New York State Testing Program
Next Generation Learning Standards
Mathematics Test

Performance Level Descriptions

Grade 8

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New York State Testing Program
Next Generation Mathematics Test

Performance Level Descriptions

GRADE 8

Performance level descriptions (PLDs) help communicate to students, families, educators, and the public the specific knowledge and skills expected of students when they demonstrate proficiency of a learning standard. The PLDs serve several purposes in classroom instruction and assessment. They are the foundation of rich discussion around what students need to do to perform at higher levels and to explain the progression of learning within a subject area. PLDs are also crucial in explaining student performance on the NYS assessments since they make a connection between the scale score, the performance level, and specific knowledge and skills typically demonstrated at that level.

Policy Definitions of Performance Levels

For each subject area, students perform along a continuum of the knowledge and skills necessary to meet the demands of the Learning Standards for English Language Arts and Mathematics. There are students who excel in standards, students who are proficient, students who are partially proficient, and students who are below proficient. New York State assessments are designed to classify student performance into one of four levels based on the knowledge and skills the student has demonstrated. These performance levels are defined as:

NYS Level 4

Students performing at this level **excel** in standards for their grade. They demonstrate knowledge, skills, and practices embodied by the Learning Standards that are considered **more than sufficient** for the expectations at this grade.

NYS Level 3

Students performing at this level are **proficient** in standards for their grade. They demonstrate knowledge, skills, and practices embodied by the Learning Standards that are considered **sufficient** for the expectations at this grade.

NYS Level 2

Students performing at this level are **partially proficient** in standards for their grade. They demonstrate knowledge, skills, and practices embodied by the Learning Standards that are considered partial but insufficient for the expectations at this grade. Students performing at Level 2 are considered on track to meet current New York high school graduation requirements but are **not yet proficient** in Learning Standards at this grade.

NYS Level 1

Students performing at this level are **below proficient** in standards for their grade. They may demonstrate **limited** knowledge, skills, and practices embodied by the Learning Standards that are considered **insufficient** for the expectations at this grade.

How were the PLDs developed?

Following best practice for the development of PLDs, the number of performance levels and their definitions were specified prior to the articulation of the full descriptions. New York State educators certified in the appropriate grade-levels and subject areas convened in separate meetings to develop the initial draft PLDs for Grades 3-8 English Language Arts and Mathematics, respectively. In developing PLDs, participants considered policy definitions of the performance level and the knowledge and skill expectations for each grade level in the Learning Standards. Once they established the appropriate knowledge and skills from a particular standard for NYS Level 3 (i.e., proficient in standards), panelists worked together to parse the knowledge and skills across the other performance levels in such a way that the progression of the knowledge and skills was clearly seen moving from Level 1 to Level 4. This process was repeated for all of the standards for each grade and subject area.

The draft PLDs were reviewed by the New York State Education Department's (NYSED's) Content Advisory Panels which consist of classroom teachers from elementary, middle and high school, school and district administrators, English Language Learners (ELLs) and students with disabilities (SWD) specialists, and higher education faculty members from across the state. The drafts then went through additional rounds of review and edits from a number of NYS-certified educators, content specialists, and assessment experts under NYSED supervision.

How can the PLDs be used by Educators and in Instruction?

The PLDs should be used as a guidance document to show the overall continuum of learning of the knowledge and skills from the Learning Standards. NYSED encourages the use of the PLDs for a variety of purposes, including differentiating instruction to maximize individual student outcomes, creating formative classroom assessments and rubrics to help identify target performance levels for individual or groups of students, and tracking student growth along the proficiency continuum as described by the PLDs. The knowledge and skills shown in the PLDs describe *typical* performance and progression, however the order in which students will demonstrate the knowledge and skills within and between performance levels may be staggered (i.e. a student who predominantly demonstrates Level 2 knowledge and skills may simultaneously demonstrate certain knowledge and skills indicative of Level 3.).

How are the PLDs used in Assessment?

PLDs are essential in setting performance standards (i.e., "cut scores") for New York State assessments. Standard setting panelists use PLDs to determine the expectations for students to demonstrate the knowledge and skills necessary to *just barely* attain a Level 2, Level 3, or Level 4 on the assessment. These knowledge and skills drive discussions that influence the panelists as they recommend the cut scores on the assessment.

PLDs are also used in question development. Question writers are assigned to write questions that draw on the specific knowledge and skills from a PLD. This ensures that each test has questions that distinguish performance all along the continuum. Teachers can use the PLDs in the same manner when developing both formative and summative classroom assessments. Tasks that require students to demonstrate knowledge and skills from the PLDs can be tied back to the performance level with which the PLD is associated, providing the teacher with feedback about the students' progress as well as a wealth of other skills that the student is likely able to demonstrate (or can aspire to in the case of the next-highest PLD).

