

Standard 1: Number and Computation**FIRST GRADE**

Standard 1: Number and Computation – The student uses numerical and computational concepts and procedures in a variety of situations.

Benchmark 1: Number Sense – The student demonstrates number sense for whole numbers, fractions, and money using concrete objects in a variety of situations.

First Grade Knowledge Base Indicators	First Grade Application Indicators
<p>The student...</p> <ol style="list-style-type: none"> 1. knows, explains, and represents whole numbers from 0 through 100 using concrete objects (2.4.K1a) (\$). 2. compares and orders (\$): <ol style="list-style-type: none"> a. whole numbers from 0 through 100 using concrete objects (2.4.K1a), b. fractions with like denominators (halves and fourths) using concrete objects (2.4.K1a,c). 3. recognizes a whole, a half, and a fourth and represents equal parts of a whole (halves, fourths) using concrete objects, pictures, diagrams, fraction strips, or pattern blocks (2.4.K1a,c) (\$). 4. identifies and uses ordinal numbers first (1st) through tenth (10th) (2.4.K1a). 5. identifies coins (pennies, nickels, dimes, quarters) and currency (\$1, \$5, \$10) and states the value of each coin and each type of currency using money models (2.4.K1d) (\$). 6. recognizes and counts a like group of coins (pennies, nickels, dimes) (2.4.K1d) (\$). 	<p>The student...</p> <ol style="list-style-type: none"> 1. solves real-world problems using equivalent representations and concrete objects to compare and order whole numbers from 0 through 50 (2.4.A1a) (\$). 2. determines whether or not numerical values using whole numbers from 0 through 50 are reasonable (2.4.A1a) (\$), e.g., when asked if 40 dictionaries will fit inside the student's desk, the student answers no and explains why. 3. demonstrates that smaller whole numbers are within larger whole numbers using whole numbers from 0 to 30 (2.4.A1a) (\$), e.g., if there are five pigs in a pen, there are also three pigs in the pen.

Teacher Notes: Number sense refers to one's ability to reason with numbers and to work with numbers in a flexible way. The ability to compute mentally, to estimate based on understanding of number relationships and magnitudes, and to judge reasonableness of answers are all involved in number sense.

When we say that someone has good number sense, we mean that he or she possesses a variety of abilities and understandings that include an awareness of the relationships between numbers, an ability to represent numbers in a variety of ways, a knowledge of the effects of operations, and an ability to interpret and use numbers in real-world counting and measurement situations. Such a person predicts with some accuracy the result of an operation and consistently chooses appropriate measurement units. This "friendliness with numbers" goes far beyond mere memorization of computational algorithms and number facts; it implies an ability to use numbers flexibly, to choose the most appropriate representation of a number for a given circumstance, and to recognize when operations have been correctly performed. (Number Sense and Operations: Addenda Series, Grades K-6, NCTM, 1993)

Mathematical models such as concrete objects, pictures, number lines, or unifix cubes are necessary for conceptual understanding and should be used to explain computational procedures. If a mathematical model can be used to represent the concept, the indicator in the Models benchmark is identified in the parentheses. For example, (2.4.K1a) refers to Standard 2 (Algebra), Benchmark 4 (Models), and Knowledge Indicator 1a (process models). Then, the indicator in the Models benchmark lists some of the mathematical models that could be used to teach the concept. In addition, each indicator in the Models benchmark is linked back to the other indicators. Those indicators are identified in the parentheses. For example, *process models* are linked to 1.1.K3, 1.2.K6, 1.3.K1, ... with 1.1.K3 referring to Standard 1 (Number and Computation), Benchmark 1 (Number Sense), and Knowledge Indicator 3.

The National Standards in **Personal Finance** identify what K-12 students should know and be able to do in personal finance; benchmarks are provided at three grade levels (grades 4, 8, and 12) and are grouped into four major categories: Income, Spending and Credit, Saving and Investing, and Money Management. Although the National Standards in Personal Finance are benchmarked at three grade levels, the indicators in the Kansas Curricular Standards for Mathematics that correlate with the National Standards in Personal Finance are indicated at each grade level with a (§). The National Standards in Personal Finance are included in the Appendix.

Standard 1: Number and Computation

FIRST GRADE

Standard 1: Number and Computation – The student uses numerical and computational concepts and procedures in a variety of situations.

Benchmark 2: Number Systems and Their Properties – The student demonstrates an understanding of whole numbers with a special emphasis on place value and recognizes, applies, and explains the concepts of properties as they relate to whole numbers in a variety of situations.

First Grade Knowledge Base Indicators	First Grade Application Indicators
<p>The student...</p> <ol style="list-style-type: none"> 1. reads and writes whole numbers from 0 through 100 in numerical form (\$). 2. represents whole numbers from 0 through 100 using various groupings and place value models (place value mats, hundred charts, or base ten blocks) emphasizing ones, tens, and hundreds (2.4.K1b) (\$), e.g., how many groups of tens are there in 32 or how many groups of tens and ones in 62? 3. counts subsets of whole numbers from 0 through 100 both forwards and backwards (2.4.K1a) (\$). 4. writes in words whole numbers from 0 through 10. 5. identifies the place value of the digits in whole numbers from 0 through 100 (2.4.K1b) (\$). 6. identifies any whole number from 0 through 30 as even or odd (2.4.K1a). 7. uses the concepts of these properties with whole numbers from 0 through 100 and demonstrates their meaning using concrete objects (2.4.K1a) (\$): <ol style="list-style-type: none"> a. commutative property of addition, e.g., $3 + 2 = 2 + 3$, b. zero property of addition (additive identity), e.g., $4 + 0 = 4$. 	<p>The student...</p> <ol style="list-style-type: none"> 1. solves real-world problems with whole numbers from 0 through 50 using place value models (place value mats, hundred charts, or base ten blocks) and the concepts of these properties to explain reasoning (2.4.A1a-b) (\$): <ol style="list-style-type: none"> a. commutative property of addition, e.g., group 5 students into a group of 3 and a group of 2, add to find the total; then reverse the order of the students to show that $2 + 3$ still equals 5; b. zero property of addition, e.g., have students lay out 11 crayons, tell them to add zero (crayons). Then ask: How many crayons are there?

Teacher Notes: From the Mathematics Dictionary and Handbook (Nichols Schwartz Publishing, 1999), **property** as a mathematical term means a characteristic (an attribute) of a number, geometric shape, mathematical operation, equation, or inequality. To give an example:

- Property of a number: 8 is divisible by 2.
- Property of a geometric shape: Each of the four sides of a square is of the same length.
- Property of an operation: Addition is commutative. For all numbers x and y , $x + y = y + x$.
- Property of an equation: For all numbers a , b , and c , if $a = b$, then $a + c = b + c$.
- Property of an inequality: For all numbers a , b , and c , if $a > b$, then $a - c > b - c$.

