Assessment Development Guide
Educator Resource
Mathematics: Grade 8

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 *excellen*t ability to understand and use the skills and knowledge needed for post-secondary readiness.

Detailed descriptions of performance levels for grade 8 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 Content Summary

The test 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 8 Mathematics Test Summary

Skills and Concepts		Percentage of Assessment	Depth of Knowledge
Domains	The Number System	75%–88%	1, 2
	Expressions and Equations		
	Functions		
	Geometry		
	Statistics and Probability		
Strategic Thinking and Reasoning		**Percentage of Assessment**	**Depth of Knowledge**
	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: 8.NS.A Know that there are numbers that are not rational, and approximate them by rational numbers.

Standards: 8.NS.1, 8.NS.2

Grade Level Focus: ◆ Supporting

Evidence Statements			
1. The student classifies real numbers as rational or irrational. 2. The student converts between fractions and decimals. 3. The student writes approximations of irrational numbers as rational numbers. 4. The student compares irrational numbers by using rational approximations of irrational numbers. 5. The student approximates the locations of irrational numbers on a number line by using rational approximations of irrational numbers.			
Performance Level Descriptors (PLDs)			
Level 1	**Level 2**	**Level 3**	**Level 4**
Students should be able to classify numbers as rational or irrational and understand that every rational number has a decimal expansion.	Students should be able to convert between fractions and terminating decimals and identify approximate locations of irrational numbers between two perfect squares on a number line.	Students should be able to convert between fractions and repeating decimals; use rational approximations to compare irrational numbers; and use rational approximations of irrational numbers to locate them more accurately on a number line.	Students should be able to use approximations of irrational numbers to solve problems and estimate the value of expressions.

Cluster: 8.EE.A Work with radicals and integer exponents.

Standards: 8.EE.1, 8.EE.2, 8.EE.3

Grade Level Focus: ▶ Major

Evidence Statements			
1. The student solves equations of the form $x^2 = p$ by representing solutions using a square root symbol or by evaluating the square root of whole-number perfect squares with solutions between 0 and 15. 2. The student solves equations of the form $x^3 = p$ by representing solutions using a cube-root symbol or by evaluating the cube root of whole-number perfect cubes with solutions between 0 and 5. 3. The student uses scientific notation to represent very large or very small numbers. 4. The student states how many times larger or smaller a number, written in scientific notation, is than another number. 5. The student converts between standard form and scientific notation.			
Performance Level Descriptors (PLDs)			
Level 1	**Level 2**	**Level 3**	**Level 4**
Students should be able to solve equations of the form $x^2 = p$ by representing solutions using a square root symbol or by evaluating the square root of whole-number perfect squares with solutions between 0 and 5; and convert between standard form and scientific notation with a single-digit whole number times a whole-number power of 10.	Students should be able to solve equations of the form $x^2 = p$ by evaluating the square root of whole-number perfect squares with solutions between 0 and 15; and convert between standard form and scientific notation with a single-digit whole number times an integer power of 10.	Students should be able to solve equations of the form $x^3 = p$ by representing solutions using a cube-root symbol or by evaluating the cube root of whole-number perfect cubes with solutions between 0 and 5; and convert between standard form and scientific notation with a decimal times an integer power of 10.	Students should be able to use scientific notation and choose units of appropriate size for realistic measurements and estimate quantities to express how many times larger or smaller one quantity is than another.

Cluster: 8.EE.B Understand the connections between proportional relationships, lines, and linear equations.

Standards: 8.EE.4, 8.EE.5, 8.EE.6

Grade Level Focus: ▶ Major

Evidence Statements			
1. The student graphs proportional relationships. 2. The student interprets the unit rate as the slope of the graph of a proportional relationship. 3. The student compares two different proportional relationships. 4. The student uses similar triangles to determine and explain why the slope *m* is the same between any two distinct points on a non-vertical line in the coordinate plane. 5. The student calculates the slope of a line when given two coordinate points. 6. The student generates the equation $y = mx$ or $y = mx + b$ for a line. 7. The student identifies and describes the relationship between the proportional relationship $y = mx$ and the non-proportional linear relationship $y = mx + b$.			
Performance Level Descriptors (PLDs)			
Level 1	**Level 2**	**Level 3**	**Level 4**
Students should be able to graph a proportional relationship on a coordinate plane and identify the slope and *y*-intercept, given a graph.	Students should be able to compare two different proportional relationships represented in the same way; use any two coordinate points to calculate the slope of a line; and generate the equation $y = mx$ or $y = mx + b$ of a line, given a graph.	Students should be able to compare two different proportional relationships represented in different ways; identify the relationship between proportional and non-proportional linear relationships as a result of a vertical translation; determine the slope and *y*-intercept of a line; and generate the equation $y = mx$ or $y = mx + b$ of a line, represented in a variety of ways.	Students should be able to use similar triangles to explain why the slope is the same between any two distinct points on a non-vertical line in a coordinate plane; describe the relationship between proportional and non-proportional relationships; and use proportional relationships to identify other points on the line.