Next Generation Learning Standards
Grade 8 Mathematics Performance Level Descriptions

Cluster	Performance Level 4	Performance Level 3	Performance Level 2	Performance Level 1
Students know there are numbers that are not rational and approximate them by rational numbers. (NY-8.NS.1-2)		Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion eventually repeats. Know that other numbers that are not rational are called irrational. (8.NS.1)	For benchmark unit fractions show that the decimal expansion repeats or terminates.	For benchmark unit fractions (rational numbers) show that the decimal expansion terminates.
	Distinguish between real numbers and non-real or imaginary numbers.	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line, and estimate the value of expressions. (8.NS.2)	Approximate common irrational numbers such as pi (π) and the square root (√) of an irrational number on a number line.	Find a decimal approximation of a square root (non-square integer).

Cluster	Performance Level 4	Performance Level 3	Performance Level 2	Performance Level 1
Students work with radicals and integer exponents. (NY-8.EE.1-4)	Apply two or more properties of integer exponents within a real-world context.	Know and apply properties of integer exponents to generate equivalent numerical expressions. (8.EE.1)	Apply one property of positive integer exponents within a real-world context.	Apply one property of positive integer exponents within a simple numerical expression.
		Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Know square roots of perfect squares up to 225 and cube roots of perfect cube roots of perfect cubes up to 125. Know that the square root of a non-perfect square is irrational. (8.EE.2)	Solve equations of perfect cubes up to 125 of the form $x^3 = p$, where p is a perfect cube, that can be written as a whole number, by representing a positive solution of the equation.	Solve equations of perfect squares up to 225 of the form $x^2=p$, where p is a perfect square, that can be written as a whole number, by representing a positive solution of the equation.
	Estimate very large and very small quantities and determine how many times as large one number is in relation to another when numbers are expressed in scientific and decimal notation. Interpret scientific notation in context.	Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. (8.EE.3)	Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities.	Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large numbers.

Cluster	Performance Level 4	Performance Level 3	Performance Level 2	Performance Level 1
Students work with radicals and integer exponents. (NY-8.EE.1-4)	Perform multiplication and division with numbers expressed in scientific and standard decimal form, with and without technology.	Perform multiplication and division with numbers expressed in scientific notation, including problems where both standard decimal form and scientific notation are used. (8.EE.4)	Perform multiplication and division with numbers expressed in scientific notation, without technology.	Perform multiplication with numbers expressed in scientific notation, without technology.
		Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities. Interpret scientific notation that has been generated by technology. (8.EE.4)		
Students understand the connections between proportional relationships, lines, and linear equations. (NY-8.EE.5-6)	Graph proportional relationships and interpret the unit rate in terms of the context.	Graph proportional relationships, interpreting the unit rate as the slope of the graph. (8.EE.5)	Identify the unit rate as the slope of the graph of a proportional relationship.	Given a table or a graph, identify the unit rate of a proportional relationship.
		Compare two different proportional relationships represented in different ways. (8.EE.5)	Given an equation that represents a proportional relationship, identify the graph that shows the proportional relationship.	Given a table of values that represent equivalent ratios, identify the graph that shows the proportional relationship.
Students understand the connections between proportional relationships, lines, and linear equations. (NY-8.EE.5-6)	Derive the equation $y = mx + b$ for a line that has a y intercept as well as x intercept.	Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b. (8.EE.6)	Derive the equation $y = mx$ for a line through the origin given a graph of a line, slope, rate of change, or a point on a proportional relationship. Derive the equation $y = mx + b$ for a line intercepting the vertical axis at b.	Given a graph of a line, identify that the ratio between y/x for any two points on the line is the same.

Cluster	Performance Level 4	Performance Level 3	Performance Level 2	Performance Level 1
Students analyze and solve linear equations and pairs of simultaneous linear equations. (NY-8.EE.7-8*)		Recognize when linear equations in one variable have one solution, infinitely many solutions, or no solutions. Give examples and show which of these possibilities is the case by successively transforming the given equation into simpler forms. (8.EE.7a)	Transform a given equation into a simpler equivalent equation by inspection.	
	Solve a multi-layered linear equation in one variable algebraically.	Solve linear equations in one variable, with rational number coefficients, including those that require use of the distributive property and/or combining like terms.† (8.EE.7b)	Solve linear equations in one variable, with integer number coefficients, including those that require use of the distributive property and/or combining like terms.	Solve linear equations in one variable, with rational number coefficients, excluding the combining of like terms and the use of the distributive property.
Students analyze and solve linear equations and pairs of simultaneous linear equations. (NY-8.EE.7-8)		Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. Recognize when the system has one solution, no solution, or infinitely many solutions. (8.EE.8a)	Given a system of two linear equations and a set of ordered pairs, select the solution to the system. Recognize that the solution to a system of two linear equations satisfies both equations simultaneously.	Know that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs.