Mathematical models such as concrete objects, pictures, number lines, or unifix cubes are necessary for conceptual understanding and should be used to explain computational procedures. If a mathematical model can be used to represent the concept, the indicator in the Models benchmark is identified in the parentheses. For example, (2.4.K1a) refers to Standard 2 (Algebra), Benchmark 4 (Models), and Knowledge Indicator 1a (process models). Then, the indicator in the Models benchmark lists some of the mathematical models that could be used to teach the concept. In addition, each indicator in the Models benchmark is linked back to the other indicators. Those indicators are identified in the parentheses. For example, *process models* are linked to 1.1.K3, 1.2.K6, 1.3.K1, ... with 1.1.K3 referring to Standard 1 (Number and Computation), Benchmark 1 (Number Sense), and Knowledge Indicator 3.

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Standard 1: Number and Computation

FIRST GRADE

Standard 1: Number and Computation – The student uses numerical and computational concepts and procedures in a variety of situations.

Benchmark 3: Estimation – The student uses computational estimation with whole numbers in a variety of situations.

First Grade Knowledge Base Indicators	First Grade Application Indicators
The student... 1. estimates whole number quantities from 0 through 100 using various computational methods including mental math, paper and pencil, concrete objects, and appropriate technology (2.4.K1a) (\$). 2. estimates to check whether or not results of whole number quantities from 0 through 100 are reasonable (2.4.K1a) (\$).	The student... 1. adjusts original whole number estimate of a real-world problem using whole numbers from 0 through 50 based on additional information (a frame of reference) (2.4.A1a) (\$), e.g., an estimate is made about the number of tennis balls in a shoebox; about half of the tennis balls are removed from the box and counted. With this additional information, an adjustment of the original estimate is made.

Teacher Notes: Estimate, as a verb, means to make an educated guess based on information in a problem or to give an answer close to the exact number. Estimation is used when an exact answer is not needed, as in many real-life situations for which “ballpark” computations are acceptable. Good number sense enables one to estimate a quantity, estimate a measure, or estimate an answer.

Estimation serves as an important companion to computation. It provides a tool for judging the reasonableness of computational methods including mental math, paper and pencil, concrete objects, and appropriate technology. However, being able to compute does not automatically lead to an ability to estimate or judge reasonableness of answers. Frequent modeling by the teacher helps students develop a range of estimation strategies. Students should be encouraged to frequently explain their thinking as they estimate. As with exact computation, sharing estimation strategies allows students access to others’ thinking and provides opportunities for class discussion. Identifying the estimation strategy by name is not critical; however, explaining the thinking behind the strategy to make a valid estimation is important. (Principles and Standards for School Mathematics, NCTM, 2000)

Mental math and **estimation** are distinct but related mathematical skills. Proficiency in mental math contributes to increased skill in estimation. Students develop mental math skills easier when they are taught specific strategies and specific strategies based on understanding also need to be developed for estimation. An estimation strategy for the early grades is front-end; the focus is on the “front-end” or the leftmost digit because these digits are the most significant for forming an estimate. In order for students to become more familiar with estimation, teachers should introduce estimation with examples where rounded or estimated numbers are used. Emphasis should be placed on real-world examples where only estimation is required, e.g., about how many hours do you sleep a night? Using the language of estimation is important, so students begin to realize that a variety of estimates (answers) are possible.

Mathematical models such as concrete objects, pictures, number lines, or unifix cubes are necessary for conceptual understanding and should be used to explain computational procedures. If a mathematical model can be used to represent the concept, the indicator in the Models benchmark is identified in the parentheses. For example, (2.4.K1a) refers to Standard 2 (Algebra), Benchmark 4 (Models), and Knowledge Indicator 1a (process models). Then, the indicator in the Models benchmark lists some of the mathematical models that could be used to teach the concept. In addition, each indicator in the Models benchmark is linked back to the other indicators. Those indicators are identified in the parentheses. For example, *process models* are linked to 1.1.K3, 1.2.K6, 1.3.K1, ... with 1.1.K3 referring to Standard 1 (Number and Computation), Benchmark 1 (Number Sense), and Knowledge Indicator 3.

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Standard 1: Number and Computation

FIRST GRADE

Standard 1: Number and Computation – The student uses numerical and computational concepts and procedures in a variety of situations.

Benchmark 4: Computation – The student models, performs, and explains computation with whole numbers using concrete objects in a variety of situations.

First Grade Knowledge Base Indicators	First Grade Application Indicators
<p>The student...</p> <ol style="list-style-type: none"> 1. computes with efficiency and accuracy using various computational methods including mental math, paper and pencil, concrete objects, and appropriate technology (2.4.K1a) (\$). 2. N states and uses with efficiency and accuracy basic addition facts with sums from 0 through 10 and corresponding subtraction facts (\$). 3. skip counts by 2s, 5s, and 10s through 50 (2.4.K1a). 4. uses repeated addition (multiplication) with whole numbers to find the sum when given the number of groups (ten or less) and given the same number of concrete objects in each group (ten or less) (2.4.K1a), e.g., three plates of cookies with 10 cookies on each plate means $10 + 10 + 10 = 30$ cookies. 5. uses repeated subtraction (division) with whole numbers when given the total number of concrete objects in each group to find the number of groups (2.4.K1a), e.g., there are 9 pencils. If each student gets 2 pencils, how many students get pencils? $9 - 2 - 2 - 2 - 2$ or 9 minus 2 four times means four students get 2 pencils each and there is 1 pencil left over. <i>or</i> There are 30 pieces of candy to put equally into five bowls, how many pieces of candy will be in each bowl? $30 - 5 - 5 - 5 - 5 - 5$ means there are six in each bowl. 6. performs and explains these computational procedures (2.4.K1a-b): <ol style="list-style-type: none"> a. adds whole numbers with sums through 99 without regrouping using concrete objects, e.g., 42 straws (bundled in 10s) + 21 straws (bundled in 10s) = 63 straws (bundled in 10s); b. subtracts two-digit whole numbers without regrouping using concrete objects, e.g., 63 cubes – 21 cubes = 42 cubes. 7. shows that addition and subtraction are inverse operations using concrete objects (2.4.K1a) (\$). 	<p>The student...</p> <ol style="list-style-type: none"> 1. solves one-step real-world addition or subtraction problems with various groupings of two-digit whole numbers without regrouping (2.4.A1a-b) (\$), e.g., Jo has 48 crayons and 16 markers in her desk. How many more crayons does she have than markers? This problem could be solved using base 10 models or a number line or by saying $48 - 10 = 38$ and $38 - 6 = 32$.