Cluster: 8.EE.C Analyze and solve linear equations and inequalities.

Standard: 8.EE.7

Grade Level Focus: ▶ Major

Evidence Statements			
1. The student identifies and writes examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. 2. The student solves linear equations and inequalities in one variable with rational number coefficients, including equations whose solutions require expanding and factoring expressions.			
Performance Level Descriptors (PLDs)			
Level 1	**Level 2**	**Level 3**	**Level 4**
Students should be able to solve one- and two-step linear equations and inequalities in one variable with integer coefficients and with the same variable appearing on one side of the equal sign and inequality signs.	Students should be able to solve multi-step linear equations in one variable with rational number coefficients, with the variable appearing on one side of the equal sign, including situations that have one solution, infinitely many solutions, or no solution; and solve multi-step linear inequalities in one variable with integer coefficients, with the variable appearing on one side of the equal sign and inequality signs.	Students should be able to solve and produce examples of multi-step linear equations in one variable, with the variable appearing on both sides of the equal sign, including situations that have one solution, infinitely many solutions, or no solution; and solve multi-step linear inequalities in one variable with rational number coefficients, with the variable appearing on one side of the equal sign and inequality signs.	Students should be able to solve and produce examples of linear inequalities in one variable, with the variable appearing on both sides of the equal sign and inequality signs.

Cluster: 8.F.A Define, evaluate, and compare functions.

Standards: 8.F.1, 8.F.2, 8.F.3

Grade Level Focus: ▶ Major

Evidence Statements			
1. The student recognizes that a function is a rule that assigns to each input exactly one output. 2. The student identifies or produces input and output pairs for given functions. 3. The student recognizes the same linear function represented in different ways (algebraically, graphically, numerically in tables, or by verbal descriptions). 4. The student compares properties of two linear functions represented in a variety of ways (algebraically, graphically, numerically in tables, or by verbal descriptions). 5. The student interprets the equation $y = mx + b$ as defining a linear function with a graph that is a straight line. 6. The student recognizes and gives examples of functions that are not linear.			
Performance Level Descriptors (PLDs)			
Level 1	**Level 2**	**Level 3**	**Level 4**
Students should be able to identify whether a relationship, represented algebraically, graphically, or numerically in tables, is a function.	Students should be able to identify whether an input-output pair satisfies a function; produce input-output pairs for a given function; recognize the same linear function represented in different ways; compare properties of two linear functions represented in the same way; and identify a function as linear or nonlinear based on its graph.	Students should be able to define a function as a rule that assigns exactly one output to each input; compare properties of two linear functions represented in a variety of ways; know linear equations of the form $y = mx + b$ are functions; and classify functions represented in a variety of ways as linear or nonlinear.	Students should be able to give examples of functions that are not linear.

Cluster: 8.F.B Use functions to model relationships between quantities.

Standards: 8.F.4, 8.F.5

Grade Level Focus: ▶ Major

Evidence Statements			
1. The student constructs a function to model a linear relationship between two quantities. 2. The student determines the rate of change and initial value (*y*-intercept) of a function from a description of a relationship or from two (*x*, *y*) values. 3. The student interprets features of a linear function, such as rate of change and initial value, in terms of the situation it models, its graph, or a table of values. 4. The student qualitatively describes the functional relationship between two quantities by analyzing a graph. 5. The student identifies a graph that exhibits the qualitative features of a function that has been described verbally.			
Performance Level Descriptors (PLDs)			
Level 1	**Level 2**	**Level 3**	**Level 4**
Students should be able to construct a graphical or tabular model to represent a linear relationship between two quantities and find the rate of change of a linear relationship displayed in a graph or table.	Students should be able to construct a function to represent a linear relationship between two quantities from a graph, a verbal description of the relationship, or two (*x*, *y*) values.	Students should be able to determine the rate of change and initial value of a linear function from a graph, a verbal description of the relationship, or two (*x*, *y*) values; analyze a graph of a linear function to qualitatively describe it; and identify and sketch a graph of a linear or nonlinear function that has been described verbally.	Students should be able to interpret the rate of change and initial value of a linear function, in terms of the situation it models and in terms of its graph or a table of values; and analyze a graph of a nonlinear function to qualitatively describe it.

Cluster: 8.G.A Geometric measurement: understand concepts of angle and measure angles.

