Kansas State Mathematics Standards and Assessment Guide

Based on the 2005 Kansas State Curricular Standards for Mathematics
adopted by the Kansas State Board of Education on July 8, 2003

Grade 8

Developed by the Kansas State Department of Education
and
Mathematics Specialists in the Private Sector
from Kansas

2005

Standard/Benchmark/Indicator
M.8.1.1.K5a-c Standard: Number and Computation Benchmark: Number Sense Indicator: Knows and explains what happens to the product or quotient when: a) a positive number is multiplied or divided by a rational number greater than zero and less than one; b) a positive number is multiplied or divided by a rational number greater than one; c) a nonzero real number is multiplied or divided by zero
Explanation of Indicator When a positive number (such as 4) is multiplied by a number greater than zero but less than 1 (such as ½), the result is smaller than the first number (4 ● 1/2 = 2). When a positive number (such as 4) is divided by a number greater than zero but less than 1 (such as ½), the result is greater than the first number (4 ÷ 1/2 = 8). When a number other than 0 (such as - 4) is multiplied by 0, the result is 0 (- 4 ● 0 = 0).
Instructional Example Have your student find ½ of a recipe. For example if a recipe called for 2 cups of flour, then 2 ● ½ = 1 or if the recipe called for ½ cup of sugar, then ½ ● ½ = ¼ . Have your student divide two candy bars into 1/4's (2 ÷ ¼ = 8 pieces). Have student figure how much buying 0 candy bars at $0.59 would cost.
Item Specification **Category 2: Perform Procedures: 2b.** Do computational procedures or algorithms **Category 3: Demonstrate Understanding of Mathematical Ideas 3a.** Communicate mathematical ideas or rules and/or explain the process

Assessment Item Example
 If a positive two-digit number is multiplied by a fraction greater than one, the product **must** be
 	
  A.   less than the fraction but greater than the two-digit number.
 	
  B.   greater than both the fraction and the two-digit number.
 	
  C.   greater than the fraction and less than the two-digit number.
 	
  D.   less than both the fraction and the two-digit number.
 	
Correct Answer: B

Indicator					
M.8.1.1.K5a-c					

Standard/Benchmark/Indicator
M.8.1.2.K2
Standard: Number and Computation
Benchmark: Number Systems and Their Properties
Indicator: Identifies all the subsets of the real number system [natural (counting) numbers, whole numbers, integers, rational numbers, irrational numbers] to which a given number belongs

Explanation of Indicator
Natural numbers are those numbers we count with; whole numbers are the counting numbers and zero; integers include zero, whole numbers and their opposites; rational numbers are those numbers that can be expressed as fractions; and irrational numbers are those numbers that cannot be expressed as fractions. Students need to know which set(s) of numbers to which a given number belongs.

Instructional Example
Identify sets of numbers to which a given number belongs. For instance, which set(s) of numbers does your child's shoe size fit in? the money in your pocket? your address?

Item Specification
Category 1: Memorize Facts/Definitions/Formulas: 1b. Recall or recognize mathematical terms, definitions, or concepts

Assessment Item Example
Which number is a natural/counting number?
A.   -1
B. $\dfrac{1}{2}$
C.   19.99
D.   109
Correct Answer: D

	Indicator				
	M.8.1.2.K2				

Standard/Benchmark/Indicator
M.8.1.4.K2a-b N Standard:　　Number and Computation Benchmark:　Computation Indicator:　　Performs and explains these computational procedures with rational numbers: a) addition, subtraction, multiplication, and division of integers; b) order of operations (evaluates within grouping symbols, evaluates powers to the second or third power, multiplies or divides in order from left to right, then adds or subtracts in order from left to right)
Explanation of Indicator
Compute with integers (positive and negative whole numbers and zero). Use order of operations when computing with rational numbers. (First work within grouping symbols; then find powers; then perform multiplication/division left to right; then perform addition/subtraction left to right.)
Instructional Example
1. Have student figure the new temperature if at 10 pm the temperature outside is 2° F and during the night time hours the temperature fell another 12°F by 5 am. 2. If a golfer was -1 on 6 holes, even par on 10 holes, and +1 on the remaining 2 holes, what would be his net result after the holes? 3. If each of 10 atoms of a certain element contained a -1 charge what would be the net charge of all 10 atoms?
Item Specification
Category 2:　Perform Procedures: 2b. Do computational procedures or algorithms **Category 3:　Demonstrate Understanding of Mathematical Ideas: 3a.** Communicate mathematical ideas or rules and/or explain the process
Assessment Item Example
Simplify: (-7) · (-3). 　A.　　　-21 　B.　　　$-\dfrac{7}{3}$ 　C.　　　$\dfrac{7}{3}$ 　D.　　　21 Correct Answer: D