8. reads and writes horizontally and vertically the same addition expression, e.g., $5 + 4$ is the same as $4 + 5$.

Teacher Notes: Efficiency and accuracy means that students are able to compute single-digit numbers with fluency. Students increase their understanding and skill in single-digit addition and subtraction by developing relationships within addition and subtraction combinations and by counting on for addition and counting up for subtraction and unknown-addend situations. Students learn basic number combinations and develop strategies for computing that makes sense to them. Through class discussions, students can compare the ease of use and ease of explanation of various strategies. In some cases, their strategies for computing will be close to conventional algorithms; in other cases, they will be quite different. Many times, students' invented approaches are based on a sound understanding of numbers and operations, and these invented approaches often can be used with efficiency and accuracy. (Principles and Standards for School Mathematics, NCTM, 2000)

The definition of computation is finding the standard representation for a number. For example, $6 + 6$, 4×3 , $17 - 5$, and $24 \div 2$ are all representations for the standard representation of 12. **Mental math** is mentally finding the standard representation for a number – calculating in your head instead of calculating using paper and pencil or technology. One of the main reasons for teaching mental math is to help students determine if a computed/calculated answer is reasonable, in other words, using mental math to estimate to see if the answer makes sense. Proficiency in mental math contributes to a better understanding of place value, mathematical operations, and basic number properties and an increased skill in estimation. Students develop mental math skills easier when they are taught specific strategies. Mental math strategies for the early grades include counting on, counting back, counting up, doubling numbers (doubles), and making ten. Other mental math strategies for the early grades include skip counting and using number patterns.

One way to improve the understanding of numbers and operations is to encourage children to develop computational procedures that are meaningful to them. Invented procedures promote the idea of mathematics as a meaningful activity. This is not to suggest that algorithm invention is the only way to promote student understanding or that children should be discouraged from using a standard algorithm if that is their choice. Different problems are best solved by different methods. For example, solving $7000 - 25$ by counting down by tens and fives, yet solving $41 - 25$ by adding up, or decomposing, the numbers. Another example is adding $52 + 45$; a student may count, "52, 62, 72, 82, 92, plus 5 is 97." ("Invented Strategies Can Develop Meaningful Mathematical Procedures" by William M. Carroll and Denise Porter, Teaching Children Mathematics, March 1997, pp. 370-374)

Regrouping refers to the reorganization of objects. In computation, **regrouping** is based on a "partitioning to multiples of ten" strategy. For example, $46 + 7$ could be solved by partitioning 46 into 40 and 6, then $40 + (6 + 7) = 40 + 13$ (and then 13 is partitioned into 10 and 3) which then becomes $(40 + 10) + 3$ which becomes $50 + 3 = 53$ or 7 could be partitioned as 4 and 3, then $46 + 4$ (bridging through 10) = 50 and $50 + 3 = 53$. Before algorithmic procedures are taught, an understanding of "what happens" must occur. For this to occur, instruction should involve the use of structured manipulatives. To emphasize the role of the base ten-numeration system in algorithms, some form of expanded notation is recommended. During instruction, each child should have a set of manipulatives to work with rather than sit and watch demonstrations by the teacher. Some additional computational strategies include *doubles plus one or two* (i.e., $6 + 8$, 6 and 6 are 12, so the answer must be 2 more or 14), *compensation* (i.e., $9 + 7$, if one is taken away from 9, it leaves 8; then that one is given to 7 to make 8, then $8 + 8 = 16$), *subtracting through ten* (i.e., $13 - 5$, 13 take away 3 is 10, then take 2 more away from 10 and that is 8), and *nine is one less than ten* (i.e., $9 + 6$, 10 and 6 are 16, and 1 less than 16 makes 15). (Teaching Mathematics in Grades K-8: Research Based Methods, ed. Thomas R. Post, Allyn and Bacon, 1988)

Mathematical models such as concrete objects, pictures, number lines, or unifix cubes are necessary for conceptual understanding and should be used to explain computational procedures. If a mathematical model can be used to represent the concept, the indicator in the Models benchmark is identified in the parentheses. For example, (2.4.K1a) refers to Standard 2 (Algebra), Benchmark 4 (Models), and Knowledge Indicator 1a (process models). Then, the indicator in the Models benchmark lists some of the mathematical models that could be used to teach the concept. In addition, each indicator in the Models benchmark is linked back to the other indicators. Those indicators are identified in the parentheses. For example, *process models* are linked to 1.1.K3, 1.2.K6, 1.3.K1, ... with 1.1.K3 referring to Standard 1 (Number and Computation), Benchmark 1 (Number Sense), and Knowledge Indicator 3.

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Standard 2: Algebra

FIRST GRADE

Standard 2: Algebra – The student uses algebraic concepts and procedures in a variety of situations.

Benchmark 1: Patterns – The student recognizes, describes, extends, develops, and explains relationships in patterns using concrete objects in a variety of situations.

