



## **Assessment Development Guide**

### **Educator Resource**

#### **Mathematics: Grade 6**

This document is intended to describe how the Kansas assessments align to the Kansas standards. It illustrates how standards, evidence statements, performance level descriptors (PLDs), and depth of knowledge influence the Kansas summative assessment.

The 2017 Kansas mathematics standards serve as the foundation of the assessment. These standards are grouped into clusters, and the assessment mirrors these same groupings. By assessing at the cluster level, it is possible to highlight student mastery of the connected material contained in the standards. Emphasis on particular clusters captures the focus, coherence, and rigor of the standards. These content emphases guide the development of each assessment.

### **Suggested Uses**

Educators can use this document to

- better understand the standards and the assessment.
- understand what is expected of students in order to achieve performance level 3.
- check the alignment of curriculum and learning activities.
- ensure that long-range instructional plans match the major emphases of the standards.
- apply standards at the level of rigor necessary to allow students to demonstrate success within a balanced assessment system.
- develop learning goals.
- build a greater understanding of student, grade-level, school, and district results and plan for future learning activities accordingly.
- provide professional development opportunities within a school or district, and for vertical team planning, grade-level planning, and professional learning communities.

### **Evidence Statements**

Evidence statements are derived from the content standards and describe the knowledge and skills that an assessment item or task elicits from students.

Evidence statements are also designed to provide guidance for teachers in creating classroom learning opportunities that align with the expectations of the standards. Evidence statements should not be used as a checklist of student understanding, nor should they be used to limit instructional practices.

### Performance Level Descriptors

To help educators and parents understand students' performance at each level, PLDs are available for each test. PLDs define the knowledge, skills, and processes that students likely demonstrate at different levels of proficiency within the reporting categories (1, 2, 3, 4). PLDs are not inclusive: they do not describe all possible skills students could demonstrate at each of the levels. PLDs should not be viewed as checklists of what students should know or be able to do.

These PLDs appear on Individual Student Reports and describe student performance on the assessment.

**Level 1:** A student at Level 1 shows a *limited* ability to understand and use the skills and knowledge needed for post-secondary readiness.

**Level 2:** A student at Level 2 shows a *basic* ability to understand and use the skills and knowledge needed for post-secondary readiness.

**Level 3:** A student at Level 3 shows an *effective* ability to understand and use the skills and knowledge needed for post-secondary readiness.

**Level 4:** A student at Level 4 shows an *excellent* ability to understand and use the skills and knowledge needed for post-secondary readiness.

Detailed descriptions of performance levels for grade 6 mathematics are contained within this document.

### Depth of Knowledge

The Kansas Assessment Program (KAP) uses Webb's Depth of Knowledge (DOK) framework to classify each assessment item based on the level of cognitive demand required by students. The four DOK levels **do not** directly correspond to the four performance levels of the KAP summative assessments.

DOK is a measure of cognitive complexity, not a measure of difficulty. Item difficulty is determined by the percentage of students who correctly respond to an item. It is possible for a DOK 2 item to be very difficult and for a DOK 3 item to be relatively easy.

Items within an assessment include a range of DOK levels and correspond to the levels of cognitive complexity required by the content standards. There are four DOK levels, as outlined below.



- Level 1** Recall and Reproduction: Recall a fact, term, definition, principle, or concept; perform a simple procedure.
- Level 2** Basic Application of Skills and Concepts: Apply conceptual knowledge; use provided information to select appropriate procedures for a task; perform two or more steps with decision points along the way; solve routine problems; organize or display data; interpret or use simple graphs.
- Level 3** Strategic Thinking: Apply reasoning, using evidence, and developing a plan to approach or solve abstract, complex, or nonroutine problems; interpret information and provide justification when more than one approach is possible.
- Level 4** Extended Thinking: Perform investigations or apply concepts and skills that require research and problem-solving across content areas or multiple sources.

### Test Summary

The test content summary provides general information related to the development and frequency of items on the summative assessment. The content emphases of the Kansas summative assessment reflect the instructional emphases outlined in the Kansas State Department of Education [Grade Level Focus](#) documents.

There are two groups of items that make up the summative assessment.

