compare temperature in degrees Fahrenheit and degrees Celsius. 16. Calculate elapsed time using a clock (15 min. and 5 min. intervals). 17. Use appropriate measuring tools and techniques to construct a figure; e.g., construct a rectangle with a length of 5¼ inches and width of 3½ inches; fill a measuring cup to the ⅜ cup mark.

Geometry and Spatial Sense Standard

Students identify, classify, compare and analyze characteristics, properties and relationships of one-, two- and three-dimensional geometric figures and objects. Students use spatial reasoning, properties of geometric objects, and transformations to analyze mathematical situations and solve problems.

Grade 2 Indicators	Grade 3 Indicators	Grade 4 Indicators
1. Identify and describe two-dimensional shapes; circle, square, rectangle, triangle, parallelogram, rhombus, and trapezoid. 2. Identify three-dimensional objects as cylinders, cones, spheres, cubes, rectangular prisms, pyramids. 3. Identify, compare, and sort three-dimensional objects according to the shape of the faces, the number of faces, number of edges, or number of vertices. 4. Investigate and predict the results of putting together and taking apart two and three-dimensional shapes. 5. Build a three-dimensional model based on an illustration or actual object using items such as legos, Lincoln logs, or wooden blocks. 6. Recognize and apply flips, slides and turns. 7. Recognize and create shapes that have symmetry. 8. Identify two-dimensional shapes as congruent (same shape and same size), or similar (same shape, different size).	1. Analyze and describe properties of two-dimensional and three-dimensional objects using terms such as vertex, edge, angle, side and face. 2. Build a three-dimensional model based on an illustration or actual object using items such as legos, Lincoln logs, or wooden blocks. 3. Identify two-dimensional shapes as congruent or similar. 4. Predict and describe the results of sliding, flipping, and turning two-dimensional shapes. 5. Draw lines of symmetry to verify symmetrical two-dimensional shapes. 6. Identify and describe right angles. 7. Use physical models, such as straws, to create different sized angles by opening and closing the sides. 8. Identify and draw angles with respect to right angles; greater than 90˚, less than 90˚, equal to 90˚. 9. Find and name locations on a labeled grid or coordinate plane.	1. Identify similarities and differences of quadrilaterals; e.g., squares, rhombuses, rectangles, parallelograms, and trapezoids. 2. Classify two and three-dimensional shapes according to their properties; e.g., develop vocabulary and definitions, compare and model plane and three-dimensional solids. 3. Identify and create shapes that show symmetry; e.g., use pattern blocks, geoboards. 4. Identify and create shapes that are similar, and shapes that are congruent; e.g. use tangrams, pattern blocks, and geoboards. 5. Identify angles as right, acute or obtuse. 6. Model and describe intersecting, parallel and perpendicular lines and line segments. 7. Identify points, lines, and planes in the environment. 8. Describe and define point, line, line segment, ray, and plane. 9. Describe, identify and model reflections (flips), rotations (turns) and translations (slides) using concrete materials; e.g. using geoboards. 10. Specify locations and plot ordered pairs on a coordinate plane, using the first quadrant.

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Geometry and Spatial Sense – Standard D
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Patterns, Functions and Algebra Standard

Students use patterns, relations and functions to model, represent and analyze problem situations that involve variable quantities, Students analyze, model and solve problems using various representations such as tables, graphs and equations.

Grade 2 Indicators	Grade 3 Indicators	Grade 4 Indicators
1. Extend simple number patterns, both repeating and growing patterns. 2. Use patterns to make generalizations and predictions; e.g., determine a missing element in a pattern. 3. Create new patterns with consistent rules or plans. 4. Describe the rule or general plan of existing patterns. 5. Model a problem situation using objects, pictures, numbers and other symbols. 6. Understand equivalence and extend the concept to situations involving symbols; e.g., 4 + 5 = 9 and 9 = 4 + 5, and 4 + 5 = 3 + 6 = Δ + □. 7. Use symbols to represent unknown quantities and identify values for symbols in an expression or equation using addition and subtraction; e.g., 7 + □ = 10; Δ - 2 = 5. 8. Describe qualitative change; e.g., a student growing taller. 9. Describe quantitative change; e.g., a student growing two inches in one year.	1. Analyze and extend increasing arithmetic (+) patterns, with or without a calculator, and describe the rules in words; e.g., 4,7,10,13,…; 6,11,16,21,… 2. Analyze and extend increasing geometric (x) patterns, with or without a calculator and describe the rule in words; e.g., 1,2,4,8,…; 1,3,9,27,… 3. Use patterns to make predictions, identify relationships, and solve problems. 4. Write, solve, and explain simple mathematical statements, such as 7 + □ > 8 or Δ + 8 = 12. 5. Create tables to discover patterns and rules; e.g., input/output tables. 6. Model problem situations using objects, pictures, tables, numbers, letters and other symbols. 7. Express mathematical relationships as equations and inequalities. 8. Identify and describe quantitative changes, especially those involving addition and subtraction; e.g., the heights of water in a glass becoming 1 centimeter lower each week due to evaporation. 9. Investigate ways a change in one variable relates to a change in a second variable by simulating an input/output machine; e.g., "x +12 machine" means if 8 goes in 20 comes out, or 1 sandwich costs $0.99, so 2 cost _____?	1. Analyze and extend increasing or decreasing arithmetic (+ and -), and geometric patterns (x and ÷) with or without a calculator, and describe the rules in words. 2. Analyze, represent and describe patterns, functions and mathematical relationships using words, tables and graphs. 3. Use patterns to make predictions, identify relationships, and solve problems. 4. Represent the idea of a variable as an unknown quantity; e.g., use a letter or symbol. 5. Use rules and variables to describe patterns and other mathematical relationships 6. Express mathematical relationships as equations and inequalities. 7. Construct a table of values as a tool to solve problems associated with mathematical or functional relationships. 8. Investigate ways a change in one variable relates to a change in a second variable by simulating an input/output machine; e.g., "x +12 machine" means if 8 goes in 20 comes out, or 1 sandwich costs $0.99, so 2 cost _____ 9. Describe how change in one variable affects the value of a related variable; e.g., as one increases the other increases, or as one increases the other decreases.