Standards: 8.G.1, 8.G.2, 8.G.3, 8.G.4, 8.G.5, 8.G.6

Grade Level Focus: ▶ Major

Evidence Statements			
1. The student relates the concept of an angle to the fraction of a circular arc between two points on a circle. 2. The student uses a protractor to measure angles and construct angles to whole-number degrees. 3. The student decomposes an angle into smaller non-overlapping parts and adds the measures of these smaller parts to calculate the measure of the whole angle. 4. The student determines the measure of an unknown angle on a diagram in real-world and mathematical problems. 5. The student identifies and solves multi-step problems involving supplementary, complementary, vertical, and adjacent angles. 6. The student draws, constructs, and describes geometric shapes given certain conditions.			
Performance Level Descriptors (PLDs)			
Level 1	**Level 2**	**Level 3**	**Level 4**
Students should be able to measure an angle with a protractor; calculate the measure of a larger angle composed of two or more non-overlapping parts; and classify pairs of angles as supplementary or complementary.	Students should be able to identify supplementary, complementary, vertical, and adjacent angles in a figure; and solve addition and subtraction problems to determine the measures of unknown angles on a diagram in real-world and mathematical problems.	Students should be able to solve multi-step problems involving supplementary, complementary, vertical, and adjacent angles; and write and solve equations to determine an unknown angle in complex figures or real-world scenarios.	Students should be able to generalize relationships between angle sums, exterior angles of triangles, and angles created when parallel lines are cut by a transversal; and determine whether a set of three given angle or side-length measures results in a unique triangle, more than one triangle, or no triangle.

Cluster: 8.G.B Understand and apply the Pythagorean Theorem.

Standards: 8.G.7, 8.G.8, 8.G.9

Grade Level Focus: ▶ Major

Evidence Statements			
1. The student solves real-world and mathematical problems involving right triangles in two and three dimensions by knowing and applying the Pythagorean Theorem and its converse. 2. The student calculates the distance between two points in a coordinate system by knowing and applying the Pythagorean Theorem.			
Performance Level Descriptors (PLDs)			
Level 1	**Level 2**	**Level 3**	**Level 4**
Students should be able to identify the hypotenuse and legs of a right triangle, given the side lengths or an image of a right triangle.	Students should be able to apply the Pythagorean Theorem to determine whether a triangle is a right triangle, given its side lengths; and calculate the distance between two points on a horizontal or vertical line in a two-dimensional coordinate system.	Students should be able to apply the Pythagorean Theorem to determine the unknown side length of a right triangle and to calculate the distance between two points in a two-dimensional coordinate system.	Students should be able to apply the Pythagorean Theorem to calculate the distance between two points in a three-dimensional coordinate system.

Cluster: 8.G.C Solve real-world and mathematical problems involving measurement.

Standards: 8.G.10, 8.G.11, 8.G.12

Grade Level Focus: ● Additional

Evidence Statements			
1. The student solves real-world and mathematical problems involving arc length and area of sectors. 2. The student solves real-world and mathematical problems by applying the volume formulas for pyramids, cones, and spheres. 3. The student solves real-world and mathematical problems by applying the surface area formulas for pyramids, cones, and spheres.			
Performance Level Descriptors (PLDs)			
Level 1	**Level 2**	**Level 3**	**Level 4**
Students should be able to identify the key dimensions (i.e., radii, heights, circumferences, and diameters) of pyramids, cones, and spheres.	Students should be able to recognize the appropriate formulas for the volume and surface area of pyramids, cones, and spheres and connect the key dimensions to the appropriate locations in the formula.	Students should be able to apply the appropriate formulas to calculate the volume and surface area of pyramids, cones, and spheres in real-world and mathematical problems.	Students should be able to solve real-world and mathematical problems involving arc length and area of sectors; and solve multi-step, real-world problems involving volume and surface area of composite figures.

Cluster: 8.SP.A Investigate patterns of association in bivariate data.

Standards: 8.SP.1, 8.SP.2, 8.SP.3

Grade Level Focus: ◆ Supporting

Evidence Statements			
1. The student describes and interprets patterns of association between two quantities in a scatter plot. 2. The student determines an approximate linear equation that models the relationship between two quantitative variables. 3. The student identifies and interprets the slope (rate of change) and *y*-intercept (initial value) of a linear model in the context of bivariate measurement data.			
Performance Level Descriptors (PLDs)			
Level 1	**Level 2**	**Level 3**	**Level 4**
Students should be able to investigate a scatter plot for clustering between two quantities and construct a scatter plot from given data.	Students should be able to investigate a scatter plot for positive, negative, and linear association and informally fit a line to data that suggests a linear association for a given scatter plot.	Students should be able to construct and interpret scatter plots; describe patterns such as clustering, outliers, positive or negative association, and linear and nonlinear association; informally fit a straight line to a given scatter plot; and use the line and equation to interpret the slope and *y*-intercept.	Students should be able to use scatter plots, trend lines, and associations between variables to make predictions in real-world situations.