#### 1. Skills and Concepts:

Items that assess Skills and Concepts align to one or more evidence statements within a single cluster and require students to perform operations, apply formulas, compare and classify information, and demonstrate conceptual understanding. These items involve applying knowledge of mathematical concepts and executing procedures to solve problems.

#### 2. Strategic Thinking and Reasoning:

Items that assess Strategic Thinking and Reasoning align to one or more clusters and require students to use problem-solving and modeling strategies and to communicate their reasoning. These items involve analyzing complex mathematical and real-world problems, using problem-solving strategies and mathematical models to interpret and solve problems, constructing arguments to support the reasoning used, and critiquing the reasoning of others.

**Table 1. Grade 6 Mathematics Test Summary**

<b>Skills and Concepts</b>		<b>Percentage of Assessment</b>	<b>Depth of Knowledge</b>
<i>Domains</i>	Ratios and Proportional Relationships	75%–88%	1, 2
	The Number System		
	Expressions and Equations		
	Geometry		
	Statistics and Probability		
<b>Strategic Thinking and Reasoning</b>		<b>Percentage of Assessment</b>	<b>Depth of Knowledge</b>
	Problem-Solving and Modeling	12%–25%	2, 3
	Communicating Reasoning		

The remaining pages of this document are organized by cluster. The cluster descriptions include the cluster heading and a list of the standards within each cluster, as structured in the 2017 Kansas mathematics standards. Evidence statements and PLDs are shown below each cluster.

**Cluster: 6.RP.A** Understand ratio concepts and use ratio reasoning to solve problems.

**Standards:** 6.RP.1, 6.RP.2, 6.RP.3

**Grade Level Focus:** ► Major

#### Evidence Statements

1. The student uses ratio language to describe a ratio relationship between two quantities.
2. The student represents ratios as part-to-part and part-to-whole relationships.
3. The student determines the unit rate or uses the unit rate to solve real-world problems.
4. The student makes tables of equivalent ratios relating quantities with whole-number measurements.
5. The student determines missing values in tables of equivalent ratios.
6. The student plots coordinate pairs to represent equivalent ratios.
7. The student solves real-world and mathematical problems involving finding a percentage of a quantity as a rate per 100.
8. The student solves mathematical problems involving finding the whole, given a part and the percentage.
9. The student uses ratio reasoning to convert measurement units.
10. The student uses ratio reasoning to manipulate and transform units appropriately when multiplying or dividing quantities.

<b>Performance Level Descriptors (PLDs)</b>			
<b>Level 1</b>	<b>Level 2</b>	<b>Level 3</b>	<b>Level 4</b>
Students should be able to describe a ratio relationship between two whole-number quantities; identify ratios involving part-to-part and part-to-whole relationships; plot pairs of values from a table on the coordinate plane; find a percentage as a rate per hundred; and convert measurement units.	Students should be able to solve problems involving part-to-part and part-to-whole relationships; determine the unit rate when solving one-step problems requiring ratio reasoning; and determine missing values in tables that display a proportional relationship in consecutive increments.	Students should be able to use ratio reasoning to find unit rates in multi-step problems, including instances of unit pricing and constant speed; determine missing values in tables that display a proportional relationship in nonconsecutive increments; solve real-world problems involving unit rate; and solve percentage problems by finding the whole, given a part and the percentage.	Students should be able to solve real-world and mathematical multi-step problems involving percentages; explain ratio relationships between two number quantities; and identify relationships between models or representations.

**Cluster: 6.NS.A** Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

**Standard:** 6.NS.1

**Grade Level Focus:** ► Major

Evidence Statements			
1. The student interprets quotients of fractions using visual fraction models, equations, and the relationship between multiplication and division. 2. The student solves real-world and mathematical one-step problems involving division of fractions by fractions.			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
Students should be able to apply and extend previous understandings of multiplication and division to divide a fraction between 0 and 1 by a whole number; divide a fraction between 0 and 1 by a unit fraction with the same denominator; and connect division of fractions to visual models.	Students should be able to apply and extend previous understandings of multiplication and division to divide a whole number by a fraction between 0 and 1; divide a mixed number by a whole number; and connect division of fractions to visual models.	Students should be able to apply and extend previous understandings of multiplication and division to divide a fraction or mixed number by another fraction or mixed number and connect division of fractions to visual models and equations.	Students should be able to solve real-world problems involving division of fractions and interpret the meaning of the quotient, as related to the context of the problem.