		Indicator			
		M.8.1.4.K2a-b			

Standard/Benchmark/Indicator
M.8.2.2.K3a Standard: Algebra Benchmark: Variable, Equations, and Inequalities Indicator: Solves: a) one- and two-step linear equations in one variable with rational number coefficients and constants intuitively and/or analytically
Explanation of Indicator Find the solution to an equation. Students may choose to do this in any way that is successful and makes sense to them.
Instructional Example 1. If 4 movie tickets cost $24, how much would one cost ($24 = 4x, where x is the cost of a movie ticket)? 2. If your parent/s are going to divide $30 between you and your 3 siblings, how much would you receive? 3. If your make $25 a week at mowing yards and you are saving for a skateboard that costs $175, how many weeks will you need to save in order to purchase the skateboard?
Item Specification **Category 2: Perform Procedures: 2d.** Solve equations, formulas, or routine word problems

Assessment Item Example
An equation is shown below.
 	
$17.1 = 4.5h + 1.8$
 	
What is the value of *h* in the equation?
 	
  A. $h = 2.0$
 	
  B. $h = 3.4$
 	
  C. $h = 3.8$
 	
  D. $h = 4.2$
 	
Correct Answer: B

			Indicator		
			M.8.2.2.K3a		

Standard/Benchmark/Indicator
Standard/Benchmark/Indicator M.8.3.1.K6a-b Standard: Geometry Benchmark: Geometric Figures and Their Properties Indicator: Uses the Pythagorean theorem: a) determine if a triangle is a right triangle; b) find a missing side of a right triangle where the lengths of all three sides are whole numbers
Explanation of Indicator The Pythagorean Theorem is a formula that states that if a triangle is a right triangle (has a 90° angle), then the sum of the squares of the two legs is equal to the square of the hypotenuse (the side opposite the right angle). Decide if a triangle is a right triangle. Find the missing side on a right triangle. The formula is $a^2 + b^2 = c^2$.
Instructional Example If a rectangle room is divided into equal parts by cutting a diagonal from one corner to the other, what would the length of the diagonal be if the room measures 9 feet by 12 feet?
Item Specification **Category 2: Perform Procedures: 2d.** Solve equations, formulas, or routine word problems

Assessment Item Example
Which 3 measurements could be the dimensions of a **right** triangle?
$a^2 + b^2 = c^2$
 	
  A.   20 in   21 in   29 in
 	
  B.   8 in   15 in   23 in
 	
  C.   12 in   24 in   48 in
 	
  D.   5 in   10 in   15 in
 	
Correct Answer: A

				Indicator	
				M.8.3.1.K6a-b	

Standard/Benchmark/Indicator
M.8.3.4.K1a-d Standard: Geometry Benchmark: Geometry from an Algebraic Perspective Indicator: Uses the coordinate plane to: a) list several ordered pairs on the graph of a line and find the slope of the line; b) recognize that ordered pairs that lie on the graph of an equation are solutions to that equation; c) recognize that points that do not lie on the graph of an equation are not solutions to that equation; d) determine the length of a side of a figure drawn on a coordinate plane with vertices having the same x- or y- coordinates
Explanation of Indicator
On the graph of a line, list points on the line. Recognize these points (ordered pairs) as solutions to the equation. Find the slope (rate of change) of the graph. From a figure drawn on the graph, find the length of a side given two points.
Instructional Example
Have student find a line graph in a newspaper to identify points that are on the graph and points that are not on the graph. Have student find the slope of the graph (rate of change) either positive (going up from left to right) of negative (going down from left to right).
Item Specification **Category 1: Memorize Facts/Definitions/Formulas: 1b.** Recall or recognize mathematical terms, definitions, or concepts **Category 2: Perform Procedures: 2b.** Do computational procedures or algorithms

Assessment Item Example
The point (3, 2) lies on the graph of an equation. Which statement **best** describes the ordered pair (3, 2)?
 	