First Grade Knowledge Base Indicators	First Grade Application Indicators
<p>The student...</p> <ol style="list-style-type: none"> 1. uses concrete objects, drawings, and other representations to work with types of patterns (2.4.K1a): <ol style="list-style-type: none"> a. repeating patterns, e.g., an AB pattern is like 1-2, 1-2, ...; an ABC pattern is like dog-horse-pig, dog-horse-pig, ...; an AAB pattern is like Δ-Δ-O, Δ-Δ-O, ...; b. growing (extending) patterns, e.g., 1, 2, 3, ... 2. uses the following attributes to generate patterns: <ol style="list-style-type: none"> a. counting numbers related to number theory (2.4.K1.a), e.g., evens, odds, or skip counting by 2s, 5s, or 10s; b. whole numbers that increase (2.4.K1a) (\$), e.g., 11, 21, 31, ... or like 2, 4, 6, ...; c. geometric shapes (2.4.K1f), e.g., \blacktriangle, \blacksquare, \blacklozenge, \blacktriangle, \blacksquare, \blacklozenge, ...; d. measurements (2.4.K1a), e.g., counting by inches or feet; e. the calendar (2.4.K1a), e.g., January, February, March, ...; f. money and time (2.4.K1d) (\$), e.g., 10¢, 20¢, 30¢, ... or 1:00, 1:30, 2:00, ...; g. things related to daily life (2.4.K1a), e.g., seasons, temperature, or weather; h. things related to size, shape, color, texture, or movement (2.4.K1a); e.g., tall-short, tall-short, tall-short, ...; or snapping fingers, clapping hands, or stomping feet (kinesthetic patterns). 3. identifies and continues a pattern presented in various formats including numeric (list or table), visual (picture, table, or graph), verbal (oral description), kinesthetic (action), and written (2.4.K1a) (\$). 4. generates (2.4.K1a): <ol style="list-style-type: none"> a. repeating patterns for the AB pattern, the ABC pattern, and the AAB pattern; b. growing patterns that add 1, 2, 5, or 10. 	<p>The student...</p> <ol style="list-style-type: none"> 1. generalizes the following patterns using pictorial, oral, and/or written descriptions including the use of concrete objects: <ol style="list-style-type: none"> a. whole number patterns (2.4.A1a) (\$); b. patterns using geometric shapes (2.4.A1c); c. calendar patterns (2.4.A1a); d. patterns using size, shape, color, texture, or movement (2.4.A1a). 2. recognizes multiple representations of the same pattern (2.4.A1a), e.g., the AB pattern could be represented by clap, snap, clap, snap, ... or red, green, red, green, ... or square, circle, square, circle, ... 3. uses concrete objects to model a whole number pattern (2.4.A1a): <ol style="list-style-type: none"> a. counting by ones: $\textcircled{\ast}$, $\textcircled{\ast}$, $\textcircled{\ast}$, $\textcircled{\ast}$, ... b. counting by twos: \blacklozenge, \blacklozenge \blacklozenge \blacklozenge, \blacklozenge \blacklozenge, ... c. counting by fives: xxxxx, xxxxx xxxxx xxxxx, xxxxx xxxxx, ... d. counting by tens: $\blacksquare$$\blacksquare$$\blacksquare$$\blacksquare$$\blacksquare$, $\blacksquare$$\blacksquare$$\blacksquare$$\blacksquare$$\blacksquare$ $\blacksquare$$\blacksquare$$\blacksquare$$\blacksquare$$\blacksquare$ $\blacksquare$$\blacksquare$$\blacksquare$$\blacksquare$$\blacksquare$, $\blacksquare$$\blacksquare$$\blacksquare$$\blacksquare$$\blacksquare$ $\blacksquare$$\blacksquare$$\blacksquare$$\blacksquare$$\blacksquare$, ...

Teacher Notes: Working with **patterns** is an important process in the development of mathematical thinking. Patterns can be based on geometric attributes (shapes, regions, angles); measurement attributes (color, texture, length, weight, volume, number); relational attributes (proportion, sequence, functions); and affective attributes (values, likes, dislikes, familiarity, heritage, culture). (Learning to Teach Mathematics, Randall J. Souviney, Macmillan Publishing Company, 1994)

This process (working with patterns) can be used to develop or deepen understandings of important concepts in number theory, whole numbers, measurement, geometry, probability, and functions. Working with patterns provides opportunities for students to recognize, describe, extend, develop, and explain.

Number theory is the study of the properties of the counting numbers (positive integers), their relationships, ways to represent them, and patterns among them. Number theory includes the concepts of odd and even numbers, factors and multiples, primes and composites, and greatest common factor and least common multiple.

Mathematical models such as concrete objects, pictures, diagrams, number lines, unifix cubes, hundred charts, or base ten blocks are necessary for conceptual understanding and should be used to explain computational procedures. If a mathematical model can be used to represent the concept, the indicator in the Models benchmark is identified in the parentheses. For example, (2.4.K1a) refers to Standard 2 (Algebra), Benchmark 4 (Models), and Knowledge Indicator 1a (process models). Then, the indicator in the Models benchmark lists some of the mathematical models that could be used to teach the concept. In addition, each indicator in the Models benchmark is linked back to the other indicators. Those indicators are identified in the parentheses. For example, *process models* are linked to 1.1.K3, 1.2.K6, 1.3.K1, ... with 1.1.K3 referring to Standard 1 (Number and Computation), Benchmark 1 (Number Sense), and Knowledge Indicator 3.

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Standard 2: Algebra

FIRST GRADE

Standard 2: Algebra – The student uses algebraic concepts and procedures in a variety of situations.

Benchmark 2: Variable, Equations, and Inequalities – The student solves addition and subtraction equations using concrete objects in a variety of situations.

First Grade Knowledge Base Indicators	First Grade Application Indicators
<p>The student...</p> <ol style="list-style-type: none"> explains and uses symbols to represent unknown whole number quantities from 0 through 20 (2.4.K1a). finds the unknown sum or difference of the basic facts using concrete objects (2.4.K1a) (\$), e.g., 12 dominoes – 5 dominoes = Δ dominoes or Δ cubes = 2 cubes + 4 cubes. describes and compares two whole numbers from 0 through 100 using the terms: is equal to, is less than, is greater than (2.4.K1a-b) (\$). 	<p>The student...</p> <ol style="list-style-type: none"> represents real-world problems using concrete objects, pictures, oral descriptions, and symbols and the basic addition and subtraction facts with one operation and one unknown (2.4. A1a) (\$), e.g., given some marbles, Sue says: 3 red marbles and 3 blue marbles equal 6 marbles. Sue also shows and writes the problem and solution: $3 + 3 = \square$ or $RRR + BBB = \square$, $3 + 3 = 6$. generates and solves problem situations using the basic facts to find the unknown sum or difference with concrete objects (2.4.A1a), e.g., a student generates this problem: I have 6 marbles. My sister has 4. How many do we have altogether? The student shows $6 + 4 = \square$, and $6 + 4 = 10$.
<p>Teacher Notes: Understanding the concept of variable is fundamental to algebra. In the early grades, students use various symbols including letters and geometric shapes to represent unknown quantities that both do and do not vary. Quantities that are not given and do not vary are often referred to as unknowns or missing elements when they appear in equations, e.g., $2 + 4 = \Delta$.</p> <p>Mathematical models such as concrete objects, pictures, diagrams, number lines, unifix cubes, hundred charts, or base ten blocks are necessary for conceptual understanding and should be used to explain computational procedures. If a mathematical model can be used to represent the concept, the indicator in the Models benchmark is identified in the parentheses. For example, (2.4.K1a) refers to Standard 2 (Algebra), Benchmark 4 (Models), and Knowledge Indicator 1a (process models). Then, the indicator in the Models benchmark lists some of the mathematical models that could be used to teach the concept. In addition, each indicator in the Models benchmark is linked back to the other indicators. Those indicators are identified in the parentheses. For example, <i>process models</i> are linked to 1.1.K3, 1.2.K6, 1.3.K1, ... with 1.1.K3 referring to Standard 1 (Number and Computation), Benchmark 1 (Number Sense), and Knowledge Indicator 3.</p> <p>The National Standards in Personal Finance identify what K-12 students should know and be able to do in personal finance; benchmarks are provided at three grade levels (grades 4, 8, and 12) and are grouped into four major categories: Income, Spending and Credit, Saving and Investing, and Money Management. Although the National Standards in Personal Finance are benchmarked at three grade levels, the indicators in the Kansas Curricular Standards for Mathematics that correlate with the National Standards in Personal Finance are indicated at each grade level with a (\$). The National Standards in Personal Finance are included in the Appendix.</p>	

Standard 2: Algebra

FIRST GRADE

Standard 2: Algebra – The student uses algebraic concepts and procedures in a variety of situations.