**Cluster: 6.NS.B** Compute fluently (efficiently, accurately, and flexibly) with multi-digit numbers and find common factors and multiples.

**Standards:** 6.NS.2, 6.NS.3, 6.NS.4

**Grade Level Focus:** ● Additional

Evidence Statements			
<ol style="list-style-type: none"> <li>1. The student divides multi-digit whole numbers.</li> <li>2. The student adds, subtracts, multiplies, and divides multi-digit decimals.</li> <li>3. The student determines the greatest common factor of two whole numbers.</li> <li>4. The student determines the least common multiple of two whole numbers.</li> <li>5. The student uses the distributive property to express a sum of two whole numbers with a common factor as a multiple of a sum of two whole numbers with no common factor.</li> </ol>			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
Students should be able to add, subtract, and multiply multi-digit whole numbers and decimals to the hundredths place.	Students should be able to divide multi-digit whole numbers and express remainders as whole numbers; add, subtract, and multiply multi-digit decimals; find common factors of two numbers less than or equal to 100; find multiples of two numbers less than or equal to 12; and use the distributive property to express the sum of two whole numbers with a common factor as a multiple of a sum and two whole numbers with a common factor.	Students should be able to fluently (efficiently, accurately, and flexibly) divide multi-digit whole numbers using an efficient algorithm; fluently (efficiently, accurately, and flexibly) add, subtract, multiply, and divide multi-digit decimals using an efficient algorithm and express remainders as a decimal or a simplified fraction; find the greatest common factor of two numbers less than or equal to 100; find the least common multiple of two whole numbers less than or equal to 12; and use	Students should be able to apply multi-digit computation and the distributive property to solve real-world and mathematical problems and interpret the meaning of the answer.



		<p>the distributive property to express a sum of two whole numbers with a common factor as a multiple of a sum of two whole numbers with no common factor.</p>	
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**Cluster: 6.NS.C** Apply and extend previous understandings of numbers to the system of rational numbers.

**Standards:** 6.NS.5, 6.NS.6, 6.NS.7, 6.NS.8

**Grade Level Focus:** ► Major

Evidence Statements			
<ol style="list-style-type: none"> <li>1. The student uses positive numbers, negative numbers, and zero to represent quantities in real-world contexts.</li> <li>2. The student locates and positions integers and other rational numbers on a number line.</li> <li>3. The student locates and positions ordered pairs of integers and other rational numbers on a coordinate plane.</li> <li>4. The student interprets statements about inequalities as the relative position of two numbers on a number line.</li> <li>5. The student writes and interprets statements about the order of rational numbers in real-world contexts.</li> <li>6. The student represents the absolute value of a rational number as the distance from zero on a number line.</li> <li>7. The student distinguishes comparisons of absolute value from statements about order.</li> <li>8. The student solves real-world and mathematical problems by graphing ordered pairs on a coordinate plane and using coordinates and absolute value to find the distances between points with the same first coordinate or the same second coordinate.</li> </ol>			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
Students should be able to place all integers on a number line and integer pairs on a coordinate plane with one-unit increments on both axes.	Students should be able to apply and extend previous understandings of whole numbers to order rational numbers and interpret statements of their order in the context of a situation; place all rational numbers on a number line and integer ordered pairs on a coordinate plane with various axis increments; and relate changes in sign to placements on opposite sides of the number line.	Students should be able to apply and extend previous understandings of numbers to relate statements of inequality to relative positions on a number line; place points with rational coordinates on a coordinate plane; understand the absolute value of a number as its distance from zero on a number line; distinguish comparisons of absolute value from statements about order; and solve problems involving the distance between points when they share a coordinate.	Students should be able to interpret statements of inequality to include all possible solutions and relate changes in sign to reflection across axes.