*Solving systems algebraically will be limited to at least one equation containing at least one variable whose coefficient is 1. Algebraic solution methods include elimination and substitution.

† This includes equations that contain variables on both sides of the equation.

Cluster	Performance Level 4	Performance Level 3	Performance Level 2	Performance Level 1
Students analyze and solve linear equations and pairs of simultaneous linear equations. (NY-8.EE.7-8)		Solve systems of two linear equations in two variables with integer coefficients: graphically, numerically using a table, and algebraically. Solve simple cases by inspection.[‡] (8.EE.8b)	Solve a system of two linear equations in two variables by inspection.	
		Solve real-world and mathematical problems involving systems of two linear equations in two variables with integer coefficients. (8.EE.8c)	Solve mathematical problems involving systems of two linear equations in two variables with integer coefficients.	
Students define, evaluate, and compare functions.[§] (8.F.1-3)	Define a function as a relation that assigns to each element from one set, called the domain, exactly one element of another set, called the range. Know that one-to-one, many-to-one, one-to-many, many-to-many are functions and/or not functions. Know and solve real life applications by using functions.	Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.[††] (8.F.1)	Define a function as a rule that assigns to each input exactly one output. Recognize a graph and/or a table of a function as the set of ordered pairs consisting of an input and its corresponding output.	Identify values of *x* and *y* for a given function. Identify the graph of a function given a table of values.

[‡] Solving by Inspection is limited to simple cases in Performance Level 3. This standard is a fluency expectation for Grade 8.
[§] Function notation is not required in Grade 8.
[††] The terms domain and range may be introduced at this level; however, these terms are formally introduced in Algebra I (AI-F.IF.1).

Cluster	Performance Level 4	Performance Level 3	Performance Level 2	Performance Level 1
Students define, evaluate, and compare functions.** (8.F.1-3)	Compare properties of more than two functions represented in different ways.	Compare properties of two functions represented in different ways (algebraically, graphically, numerically in tables, or by verbal descriptions). (8.F.2)	Identify properties of linear, quadratic, and cubic functions in the form "*y* =" from any given representation (algebraically, graphically, numerically in tables, or by verbal descriptions).	
	Distinguish between linear and non-linear functions given an algebraic expression, a table, a verbal description, and/or a graph.	Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line. Recognize examples of functions that are linear and non-linear.‡‡ (8.F.3)	Identify a non-linear function from a graph and/or a table.	Determine the rate of change given a table or a graph.
Use functions to model relationships between quantities. (NY-8.F.4-5)		Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. 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. (8.F.4)	Find the initial value and/or rate of change of a linear function from a table of values and/or two pairs of (x, y) values.	Find the initial value and/or rate of change of a linear function in the form "*y* =" from the graph of a relationship.

** Function notation is not required in Grade 8.
‡‡ This standard does not include formal geometric proof. Multiple representations may be used to demonstrate understanding.

Cluster	Performance Level 4	Performance Level 3	Performance Level 2	Performance Level 1
Use functions to model relationships between quantities. (NY-8.F.4-5)		Describe qualitatively the functional relationship between two quantities by analyzing a graph. Sketch a graph that exhibits the qualitative features of a function that has been described in a real-world context. (8.F.5)	Describe attributes of a function by analyzing a graph.	Use a function for a problem context to make qualitative inferences.
Students understand congruence and similarity using physical models, transparencies, or geometry software. (NY-8.G.1-5)		Verify experimentally lines are mapped to lines, and line segments to line segments of the same length; angles are mapped to angles of the same measure; and parallel lines are mapped to parallel lines.[§§] (8.G.1a,b,c)	On a coordinate plane verify that congruence of line segments is maintained; angles of the same measure are maintained; and parallel lines remain parallel lines, after transformations including rotation, reflection, and translation.	Given a visual model not on a coordinate plane, recognize lines are mapped to lines, and line segments to line segments of the same length; angles are mapped to angles of the same measure; and parallel lines are mapped to parallel lines.
		Know that a two-dimensional figure is congruent to another if the corresponding angles are congruent and the corresponding sides are congruent. Equivalently, two two-dimensional figures are congruent if one is the image of the other after a sequence of rotations, reflections, and translations. Given two congruent figures, describe a sequence that maps the congruence between them on the coordinate plane. (8.G.2)	On a coordinate plane or not, recognize that a two-dimensional figure is congruent to another if the corresponding angles are congruent and the corresponding sides are congruent. Recognize that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and/or translations.	Given a figure not on a coordinate plane, select the congruent match from among a set of choices.