Benchmark 3: Functions – The student recognizes and describes whole number relationships using concrete objects in a variety of situations.

First Grade Knowledge Base Indicators	First Grade Application Indicators														
<p>The student...</p> <ol style="list-style-type: none"> plots whole numbers from 0 through 100 on segments of a number line (2.4.K1a). states mathematical relationships between whole numbers from 0 through 50 using various methods including mental math, paper and pencil, and concrete objects (2.4.K1a) (\$), e.g., every time a hand is added to the set, five more fingers are added to the total. states numerical relationships for whole numbers from 0 through 50 in a horizontal or vertical function table (input/output machine, T-table) (2.4.K1e) (\$), e.g., <table border="1" data-bbox="373 760 1037 831"> <tr> <td>Number of bicycles</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>...</td> </tr> <tr> <td>Total number of wheels</td> <td>2</td> <td>4</td> <td>6</td> <td>8</td> <td>10</td> <td>...</td> </tr> </table> <p>The student states: For every bicycle added, you add two more wheels.</p>	Number of bicycles	1	2	3	4	5	...	Total number of wheels	2	4	6	8	10	...	<p>The student...</p> <ol style="list-style-type: none"> represents and describes mathematical relationships for whole numbers from 0 through 50 using concrete objects, pictures, oral descriptions, and symbols (2.4.A1a) (\$). recognizes numerical patterns (counting by 2s, 5s, and 10s) through 50 using a hundred chart (2.4.A1a).
Number of bicycles	1	2	3	4	5	...									
Total number of wheels	2	4	6	8	10	...									

Teacher Notes: A **number line** (a mathematical model) is a diagram that represents numbers with equal distances marked off as points on a line, an example of one-to-one correspondence (a relation). There are many kinds of relations – one-to-many, many-to-one, many-to-many, and one-to-one. A function is a special kind of relation.

Functions are relationships or rules in which each member of one set is paired with one, and only one, member of another set (an ordered pair). The concept of function can be introduced using function machines. Any number put in the machine will be changed according to some rule. A record of inputs and corresponding outputs can be maintained in a two-column format. Function tables, input/output machines, and T-tables may be used interchangeably and serve the same purpose.

Function concepts should be developed from **growing patterns**. Each term in a number sequence is related to its position in the sequence – the functional relationship. The pattern – 4, 7, 10, 13, 16, 19, and so on – is an arithmetic sequence *with a difference of 3*. The pattern could be described as *add 3* meaning that 3 must be added to any term after the first to find the next. This is an example of a recursive pattern. In a recursive pattern, after one or more consecutive terms are given, each successive term in the sequence is obtained from the previous term(s). In the pattern 1, 4, 9, 16, 25, ..., 225; there is *no common difference*. This sequence is not arithmetic or geometric (no common ratio between geometric terms). Neither is it a combination of the two; however, there is a pattern and the missing terms between 25 and 225 can be found. To find the term value, square the number of the term. The next missing terms would be 36, 49, 64, 81, 100, 121, and 144. This is an example of an explicit pattern. In an explicit pattern, each term in the sequence is defined by the term's number in the sequence.

Mathematical models such as concrete objects, pictures, diagrams, number lines, unifix cubes, hundred charts, or base ten blocks are necessary for conceptual understanding and should be used to explain computational procedures. If a mathematical model can be used to represent the concept, the indicator in the Models benchmark is identified in the parentheses. For example, (2.4.K1a) refers to Standard 2 (Algebra), Benchmark 4 (Models), and Knowledge Indicator 1a (process models). Then, the indicator in the Models benchmark lists some of the mathematical models that could be used to teach the concept. In addition, each indicator in the Models benchmark is linked back to the other indicators. Those indicators are identified in the parentheses. For example, *process models* are linked to 1.1.K3, 1.2.K6, 1.3.K1, ... with 1.1.K3 referring to Standard 1 (Number and Computation), Benchmark 1 (Number Sense), and Knowledge Indicator 3.

The National Standards in **Personal Finance** identify what K-12 students should know and be able to do in personal finance; benchmarks are provided at three grade levels (grades 4, 8, and 12) and are grouped into four major categories: Income, Spending and Credit, Saving and Investing, and Money Management. Although the National Standards in Personal Finance are benchmarked at three grade levels, the indicators in the Kansas Curricular Standards for Mathematics that correlate with the National Standards in Personal Finance are indicated at each grade level with a (\$) . The National Standards in Personal Finance are included in the Appendix.

Standard 2: Algebra

FIRST GRADE

Standard 2: Algebra – The student uses algebraic concepts and procedures in a variety of situations.

Benchmark 4: Models – The student uses mathematical models including concrete objects to represent, show, and communicate mathematical relationships in a variety of situations.

First Grade Knowledge Base Indicators	First Grade Application Indicators
<p>The student...</p> <ol style="list-style-type: none"> 1. knows, explains, and uses mathematical models to represent mathematical concepts, procedures, and relationships. Mathematical models include: <ol style="list-style-type: none"> a. process models (concrete objects, pictures, diagrams, number lines, unifix cubes, hundred charts, measurement tools, or calendars) to model computational procedures and mathematical relationships, to compare and order numerical quantities, and to represent fractional parts (1.1.K1-4, 1.2.K3, 1.2.K6-7, 1.3.K1-2, 1.4.K1, 1.4.K2-7, 2.1.K1, 2.1.K1d-h, 2.1.K2a-b, 2.2.K3-4, 2.3.K1-2, 3.2.K1-6, 3.3.K1-3, 3.4.K1-3 4.2.K3-4) (\$); b. place value models (place value mats, hundred charts, or base ten blocks) to compare, order, and represent numerical quantities and to model computational procedures (1.2.K2, 1.2.K5, 1.4.K6, 2.2.K3) (\$); c. fraction models (fraction strips or pattern blocks) to compare, order, and represent numerical quantities (1.1.K2-3) (\$); d. money models (base ten blocks or coins) to compare, order, and represent numerical quantities (1.1.K5-6, 2.1.K2f) (\$); e. function tables (input/output machines, T-tables) to model numerical relationships (2.3.K3) (\$); f. two-dimensional geometric models (geoboards, dot paper, pattern blocks, tangrams, or attribute blocks), three-dimensional geometric models (solids), and real-world objects to compare size and to model attributes of geometric shapes (2.1.K1c, 3.1.K1-3); g. two-dimensional geometric models (spinners), three-dimensional geometric models (number cubes), and concrete objects to model probability (4.1.K1-2) (\$); 	<p>The student...</p> <ol style="list-style-type: none"> 1. recognizes that various mathematical models can be used to represent the same problem situation. Mathematical models include: <ol style="list-style-type: none"> a. process models (concrete objects, pictures, diagrams, number lines, unifix cubes, measurement tools, or calendars) to model computational procedures and mathematical relationships, to compare and order numerical quantities, and to model problem situations (1.1.A1-3, 1.2.A1, 1.3.A1, 1.4.A1, 2.1.A1a, 2.1.A1c-d, 2.1.A2-3, 2.2.A1-2, 2.3.A1-2, 3.2.A1-3, 3.3.A1-2, 3.4.A1, 4.2.A2) (\$); b. place value models (place value mats, hundred charts, or base ten blocks) to compare, order, and represent numerical quantities and to model computational procedures (1.2.A1, 1.4.A1) (\$); c. two-dimensional geometric models (geoboards, dot paper, pattern blocks, tangrams, or attribute blocks), three-dimensional geometric models (solids), and real-world objects to compare size and to model attributes of geometric shapes (2.1.A1b, 3.1.A1-2); d. two-dimensional geometric models (spinners), three-dimensional geometric models (number cubes), and concrete objects to model probability (4.1.A1) (\$); e. graphs using concrete objects, pictographs, frequency tables, and horizontal and vertical bar graphs to organize, display, and explain data (4.1.A1, 4.2.A1) (\$).