**Cluster: 6.EE.A** Apply and extend previous understandings of arithmetic to algebraic expressions.

**Standards:** 6.EE.1, 6.EE.2, 6.EE.3

**Grade Level Focus:** ► Major

Evidence Statements			
<ol style="list-style-type: none"> <li>1. The student uses mathematical terms to describe expressions and parts of an expression.</li> <li>2. The student writes and evaluates numerical expressions.</li> <li>3. The student writes algebraic expressions that record operations with numbers and variables.</li> <li>4. The student evaluates algebraic expressions and expressions from formulas in real-world problems.</li> <li>5. The student identifies and generates equivalent expressions by applying the properties of operations.</li> </ol>			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
Students should be able to write numerical expressions with one or two operations; evaluate numerical expressions without exponents; and identify parts of an expression using mathematical terms (e.g., coefficient, term, sum, product, difference, quotient, and factor).	Students should be able to write and evaluate numerical expressions with whole-number exponents; write algebraic expressions with one or two operations; evaluate algebraic expressions without exponents; and identify equivalent expressions.	Students should be able to write and evaluate numerical expressions with whole-number exponents and/or parentheses; write and evaluate algebraic expressions with whole-number exponents and/or parentheses; evaluate expressions from formulas in real-world problems; and generate equivalent expressions by applying the properties of operations.	Students should be able to apply the understanding of the properties of operations and use the properties to show why two expressions are equivalent.

**Cluster: 6.EE.B** Reason about and solve one-variable equations and inequalities.

**Standards:** 6.EE.4, 6.EE.5, 6.EE.6, 6.EE.7

**Grade Level Focus:** ► Major

Evidence Statements			
<ol style="list-style-type: none"> <li>1. The student uses substitution in one-variable equations to determine whether a given number is the solution.</li> <li>2. The student uses substitution in one-variable inequalities to determine whether a given number is a solution.</li> <li>3. The student writes algebraic expressions to represent and solve real-world and mathematical problems.</li> <li>4. The student writes and solves one-variable, one-step equations in real-world and mathematical problems.</li> <li>5. The student writes one-variable inequalities of the form <math>x &gt; c</math> or <math>x &lt; c</math> to represent real-world and mathematical problems.</li> <li>6. The student represents solutions of inequalities on a number line.</li> </ol>			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
Students should be able to use substitution to determine whether a given number makes an equation true.	Students should be able to use substitution to determine whether a given number makes an inequality true; identify and use variables when writing algebraic expressions; and solve one-variable equations.	Students should be able to identify and use variables when writing one-variable equations and inequalities; and represent solutions of inequalities on a number line.	No descriptor

**Cluster: 6.EE.C** Represent and analyze quantitative relationships between dependent and independent variables.

**Standard:** 6.EE.8

**Grade Level Focus:** ► Major

Evidence Statements			
<ol style="list-style-type: none"> <li>1. The student identifies the independent and dependent variables in real-world problems.</li> <li>2. The student writes equations to express one quantity versus another quantity using dependent and independent variables in real-world problems.</li> <li>3. The student analyzes the relationship between dependent and independent variables in real-world problems from graphs and tables and relates them to equations.</li> </ol>			
Performance Level Descriptors (PLD)			
Level 1	Level 2	Level 3	Level 4
Students should be able to identify a table of values that represent a relationship between two variables of the forms $y = kx$ and $y = x \pm c$ with rational numbers and plot points corresponding to equations on coordinate planes.	Students should be able to use variables to represent and analyze two quantities that change in relationship to each other of the form $y = kx$ and $y = x \pm c$ with rational numbers and use graphs and tables to represent the relationship.	Students should be able to use graphs, tables, or context to analyze the relationship between dependent and independent variables and relate them to a linear equation.	Students should be able to use graphs, tables, or context to analyze two-step equations that represent relationships between dependent and independent variables.