  A.   It is the *y*-intercept of the graph.
 	
  B.   It is a solution of the equation.
 	
  C.   It is the *x*-intercept of the graph.
 	
  D.   It is the slope of the equation.
 	
Correct Answer: B

Standard/Benchmark/Indicator
M.8.4.1.K3 Standard:　　Data Benchmark: Probability Indicator:　　Finds the probability of a compound event composed of two independent events in an experiment, simulation, or situation
Explanation of Indicator Find probability (likelihood of something happening) of two independent (not related or dependent) events happening concurrently (at the same time) or consecutively (one after the other).
Instructional Example 　1. Have student roll two dice and figure the probability of rolling a 1 on the first die and a 6 on the second die (1/6 ● 1/6 = 1/36). 　2. If a student has 4 different pairs of socks that a separated into two piles with each matching sock being in the other pile, what would the probability of getting a pair when drawing one sock from each pile while blindfolded.
Item Specification **Category 2: Perform Procedures: 2b.** Do computational procedures or algorithms
Assessment Item Example Two number cubes are each numbered 1 through 6. If the two number cubes are rolled, what is the **probability** that both number cubes land with a 5 facing up? A.　　$\dfrac{1}{36}$ B.　　$\dfrac{1}{25}$ C.　　$\dfrac{1}{12}$ D.　　$\dfrac{1}{5}$ Correct Answer: A

Indicator					
M.8.4.1.K3					

Standard/Benchmark/Indicator
M.8.4.2.K3 Standard: Data Benchmark: Statistics Indicator: Determines and explains the measure of central tendency (mode, median, mean) for a rational number data set
Explanation of Indicator Calculate mean, median, and mode for a set of numbers. Mean is the sum of the values divided by the number of values, median is middle value when all values are ordered, and mode is the value that appears the most
Instructional Example Student will collect a set of numerical data, compute mean, median, and mode, explain which measure would be the best to use to represent the data norm, and also determine if they could be used by some to misrepresent a set of data.
Item Specification **Category 2: Perform Procedures: 2b.** Do computational procedures or algorithms **Category 3: Demonstrate Understanding of Mathematical Ideas: 3c.** Explain findings and/or results from data analysis strategies or experiments/simulations
Assessment Item Example Jake recorded the average speed in miles per hour (mph) of eight cars, as shown below.

Car Speeds

Car	Speed (mph)
1	45
2	54
3	59
4	62
5	50
6	55
7	62
8	77

What is the **median** average speed of the cars shown in the table?

A.   55 mph

B.   57 mph

C.   59 mph

D.   62 mph

Correct Answer: B

	Indicator				
	M.8.4.2.K3				

Standard/Benchmark/Indicator
M.8.1.2.A1a-b <u>Standard</u>:   Number and Computation <u>Benchmark</u>: Number Systems and Their Properties <u>Indicator</u>:   Generates and or/solves real-world problems with rational numbers using the concepts of these properties to explain reasoning: a) commutative, associative, distributive, and substitution properties; b) identity and inverse properties of addition and multiplication

Explanation of Indicator
Numbers can be added or multiplied in any order resulting with the same answer (commutative). When a series of numbers is added or multiplied, the order in which the values are added or multiplied doesn't affect the result (associative). When multiplying a number by the sum of numbers, you can multiply each of the numbers by the factor fist and then add (distributive). A number may be substituted for a variable or equivalent quantity (substitution). When 0 is added to another number it doesn't change the value of the number (identity for addition). When a number is multiplied by 1 it doesn't change the value of the number (identity for multiplication).   A number plus its opposite is 0 (additive inverse). A number multiplied by its reciprocal is 1 (multiplicative inverse). It is important that students know the name of the property as used in the indicator.