- h. graphs using concrete objects, pictographs, frequency tables, horizontal and vertical bar graphs, and Venn diagrams or other pictorial displays to organize, display, and explain data (4.1.A1, 4.2.A1-2) (\$);
 - i. Venn diagrams to sort data (4.2.K4).
2. uses concrete objects, pictures, diagrams, drawings, or dramatizations to show the relationship between two or more things (\$).

Teacher Notes: For assessment purposes, the mathematical modeling process appropriate to the indicator may be included as part of the item being assessed.

The **mathematical modeling** process involves:

- a. selecting key features and relationships within the real-world situation and representing these concepts in mathematical terms through some sort of mathematical model,
- b. performing manipulations and mathematical procedures within the mathematical model,
- c. interpreting the results of the manipulations within the mathematical model,
- d. using these results to make inferences about the original real-world situation.

The use of **mathematical models** is necessary for conceptual understanding. The ways in which mathematical ideas are represented is fundamental to how students understand and use those ideas. As students begin to use multiple representations of the same situation, they begin to develop an understanding of the advantages and disadvantages of the various representations/models. For example, comparing the number of boys and girls in the classroom can be represented by lining them up in two different lines. The same situation also can be represented by pictures of the children (pictograph), a bar graph, or by using two different colors of the same manipulative (unifix cubes or color tiles).

Many **mathematical models** are listed in this benchmark. The indicator lists some of the mathematical models that could be used to teach a concept. Each indicator in this benchmark is linked to other indicators in other benchmarks; those indicators are identified in the parentheses. For example, *process models* are linked to 1.1.K3, 1.2.K6, 1.3.K1, ... with 1.1.K3 referring to Standard 1 (Number and Computation), Benchmark 1 (Number Sense), and Knowledge Indicator 3. In addition, the indicator in the other benchmarks identifies, in parentheses, the Models' indicator. For example, (2.4.K1a) refers to Standard 2 (Algebra), Benchmark 4 (Models), and Knowledge Indicator 1a (process models).

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Standard 3: Geometry

FIRST GRADE

Standard 3: Geometry – The student uses geometric concepts and procedures in a variety of situations.

Benchmark 1: Geometric Figures and Their Properties – The student recognizes geometric shapes and describes their attributes using concrete objects in a variety of situations.

First Grade Knowledge Base Indicators	First Grade Application Indicators
<p>The student...</p> <ol style="list-style-type: none">1. recognizes and draws circles, squares, rectangles, triangles, and ellipses (ovals) (plane figures/two-dimensional figures) (2.4.K1f).2. recognizes and investigates attributes of circles, squares, rectangles, triangles, and ellipses (plane figures) using concrete objects, drawings, and appropriate technology (2.4.K1f).3. recognizes cubes, rectangular prisms, cylinders, cones, and spheres (solids/three-dimensional figures) (2.4.K1f).	<p>The student...</p> <ol style="list-style-type: none">1. demonstrates how (2.4.A1c):<ol style="list-style-type: none">a. a geometric shape made of several plane figures (circles, squares, rectangles, triangles, ellipses) can be separated to make two or more different plane figures;b. several plane figures (circles, squares, rectangles, triangles, ellipses) can be combined to make a new geometric shape;c. several solids (cubes, rectangular prisms, cylinders, cones, spheres) can be combined to make a new geometric shape.2. sorts plane figures and solids (circles, squares, rectangles, triangles, ellipses, cubes, rectangular prisms, cylinders, cones, spheres) by a given attribute (2.4.A1c).

Teacher Notes: Geometry is the study of shapes, their properties, and their relationships to other shapes. Symbols and numbers are used to describe their properties and their relationships to other shapes. The fundamental concepts in geometry are point (no dimension), line (one-dimensional), plane (two-dimensional), and space (three-dimensional). Plane figures are referred to as two-dimensional and solids are referred to as three-dimensional.

From the Mathematics Dictionary and Handbook (Nichols Schwartz Publishing, 1999), **property** as a mathematical term means a characteristic (an attribute) of a number, geometric shape, mathematical operation, equation, or inequality. To give an example:

- Property of a number: 8 is divisible by 2.
- Property of a geometric shape: Each of the four sides of a square is of the same length.
- Property of an operation: Addition is commutative. For all numbers x and y , $x + y = y + x$.
- Property of an equation: For all numbers a , b , and c , if $a = b$, then $a + c = b + c$.
- Property of an inequality: For all numbers a , b , and c , if $a > b$, then $a - c > b - c$.

Mathematical models such as concrete objects, pictures, diagrams, number lines, unifix cubes, hundred charts, or base ten blocks are necessary for conceptual understanding and should be used to explain computational procedures. If a mathematical model can be used to represent the concept, the indicator in the Models benchmark is identified in the parentheses. For example, (2.4.K1a) refers to Standard 2 (Algebra), Benchmark 4 (Models), and Knowledge Indicator 1a (process models). Then, the indicator in the Models benchmark lists some of the mathematical models that could be used to teach the concept. In addition, each indicator in the Models benchmark is linked back to the other indicators. Those indicators are identified in the parentheses. For example, *process models* are linked to 1.1.K3, 1.2.K6, 1.3.K1, ... with 1.1.K3 referring to Standard 1 (Number and Computation), Benchmark 1 (Number Sense), and Knowledge Indicator 3.