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Patterns, Functions and Algebra – Standard E
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Data Analysis and Probability Standard

Students pose questions and collect, organize, represent, interpret and analyze data to answer those questions. Students develop and evaluate inferences, predictions and arguments that are based on data.

Grade 2 Indicators	Grade 3 Indicators	Grade 4 Indicators
1. Pose questions and collect data through <u>observations</u>, <u>interviews</u> and <u>surveys</u>. 2. Organize data into <u>tables</u> and <u>charts</u> using <u>tally marks</u>. 3. Display collected data in picture graphs with units of 1 or 2 and <u>bar graphs</u> and <u>line plots</u> with intervals of 1 or 2. 4. Recognize that data may vary from one <u>population</u> to another; e.g., favorite foods or favorite TV shows of parents and students. 5. Read, interpret, compare, and make predictions from data represented in <u>charts</u>, <u>tables</u>, <u>bar graphs</u>, <u>picture graphs</u> and <u>line plots</u>. 6. Write sentences to describe and compare categories of data represented in a chart or graph, and make statements about the data as a whole. 7. Read, use and construct <u>time lines</u> to display a <u>sequence</u> of events. 8. Identify <u>untrue</u> or <u>inappropriate</u> statements about a given set of data. 9. List some of the possible <u>outcomes</u> of a simple experiment, and predict whether given outcomes are <u>more</u>, <u>less</u>, or <u>equally likely</u> to occur. 10. Use physical models and pictures to represent possible <u>arrangements</u> of 2 or 3 objects.	1. Collect and organize data from an experiment, such as recording and classifying observations or measurements in response to a question posed. 2. Interpret and construct <u>picture graphs</u> in which a symbol or picture represents more than one object. 3. Interpret and construct <u>bar graphs</u> with intervals greater than one; e.g., intervals of 2, 5, or 10. 4. Support a <u>conclusion</u> orally and in writing, using information in a table or a graph. 5. Match a set of data with a <u>graphical representation</u> of that data. 6. Fluently translate data among <u>charts</u>, <u>tables</u>, <u>line plots</u>, <u>picture graphs</u>, and <u>bar graphs</u>. 7. Analyze and interpret information represented on a <u>time line</u>. 8. Identify the <u>mode</u> of a data set and describe the information it gives about the data set. 9. Conduct a simple experiment, record the results in a chart, table or graph. Use results to draw conclusions about <u>possible outcomes</u>. 10. Use physical models, pictures, diagrams, and lists to solve problems involving possible <u>arrangements</u> or <u>combinations</u> of two to four objects.	1. Create a plan for collecting data for a specific purpose. 2. Represent and interpret data using <u>tables</u>, <u>bar graphs</u>, <u>line plots</u> and <u>line graphs</u>. 3. Interpret and construct <u>Venn diagrams</u> to sort and describe data. 4. Compare different <u>representations</u> of the same data to evaluate orally and in writing how well each representation shows important aspects of the data. 5. Identify the <u>median</u> of a set of data and describe what it indicates about the data. 6. Identify the <u>range</u> of a set of data. 7. Use <u>range, median</u> and <u>mode</u> to make comparisons about related sets of data. 8. Describe the characteristics of a set of data based on <u>graphical representations</u>; e.g., <u>range of the data</u>, <u>clumps of data</u> and <u>holes in the data</u>. 9. Represent the likelihood of <u>possible outcomes</u> for <u>chance situations</u>; e.g., probability of selecting a red marble from a bag containing 3 red and 5 white marbles. 10. Place events in order of likelihood and use a diagram of appropriate language to compare the chance of each event occurring; e.g., <u>impossible</u>, <u>unlikely</u>, <u>equally likely</u>, <u>certain</u>. 11. Conduct simple <u>probability experiments</u> and draw conclusions from the results; e.g., rolling number cubes

Grade 2 Indicators	Grade 3 Indicators	Grade 4 Indicators
		or drawing marbles from a bag. 12. List and count all possible combinations using one member from each of several sets; e.g., make a tree diagram to show the number of possible outfits from 3 shirts, 2 shorts and 2 pairs of shoes. 13. Relate the concepts of impossible and certain-to-happen events to the numerical values of 0 (impossible) and 1 (certain).

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