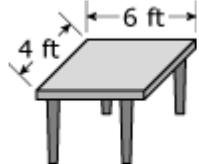| Instructional Example |
| --- |
| Distributive property: Each class will get a third of the concession stand profits. One night has $100 profit and the next night has $200 profit. You can either, add the profits from each night and then multiply the sum of $300 by one third or you can multiply each night's profit by one third and add the results.
Commutative property: Have student add a list of numbers together that have some compatible numbers such as 2, 7, 5, 4, 3, 8, and 6. it is easy to add 2 and 8 to get 10, 7 and 3 to get 10, 6 and 4 to get 10, and then add 5 for a total of 35. |

Item Specification
Category 3: Demonstrate Understanding of Mathematical Ideas: 3a. Communicate mathematical ideas or rules and/or explain the process **Category 5: Solve Non-routine Problems/Make Connections: 5b.** Apply mathematics in contexts outside of mathematics (whenever possible, include diagrams/visuals

Assessment Item Example
John wants to nail edging around a table, shown below. John uses the expression (4 + 6) + (4 + 6) to determine the number of feet of edging he needs. Which expression is equivalent to John's? A. $(4 + 4) + (6 + 6)$ B. $2 \times (4 \times 6)$ C. $(6 + 4) \times (6 + 4)$ D. $(2 \times 4) + 6$ Correct Answer: A

		Indicator			
		M.8.1.2.A1a-b			

| Standard/Benchmark/Indicator |
|---|
| M.8.1.4.A1a-c |
| Standard: Number and Computation |
| Benchmark: Computation |
| Indicator: Generates and/or solves one- and two-step real-world problems using computational procedures and mathematical concepts: a) rational numbers; b) the irrational number pi as an approximation; c) applications of percents |

Explanation of Indicator
Solve real-world problems that involve one and two steps to solve using computation of addition, subtraction, multiplication, and/or subtraction of numbers that are positive and negative with decimals (that repeat or terminate), fractions, or use pi (3.1415926…) and with percents.

Instructional Example
1. Have student write a problem dealing with some real-world problem such as figuring the amount of paint needed to cover a wall if you know the dimensions of the garage floor if it measures 30 feet by 20 feet and that a gallon of paint will cover 250 square feet. (30 • 20) ÷ 250 = 2.4 gallons.
2. Find the new price of a jacket that costs $45 is on sale for 20% off. Find by $45 - .20 • $45 = $36 or .80 • $45 = $36
3. Find the area of a field that is irrigated by a circular irrigation system in which the irrigation system is 660 feet long. Find by 1320^2 • π = 5473911.04 square feet.

Item Specification
Category 2: Perform Procedures: 2d. Solve equations, formulas, or routine word problems
Category 5: Solve Non-routine Problems/Make Connections: 5b. Apply mathematics in contexts outside of mathematics (whenever possible, include diagrams/visuals

Assessment Item Example
Wendy has a circular blanket with a radius of 6 ft, as shown below.
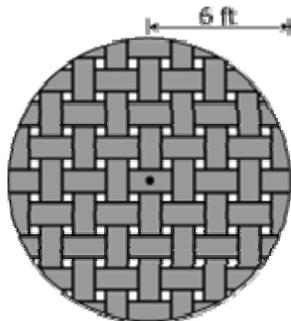
Wendy would like to sew fringe to the border of the blanket. Fringe is sold in spools of 16 ft each. How many spools does Wendy need to buy to have enough fringe for the entire border of the blanket? (Use $\pi = 3.14$)