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Standard 3: Geometry**FIRST GRADE****Standard 3: Geometry – The student uses geometric concepts and procedures in a variety of situations.****Benchmark 2: Measurement and Estimation – The student estimates and measures using standard and nonstandard units of measure with concrete objects in a variety of situations.**

First Grade Knowledge Base Indicators	First Grade Application Indicators
<p>The student...</p> <ol style="list-style-type: none"> 1. uses whole number approximations (estimations) for length and weight using nonstandard units of measure (2.4.K1a) (\$), e.g., the width of the chalkboard is about 10 erasers long or the weight of one encyclopedia is about five picture books. 2. compares two measurements using these attributes (2.4.K1a) (\$): <ol style="list-style-type: none"> a. longer, shorter (length); b. taller, shorter (height); c. heavier, lighter (weight); d. hotter, colder (temperature). 3. reads and tells time at the hour and half-hour using analog and digital clocks (2.4.K1a). 4. selects appropriate measuring tools for length, weight, volume, and temperature for a given situation (2.4.K1a) (\$). 5. measures length and weight to the nearest whole unit using nonstandard units (2.4.K1a) (\$). 6. states the number of days in a week and months in a year (2.4.K1a). 	<p>The student...</p> <ol style="list-style-type: none"> 1. compares and orders concrete objects by length or weight (2.4.A1a) (\$). 2. compares the weight of two concrete objects using a balance (2.4.A1a). 3. locates and names concrete objects that are about the same length, weight, or volume as a given concrete object (2.4.A1a) (\$).

Teacher Notes: The term *geometry* comes from two Greek words meaning “earth measure.” The **process of learning to measure** at the early grades focuses on identifying what property (length, weight) is to be measured and to make comparisons. **Estimation in measurement** is defined as making guesses as to the exact measurement of an object without using any type of measurement tool. Estimation helps students develop a relationship between the different sizes of units of measure. It helps students develop basic properties of measurement and it gives students a tool to determine whether a given measurement is reasonable.

Mathematical models such as concrete objects, pictures, diagrams, number lines, unifix cubes, hundred charts, or base ten blocks are necessary for conceptual understanding and should be used to explain computational procedures. If a mathematical model can be used to represent the concept, the indicator in the Models benchmark is identified in the parentheses. For example, (2.4.K1a) refers to Standard 2 (Algebra), Benchmark 4 (Models), and Knowledge Indicator 1a (process models). Then, the indicator in the Models benchmark lists some of the mathematical models that could be used to teach the concept. In addition, each indicator in the Models benchmark is linked back to the other indicators. Those indicators are identified in the parentheses. For example, *process models* are linked to 1.1.K3, 1.2.K6, 1.3.K1, ... with 1.1.K3 referring to Standard 1 (Number and Computation), Benchmark 1 (Number Sense), and Knowledge Indicator 3.

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Standard 3: Geometry

FIRST GRADE

Standard 3: Geometry – The student uses geometric concepts and procedures in a variety of situations.

Benchmark 3: Transformational Geometry – The student develops the foundation for spatial sense using concrete objects in a variety of situations.

First Grade Knowledge Base Indicators	First Grade Application Indicators
<p>The student...</p> <ol style="list-style-type: none"> describes the spatial relationship between two concrete objects using appropriate vocabulary (2.4.K1a), e.g., behind, above, below, on, under, beside, or in front of. recognizes that changing an object's position or orientation does not change the name, size, or shape of the object (2.4.K1a). describes movement of concrete objects using appropriate vocabulary (2.4.K1a), e.g., right, left, up, or down. 	<p>The student...</p> <ol style="list-style-type: none"> shows two concrete objects or shapes are congruent by physically fitting one object or shape on top of the other (2.4.A1a). gives and follows directions to move concrete objects from one location to another using appropriate vocabulary (2.4.A1a), e.g., right, left, up, down, behind, or above.
<p>Teacher Notes: Transformational geometry is another way to investigate geometric figures by moving every point in a plane figure to a new location. To help students form images of shapes through different transformations, students can use concrete objects, figures drawn on graph paper, mirrors or other reflective surfaces, or appropriate technology.</p> <p>Mathematical models such as concrete objects, pictures, diagrams, number lines, unifix cubes, hundred charts, or base ten blocks are necessary for conceptual understanding and should be used to explain computational procedures. If a mathematical model can be used to represent the concept, the indicator in the Models benchmark is identified in the parentheses. For example, (2.4.K1a) refers to Standard 2 (Algebra), Benchmark 4 (Models), and Knowledge Indicator 1a (process models). Then, the indicator in the Models benchmark lists some of the mathematical models that could be used to teach the concept. In addition, each indicator in the Models benchmark is linked back to the other indicators. Those indicators are identified in the parentheses. For example, <i>process models</i> are linked to 1.1.K3, 1.2.K6, 1.3.K1, ... with 1.1.K3 referring to Standard 1 (Number and Computation), Benchmark 1 (Number Sense), and Knowledge Indicator 3.</p> <p>The National Standards in Personal Finance identify what K-12 students should know and be able to do in personal finance; benchmarks are provided at three grade levels (grades 4, 8, and 12) and are grouped into four major categories: Income, Spending and Credit, Saving and Investing, and Money Management. Although the National Standards in Personal Finance are benchmarked at three grade levels, the indicators in the Kansas Curricular Standards for Mathematics that correlate with the National Standards in Personal Finance are indicated at each grade level with a (\$). The National Standards in Personal Finance are included in the Appendix.</p>	

Standard 3: Geometry

FIRST GRADE

Standard 3: Geometry – The student uses geometric concepts and procedures in a variety of situations.

Benchmark 4: Geometry From An Algebraic Perspective – The student identifies one or more points on a number line in a variety of situations.

