

RICAS Supplemental Assessment Tables and Achievement Level Descriptors

Grade 8 Mathematics

This document is designed to provide educators with assessment information for specific standards on RICAS and to describe the RICAS achievement levels for mathematics.

The first set of tables are the Supplemental Assessment Tables. These tables include additional examples or interpretations of how a standard may be assessed, explicit references to the footnotes in the CCSS, and definitions of relevant terms not included in the CCSS glossary. Examples within individual standards are highlighted in blue.

The four RICAS achievement levels are detailed later in the document. The accompanying tables provide summaries of the knowledge and skills demonstrated on RICAS for the domains of the grade as well as conceptual understanding and procedural knowledge, problem solving, mathematical reasoning, and mathematical communication.

RICAS Grade 8 Supplemental Assessment Information Chart

CCSS Standard Key	Standard Text	Supplemental Assessment Information
8.NS.1	Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.	<ul style="list-style-type: none"> • Decimal expansion – writing a rational number as a decimal. • A repeating decimal is one in which, after a certain point, a particular digit or sequence of digits repeats itself indefinitely; the decimal form of a rational number
8.NS.2	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., π^2). <i>For example, by truncating the decimal expansion of $\sqrt{2}$, show that $\sqrt{2}$ is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.</i>	An irrational number is any number that cannot be expressed as a quotient of two integers, e.g. $\sqrt{2}$. It can be shown that a number is irrational if and only if it cannot be written as a repeating or terminating decimal.
8.EE.1	Know and apply the properties of integer exponents to generate equivalent numerical expressions. <i>For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.</i>	
8.EE.2	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. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.	
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, and to express how many times as much one is than the other. <i>For example, estimate the population of the United States as 3 times 10^8 and the population of the world as 7 times 10^9, and determine that the world population is more than 20 times larger.</i>	

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8.EE.4	Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology	Scientific notation - A widely used floating-point system in which numbers are expressed as products consisting of a number between 1 and 10 multiplied by an appropriate power of 10, e.g. $562 = 5.62 \times 10^2$.
8.EE.5	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.	
8.EE.6	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.7a	Solve linear equations in one variable. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).	
8. EE.7b	Solve linear equations in one variable. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	

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CCSS Standard Key	Standard Text	Supplemental Assessment Information
8.EE.8a	Analyze and solve pairs of simultaneous linear equations. 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.	Simultaneous equations – Two or more equations containing common variables.
8.EE.8b	Analyze and solve pairs of simultaneous linear equations. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. <i>For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.</i>	<ul style="list-style-type: none"> • Simultaneous equations – Two or more equations containing common variables. • For assessment purposes, students should be familiar with both the substitution and elimination methods for solving systems of equations.
8.EE.8c	Analyze and solve pairs of simultaneous linear equations. Solve real-world and mathematical problems leading to two linear equations in two variables. <i>For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.</i>	Simultaneous equations – Two or more equations containing common variables.
8.F.1	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	Function notation is not required for Grade 8.
8.F.2	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). <i>For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.</i>	

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8.F.3	Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. <i>For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.</i>	
8.F.4	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.5	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.	
8.G.1.a	Verify experimentally the properties of rotations, reflections, and translations: Lines are taken to lines, and line segments to line segments of the same length.	Alternate wording: Lines are <i>transformed</i> to lines, and line segments to line segments of the same length.
8.G.1b	Verify experimentally the properties of rotations, reflections, and translations: Angles are taken to angles of the same measure.	Alternate wording: Angles are transformed to angles of the same measure.
8.G.1c	Verify experimentally the properties of rotations, reflections, and translations: Parallel lines are taken to parallel lines.	Alternate wording: Parallel lines are transformed to parallel lines.

RICAS Grade 8 Supplemental Assessment Information Chart

CCSS Standard Key	Standard Text	Supplemental Assessment Information
8.G.2	Understand 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 translations; given two congruent figures, describe a sequence that exhibits the congruence between them.	
8.G.3	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.	
8.G.4	Understand 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 dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.	
8.G.5	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. <i>For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.</i>	
8.G.6	Explain a proof of the Pythagorean Theorem and its converse.	<ul style="list-style-type: none"> • Students should understand the relationship among the sides in a right triangle. • For assessment purposes, students should be able to analyze and justify the Pythagorean Theorem and its converse using pictures, diagrams, narratives, or models.
8.G.7	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.	

RICAS Grade 8 Supplemental Assessment Information Chart

CCSS Standard Key	Standard Text	Supplemental Assessment Information
8.G.8	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	
8.G.9	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.	
8SP.1	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.2	Know 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.3	Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. <i>For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.</i>	

RICAS Grade 8 Supplemental Assessment Information Chart

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8.SP.4	<p>Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. <i>For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?</i></p>	

Grade 8 RICAS Achievement Level Descriptors

Student results on the RICAS assessments are reported according to four achievement levels:

- **Exceeding Expectations**
A student who performed at this level exceeded grade-level expectations by demonstrating mastery of the subject matter.
- **Meeting Expectations**
A student who performed at this level met grade-level expectations and is academically on-track to succeed in the current grade in this subject.
- **Partially Meeting Expectations**
A student who performed at this level partially met grade-level expectations in this subject. The school, in consultation with the student's parent/guardian, should consider whether the student needs additional academic assistance to succeed in this subject.
- **Not Meeting Expectations**
A student who performed at this level did not meet grade-level expectations in this subject. The school, in consultation with the student's parent/guardian, should determine the coordinated academic assistance and/or additional instruction the student needs to succeed in this subject.