A.   2 spools

B.   3 spools

C.   4 spools

D.   5 spools

Correct Answer: B

			Indicator		
			M.8.1.4.A1a-c		

Standard/Benchmark/Indicator
M.8.2.2.A1a Standard:　　Algebra Benchmark:　Variable, Equations, and Inequalities Indicator:　　　Represents real-world problems using: a) variables, symbols, expressions, one- or two-step equations with rational number coefficients and constants
Explanation of Indicator
Use variables, symbols, expressions, or equations to represent unknown quantities to represent real-world problems and solve using computation of addition, subtraction, multiplication, and/or subtraction of numbers that are positive and negative with decimals (that repeat or terminate), and fractions. A variable or symbol is used to represent an unknown and known numbers; the variable can be replaced for the number to solve.
Instructional Example
1. Using menu at a restaurant have student write and solve an equation for the total cost of their meal if they want to purchase a various items from the menu such as a salad, hamburger, onion rings, and a root beer would be represented by 　　　　　cost = s + h + o + r. 2. Have student find the total number of bricks needed to cover a patio that measures 8 feet by 8 feet if one brick covers 32 square inches.
Item Specification
Category 3: Demonstrate Understanding of Mathematical Ideas: 3b. Use representations to model mathematical ideas **Category 5: Solve Non-routine Problems/Make Connections: 5b.** Apply mathematics in contexts outside of mathematics (whenever possible, include diagrams/visuals
Assessment Item Example
John always goes to sleep 2 hours after his dinner hour (*d*). Which expression represents the time that John goes to sleep? 　**A.**　　　2 - d 　**B.**　　　d - 2 　**C.**　　　d + 2 　**D.**　　　2d   Correct Answer: C

Standard/Benchmark/Indicator
M.8.2.3.A3
<u>Standard</u>:   Algebra
<u>Benchmark</u>: Functions
<u>Indicator</u>:   Translates between the numerical, tabular, graphical, and symbolic representations of linear relationships with integer coefficients and constants

Explanation of Indicator

Change (translate) between numerical, tabular, graphical, and symbolic representations of a set of data that is linear.

Instructional Example

Have student represent a variety of situations such as the following:

A fish tank is being filled with water with 2-liter jugs. There are already 5 liters of water in the fish tank. Therefore, you are showing how full the tank is as you empty another 2-liter jug of water into it.
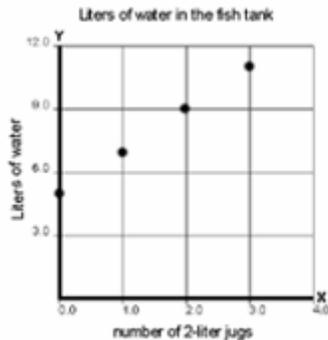
symbolic – $y = 2x + 5$

tabular –

X	0	1	2	3
Y	5	7	9	11

graphical –

Liters of water in the fish tank

Item Specification

Category 2: Perform Procedures: 2f. Read or produce graphs and tables

Category 3: Demonstrate Understanding of Mathematical Ideas: 3e. Show and/or explain relationships between models, diagrams, and/or other representations

Category 5: Solve Non-routine Problems/Make Connections: 5b. Apply mathematics in contexts outside of mathematics (whenever possible, include diagrams/visuals

Assessment Item Example

Alex set up a lemonade stand outside his house. He found that his profit after 4 hours, including the money he spent on supplies, could be represented by the equation $5x = y + 4$. Which table shows his profit (y) at the end of each hour (x)?

A.

x	0	1	2	3	4
y	-5	-1	3	7	11

C.

x	0	1	2	3	4
y	5	1	-3	-7	-11

B.

x	0	1	2	3	4
y	4	-1	-6	-11	-16

D.