[§§] A translation displaces every point in the plane by the same distance (in the same direction) and can be described using a vector. A rotation requires knowing the center/point of rotation and the measure/direction of the angle of rotation. A line reflection requires a line and the knowledge of perpendicular bisectors.

Cluster	Performance Level 4	Performance Level 3	Performance Level 2	Performance Level 1
Students understand congruence and similarity using physical models, transparencies, or geometry software. (NY-8.G.1-5)	Use coordinates to describe the effect of a sequence of transformations on a two-dimensional figure.	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.*** (8.G.3)	Recognize that size/shape does not change in translations, reflections, and rotations. Recognize that orientation changes with rotations.	Dilate simple polygons on the coordinate plane and identify coordinates of the vertices.
		Know that a two-dimensional figure is similar to another if the corresponding angles are congruent and the corresponding sides are in proportion.††† (8.G.4)	On a coordinate plane or not, recognize that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and/or dilations.	Given a figure not on a coordinate plane, select a figure similar to it from among a set of choices.
	Determine the measurements of angles formed by 2 parallel lines cut by two transversals.	Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.‡‡‡ (8.G.5)	Determine the measurements of angles formed by 2 parallel lines cut by a transversal.	Identify the angle sum of a triangle. Identify angle pair relationships when parallel lines are cut by a transversal. Find the measure of an angle in a triangle using the other two angles.

*** Lines of reflection are limited to both axes and lines of the form $y=k$ and $x=k$, where k is a constant. Rotations are limited to 90 and 180 degrees about the origin. Unless otherwise specified, rotations are assumed to be counterclockwise.
††† With dilation, the center and scale factor must be specified.
‡‡‡ This standard does not include formal geometric proof. Multiple representations may be used to demonstrate understanding.

Cluster	Performance Level 4	Performance Level 3	Performance Level 2	Performance Level 1
Students understand and apply the Pythagorean Theorem. (NY-8.G.6-8)	Explain a proof of the Pythagorean Theorem and its converse.	Understand a proof of the Pythagorean Theorem and its converse. (8.G.6)	Recognize that in a right triangle, $a^2 + b^2 = c^2$. Given three sides of a triangle, determine that it is a right triangle using the Pythagorean Theorem.	
	Use the Pythagorean Theorem to solve and model multi-step problems involving two- and/or three-dimensional contexts (cones, diagonals of rectangular prisms, etc.).	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. (8.G.7)	Given the measures of two sides of a right triangle, use the Pythagorean Theorem to solve for the length of the missing side.	Select an equation that describes a real-world problem involving a right triangle context. Apply the Pythagorean Theorem to determine the unknown hypotenuse length in right triangles.
	Extend the Pythagorean Theorem to derive the distance formula.	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system. (8.G.8)	Find the length of a leg segment for a triangle or diagonal of a rectangle on the coordinate plane by using the Pythagorean Theorem.	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system given the visual aid of a right triangle with the lengths of the legs given.
Students solve real-world and mathematical problems involving volume of cylinders, cones, and spheres. (NY-8.G.9)	Derive the formulas for prisms, pyramids, cylinders, and/or spheres and show the relationships among them.	Given the formulas for the volume of cones, cylinders, and/or spheres, solve mathematical and real-world problems. (8.G.9)	Given a real-world context, select the appropriate equation for problems involving cones, cylinders, and/or spheres.	When given the dimensions and formula, find the volumes of cylinders, cones, and/or spheres.

Cluster	Performance Level 4	Performance Level 3	Performance Level 2	Performance Level 1
Students investigate patterns of association in bivariate data. (NY-8.SP.1-3)	Analyze patterns of association between two quantities and use data to make and justify predictions.	Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association. (8.SP.1)	Describe patterns such as outliers, positive or negative association, linear association, and nonlinear association. Identify a scatter plot from a set of bivariate data.	Identify if an association between two quantities exists.
	Determine the equation for a line of best fit.	Understand that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line. (8.SP.2)	For scatter plots that suggest a linear association, informally fit a straight line.	Recognize that straight lines can be used on scatter plots to model linear relationships between two quantitative variables. Determine from a graph, which line represents the line of best fit.
	Determine the equation for a line of best fit and use the equation to make and justify predictions.	Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. (8.SP.3)	Use the equation of a linear model to solve problems in the context of bivariate measurement data, identifying the slope and intercept.	Identify the slope and intercept.