**Cluster: 6.G.A** Solve real-world and mathematical problems involving area, surface area, and volume.

**Standards:** 6.G.1, 6.G.2, 6.G.3, 6.G.4

**Grade Level Focus:** ◆ Supporting

Evidence Statements			
<ol style="list-style-type: none"> <li>1. The student determines the area of all triangles, special quadrilaterals (including parallelograms, kites, and trapezoids), and polygons whose edges meet at right angles using composition and decomposition in real-world and mathematical problems.</li> <li>2. The student determines the volume of right rectangular prisms with fractional edge lengths in real-world and mathematical problems.</li> <li>3. The student draws polygons whose edges meet at right angles in the coordinate plane, given coordinates for the vertices, in real-world and mathematical problems.</li> <li>4. The student determines the length of a side of a polygon in the coordinate plane, given the same first or second coordinate for the vertices in real-world and mathematical problems.</li> <li>5. The student determines the surface area of three-dimensional figures formed by nets of polygons in real-world and mathematical problems.</li> </ol>			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
Students should be able to find the area of right triangles; draw polygons on a grid with scales in one-unit increments, given whole-number coordinates for the vertices; and find the volume of right rectangular prisms with one side expressed as a fraction or a mixed number in halves or fourths.	Students should be able to find the area of special quadrilaterals and triangles; draw polygons in the coordinate plane with scales in one-unit increments, given integer-valued coordinates for the vertices; and find the volume of right rectangular prisms with one side expressed as a fraction or a mixed number.	Students should be able to find the area of triangles, special quadrilaterals, and polygons using composition and decomposition; find the surface area using nets made up of rectangles and triangles; find the volume of right rectangular prisms with sides expressed as fractions or mixed numbers; draw polygons in the coordinate plane to solve problems; and determine the length of a side of a polygon, given coordinates for the vertices.	Students should be able to find the surface area and volume of compound figures composed of right rectangular prisms.

**Cluster: 6.SP.A** Develop concepts of statistical measures of center and variability and an informal understanding of outlier.

**Standards:** 6.SP.1, 6.SP.2, 6.SP.3

**Grade Level Focus:** ● Additional

<b>Evidence Statements</b>			
<ol style="list-style-type: none"> <li>1. The student recognizes and generates a statistical question as one that anticipates variability.</li> <li>2. The student identifies statements that describe the center (mean, median, mode), spread (range, interquartile range), and overall shape (cluster, peak, gap, symmetry, skew [data], outlier) of a data set.</li> <li>3. The student recognizes that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.</li> </ol>			
<b>Performance Level Descriptors (PLDs)</b>			
<b>Level 1</b>	<b>Level 2</b>	<b>Level 3</b>	<b>Level 4</b>
Students should be able to identify questions that lead to variable responses and recognize that such questions are statistical questions.	Students should be able to recognize that varying responses result from statistical questions and relate the concept of varying responses to the notion of a range of possible responses; demonstrate an understanding that the responses to a statistical question will have a representative center and a given set of numerical data; and identify a reasonable measure of central tendency with respect to a familiar context.	Students should be able to generate statistical questions; demonstrate understanding that the responses to a statistical question have a distribution described by its center, spread, and overall shape; demonstrate understanding that a measure of center summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number; and identify a reasonable center and spread with respect to a familiar context.	Students should be able to justify the reasonableness of their identified center and spread with respect to a contextual situation.

**Cluster: 6.SP.B** Summarize and describe distributions.

**Standards:** 6.SP.4, 6.SP.5

**Grade Level Focus:** ● Additional

Evidence Statements			
<ol style="list-style-type: none"> <li>1. The student displays numerical data on dot plots, histograms, stem-and-leaf plots, and box plots.</li> <li>2. The student summarizes numerical data sets by describing the nature of the attribute under investigation, including how it was measured, its units of measurement, and number of observations.</li> <li>3. The student summarizes numerical data sets by determining quantitative measures of center (mean, median, mode) and variability (range, interquartile range).</li> <li>4. The student summarizes numerical data sets by describing any overall pattern and any striking deviations from the overall pattern in reference to the quantitative measures.</li> <li>5. The student summarizes numerical data sets by relating the choice of measures of center and variability to the shape of the data distribution or context data gathered.</li> </ol>			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
<p>Students should be able to summarize or display data in dot plots and histograms; determine the median of an odd number of data points; determine the mode or modes of a data set; and determine the mean when data points are nonnegative integers.</p>	<p>Students should be able to summarize and display data in a stem-and-leaf plot; determine the mean when data points are nonnegative rational numbers; determine the median of an even number of data points; demonstrate understanding that measures of center can be different or the same; and use the measure of center to summarize data with reference to the context.</p>	<p>Students should be able to summarize and display data in a box plot; determine the range and interquartile range of a data set; use variability and measures of center to describe overall patterns in a data distribution, such as symmetry, clusters, and any striking deviations; examine a data set in context and choose appropriate measures of center, as it relates to the data.</p>	<p>Students should be able to relate the choices of measures of center and variability to the shape of the data distribution in context of the data; identify outliers with reference to the context of the situation; and predict effects on the measures of center given a change in data points.</p>