x	0	1	2	3	4
y	-4	1	6	11	16

Correct Answer: D

					Indicator
					M.8.2.3.A3

Standard/Benchmark/Indicator
M.8.2.4.A2   Standard: Algebra   Benchmark: Models   Indicator: Determines if a given graphical, algebraic, or geometric model is an accurate representation of a given real-world situation
Explanation of Indicator   Mathematical models are representations of some type of situation within a mathematical situation. They can be graphical (such as a picture representing 10,000 people in a report of population), algebraic (such as a formula to represent the area of a circle), or geometric (such as a geometric shape on a balance scale represents a given weight).
Instructional Example   1. Have student solve problems such as if the cost of two shirts (represented picture of two shirts) that equal the price of one pair of pants (represented by picture of a pair of pants), then ask if you wanted to by six shirts, how many pairs of pants could be purchased with the same amount of money?   2. If the formula for the area of a triangle is $A = \frac{1}{2} b \bullet h$ (where A = Area, b = length of base of triangle, and h = height of triangle), have student measure triangles and find the are given the formula.
Item Specification   **Category 3: Demonstrate Understanding of Mathematical Ideas: 3e.** Show and/or explain relationships between models, diagrams, and/or other representations   **Category 4: Conjecture/Generalize/Prove: 4f.** Identify faulty arguments or identify misrepresentations of data   **Category 5: Solve Non-routine Problems/Make Connections: 5b.** Apply mathematics in contexts outside of mathematics (whenever possible, include diagrams/visuals
Assessment Item Example   Each week, Joe saves $5 less than the amount Karen saves. Using *j* for the amount Joe saves and *k* for the amount Karen saves, which equation correctly shows the relationship between the amounts they save each week?   A. $j = 5 \bullet k$ B. $j = k - 5$ C. $k = 5 \bullet j$ D. $k = j - 5$ Correct Answer: B

Indicator					
M.8.2.4.A2					

Standard/Benchmark/Indicator
M.8.3.1.A1a
Standard: Geometry
Benchmark: Geometric Figures and Their Properties
Indicator: Solves real-world problems by: a) using the properties of corresponding parts of similar and congruent figures

Explanation of Indicator
Solve real-world problems using knowledge that congruent figures are the same exact shape and size and their corresponding sides are the same length and their areas are the same.
Solve real-world problems using knowledge that similar figures are the same exact shape and their corresponding sides are proportional in length and their areas are proportional to the increase in the sides.

Instructional Example
Have student use scale drawings, map keys, proportions, and indirect measures to find unknown quantities in a variety of situations.

Item Specification
Category 2: Perform Procedures: 2d. Solve equations, formulas, or routine word problems
Category 5: Solve Non-routine Problems/Make Connections: 5b. Apply mathematics in contexts outside of mathematics (whenever possible, include diagrams/visuals

Assessment Item Example
The scale on a floor plan of a house is 1 inch = 4 feet. If the length of the hallway on the floor plan is 4.25 inches, what is the **actual** length of the hallway in the house?
A.   8.25 feet
B.   16.25 feet
C.   17.00 feet
D.   21.00 feet
Correct Answer: C

	Indicator				
	M.8.3.1.A1a				

Standard/Benchmark/Indicator
M.8.4.1.A4a Standard: Data Benchmark: Probability Indicator: Makes predictions based on the theoretical probability a) a simple event in an experiment or simulation
Explanation of Indicator Theoretical probability is the expected probability in an experiment. If a die is rolled, each number 1 - 6 has a 1/6 probability of being rolled. If a die is rolled 300 times it is expected that a 6 would be rolled 50 times (1/6 ●300 = 50 times).
Instructional Example Play board games with a die and discuss with them how many 2's can be expected in 60 rolls. If a coin is flipped 100 times, what would the expected number of heads and tails be?
Item Specification **Category 3: Demonstrate Understanding of Mathematical Ideas: 3c.** Explain findings and/or results from data analysis strategies or experiments/simulations **Category 4: Conjecture/Generalize/Prove: 4a.** Determine the truth of a mathematical pattern, a mathematical statement, and/or proposition or make predictions **Category 5: Solve Non-routine Problems/Make Connections: 5b.** Apply mathematics in contexts outside of mathematics (whenever possible, include diagrams/visuals
Assessment Item Example The faces of a cube are numbered 1 through 6. The cube is rolled 60 times. Which is the **best** prediction of the number of times the cube is expected to land with a 4 facing up?   **A** 5 times   **B** 6 times   **C** 10 times   **D** 15 times Correct Answer: C

		Indicator			
		M.8.4.1.A.4a			