First Grade Knowledge Base Indicators	First Grade Application Indicators
<p>The student...</p> <ol style="list-style-type: none"> locates and plots whole numbers from 0 through 100 on a segment of a number line (horizontal/vertical) (2.4.K1a), e.g., using a segment of a number line from 45 to 60 to locate the whole number 50. describes a given whole number from 0 to 100 as coming before or after another number on a number line (2.4.K1a). uses a number line to model addition and counting using whole numbers from 0 to 100 (2.4.K1a). 	<p>The student...</p> <ol style="list-style-type: none"> solves real-world problems involving counting and adding whole numbers from 0 to 50 using a number line (2.4.A1a) (\$), e.g., Nancy has 23¢. She finds 18¢ more in her pocket. How much money does she now have?
<p>Teacher Notes: A number line (a mathematical model) is a diagram that represents numbers with equal distances marked off as points on a line, and is an example of one-to-one correspondence (a relation). A number line can be used as a visual representation of numbers and operations. In addition, a number line used horizontally and vertically is a precursor to the coordinate plane.</p> <p>Mathematical models such as concrete objects, pictures, diagrams, number lines, unifix cubes, hundred charts, or base ten blocks are necessary for conceptual understanding and should be used to explain computational procedures. If a mathematical model can be used to represent the concept, the indicator in the Models benchmark is identified in the parentheses. For example, (2.4.K1a) refers to Standard 2 (Algebra), Benchmark 4 (Models), and Knowledge Indicator 1a (process models). Then, the indicator in the Models benchmark lists some of the mathematical models that could be used to teach the concept. In addition, each indicator in the Models benchmark is linked back to the other indicators. Those indicators are identified in the parentheses. For example, <i>process models</i> are linked to 1.1.K3, 1.2.K6, 1.3.K1, ... with 1.1.K3 referring to Standard 1 (Number and Computation), Benchmark 1 (Number Sense), and Knowledge Indicator 3.</p> <p>The National Standards in Personal Finance identify what K-12 students should know and be able to do in personal finance; benchmarks are provided at three grade levels (grades 4, 8, and 12) and are grouped into four major categories: Income, Spending and Credit, Saving and Investing, and Money Management. Although the National Standards in Personal Finance are benchmarked at three grade levels, the indicators in the Kansas Curricular Standards for Mathematics that correlate with the National Standards in Personal Finance are indicated at each grade level with a (\$). The National Standards in Personal Finance are included in the Appendix.</p>	

Standard 4: Data

FIRST GRADE

Standard 4: Data – The student uses concepts and procedures of data analysis in a variety of situations.

Benchmark 1: Probability – The student applies the concepts of probability using concrete objects in a variety of situations.

First Grade Knowledge Base Indicators	First Grade Application Indicators
<p>The student...</p> <ol style="list-style-type: none"> 1. recognizes whether an outcome of a simple event in an experiment or simulation is impossible, possible, or certain (2.4.K1g) (§). 2. recognizes and states whether a simple event in an experiment or simulation including the use of concrete objects can have more than one outcome (2.4.K1g). 	<p>The student...</p> <ol style="list-style-type: none"> 1. makes a prediction about a simple event in an experiment or simulation, conducts the experiment or simulation, and records the results in a graph using concrete objects, a pictograph with a symbol or picture representing only one, or a bar graph (2.4.A1d-e).
<p>Teacher Notes: Ideas from probability reinforce concepts in the other Standards, especially Number and Computation and Geometry. In the early grades, students need to develop an intuitive concept of chance – whether or not something is unlikely or likely to happen. Beginning probability experiences should be addressed through the use of concrete objects, coins, and geometric models (spinners or number cubes).</p> <p>Mathematical models such as concrete objects, pictures, diagrams, number lines, unifix cubes, hundred charts, or base ten blocks are necessary for conceptual understanding and should be used to explain computational procedures. If a mathematical model can be used to represent the concept, the indicator in the Models benchmark is identified in the parentheses. For example, (2.4.K1a) refers to Standard 2 (Algebra), Benchmark 4 (Models), and Knowledge Indicator 1a (process models). Then, the indicator in the Models benchmark lists some of the mathematical models that could be used to teach the concept. In addition, each indicator in the Models benchmark is linked back to the other indicators. Those indicators are identified in the parentheses. For example, <i>process models</i> are linked to 1.1.K3, 1.2.K6, 1.3.K1, ... with 1.1.K3 referring to Standard 1 (Number and Computation), Benchmark 1 (Number Sense), and Knowledge Indicator 3.</p> <p>The National Standards in Personal Finance identify what K-12 students should know and be able to do in personal finance; benchmarks are provided at three grade levels (grades 4, 8, and 12) and are grouped into four major categories: Income, Spending and Credit, Saving and Investing, and Money Management. Although the National Standards in Personal Finance are benchmarked at three grade levels, the indicators in the Kansas Curricular Standards for Mathematics that correlate with the National Standards in Personal Finance are indicated at each grade level with a (§). The National Standards in Personal Finance are included in the Appendix.</p>	

Standard 4: Data

FIRST GRADE

Standard 4: Data – The student uses concepts and procedures of data analysis in a variety of situations.

Benchmark 2: Statistics – The student collects, displays, and explains numerical (whole numbers) and non-numerical data sets including the use of concrete objects in a variety of situations.

First Grade Knowledge Base Indicators	First Grade Application Indicators
<p>The student...</p> <ol style="list-style-type: none"> 1. displays and reads numerical (quantitative) and non-numerical (qualitative) data in a clear, organized, and accurate manner including a title, labels, and whole number intervals using these data displays (2.4.K1h) (\$): <ol style="list-style-type: none"> a. graphs using concrete objects, b. pictographs with a whole symbol or picture representing one (no partial symbols or pictures), c. frequency tables (tally marks), d. horizontal and vertical bar graphs, e. Venn diagrams or other pictorial displays, e.g., glyphs. 2. collects data using different techniques (observations or interviews) and explains the results (2.4.K1h) (\$). 3. identifies the minimum (lowest) and maximum (highest) values in a data set (2.4.K1a) (\$). 4. determines the mode (most) after sorting by one attribute (2.4.K1a,i) (\$). 5. sorts and records qualitative (non-numerical, categorical) data sets using one attribute (2.4.K1a) (\$), e.g., color, shape, or size. 	<p>The student...</p> <ol style="list-style-type: none"> 1. communicates the results of data collection and answers questions (identifying more, less, fewer, greater than, or less than) based on information from (2.4.A1e) (\$): <ol style="list-style-type: none"> a. graphs using concrete objects, b. a pictograph with a whole symbol or picture representing only one (no partial symbols or pictures), c. a horizontal or vertical bar graph. 2. determines categories from which data could be gathered (2.4.A1a) (\$), e.g., categories could include shoe size, height, favorite candy bar, or number of pockets in clothing.

Teacher Notes: Graphs (data displays) are pictorial representations of mathematical relationships and are used to tell a story. Emphasizing the importance of using equal-sized pictures or intervals is critical to ensuring that the data display is accurate. Graphs take many forms: pictographs and graphs using concrete objects compare discrete data, frequency tables show how many times a certain piece of data occurs using tally marks to record the data, circle graphs (pie charts) model parts of a whole, line graphs show change over time, and Venn diagrams show relationships between sets of objects.

The **measures of central tendency** (averages) of a data set are mean, median, and mode. Conceptual understanding of mean, median, and mode is developed through the use of concrete objects that represent the data values.

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