The descriptors included in the table below illustrate the knowledge and skills students demonstrate on RICAS at each level. Knowledge and skills are cumulative at each level. No descriptors are provided for the *Not Meeting Expectations* achievement level because students' work at this level, by definition, does not meet the criteria of the *Partially Meeting Expectations* level.

Grade 8 RICAS Achievement Level Descriptors

Grade 8	Partially Meets Expectations <i>On RICAS, a student at this level:</i>	Meeting Expectations <i>On RICAS, a student at this level:</i>	Exceeding Expectations <i>On RICAS, a student at this level:</i>
Conceptual Understanding and Procedural Knowledge	<ul style="list-style-type: none"> • Demonstrates partial understanding of the grade appropriate numeration system • Performs some calculations and estimations • Identifies examples of basic math facts or mathematical concepts • Mostly reads and sometimes constructs graphs, tables and charts 	<ul style="list-style-type: none"> • Applies understanding of the base-ten system and fractions to interpret numbers and solve problems • Performs most calculations and estimations • Describes mathematical concepts and generates examples and counterexamples of concepts • Represents data and mathematical relationships using equations, verbal descriptions, tables, and graphs 	<ul style="list-style-type: none"> • Performs complex calculations and estimations • Selects the best representations for a given set of data • Explains relationships between models such as equations, verbal descriptions, tables, and graphs • Applies math facts and connects mathematical concepts from various areas of mathematics, and uses the concepts to develop generalizations • Recognizes and makes use of structure, discerning patterns by seeing complicated things as single objects
Problem Solving	<ul style="list-style-type: none"> • Applies learned procedures to solve routine problems • Uses concrete objects or pictures to help conceptualize and solve problems. 	<ul style="list-style-type: none"> • Applies learned procedures and mathematical concepts to solve a variety of problems, including multi-step problems • Solves problems using multiple methods • Demonstrates the relationships between operations used to solve problems and the context of the problems 	<ul style="list-style-type: none"> • Generates strategies and procedures to solve non-routine problems • Solves problems using multiple methods, evaluating reasonableness of intermediate steps leading to the standard algorithms • Draws connections between strategies • Analyzes givens, constraints, and relationships in problems, using multiple methods and appropriate tools

Grade 8 RICAS Achievement Level Descriptors

Grade 8	Partially Meets Expectations <i>On RICAS, a student at this level:</i>	Meeting Expectations <i>On RICAS, a student at this level:</i>	Exceeding Expectations <i>On RICAS, a student at this level:</i>
Mathematical Reasoning	<ul style="list-style-type: none"> Applies some reasoning methods to solve routine problems 	<ul style="list-style-type: none"> Uses a variety of reasoning methods to solve routine and non-routine problems Uses symbols to solve routine mathematical problems 	<ul style="list-style-type: none"> Reasons abstractly and quantitatively, using multiple reasoning methods to solve complex problems and provides justification for the reasoning Decontextualizes situations and represents them symbolically
Mathematical Communication	<ul style="list-style-type: none"> Identifies and uses basic terms 	<ul style="list-style-type: none"> Uses logical forms of representation (e.g., text, graphs, symbols) to illustrate steps to a solution 	<ul style="list-style-type: none"> Uses logical forms of representation (e.g., text, graphs, symbols) to justify solutions and solution strategies Constructs viable arguments and critiques the reasoning of others, attending to precision
The Number System	<ul style="list-style-type: none"> Distinguishes between rational and irrational numbers 	<ul style="list-style-type: none"> Recognizes that rational and irrational numbers have decimal expansions Uses rational approximations of irrational numbers to compare the size of irrational numbers Finds the approximate location of irrational numbers on the number line Finds rational approximations of irrational numbers 	<ul style="list-style-type: none"> Estimates the values of expressions with irrational numbers Converts a decimal expansion that repeats eventually to a rational number
Expressions and Equations	<ul style="list-style-type: none"> Identifies the properties of integer exponents Knows that $\sqrt{2}$ is irrational Uses and evaluates square roots of small squares Graphs proportional relationships, and identifies the unit rate as the slope 	<ul style="list-style-type: none"> Applies the properties of integer exponents to generate equivalent expressions Uses and evaluates cube roots of small cubes Uses numbers in the form of a single digit times an integer power of 10 to estimate the magnitude and relationships of quantities 	<ul style="list-style-type: none"> Uses numbers in the form of a single digit times an integer power of 10 to estimate the magnitude and interpret relationships of quantities in word problems Use similar triangles to explain why the slope is the same between any two distinct points on a non-vertical line in the coordinate plane

Grade 8 RICAS Achievement Level Descriptors

Grade 8	Partially Meets Expectations <i>On RICAS, a student at this level:</i>	Meeting Expectations <i>On RICAS, a student at this level:</i>	Exceeding Expectations <i>On RICAS, a student at this level:</i>
Expressions and Equations	<ul style="list-style-type: none"> Solves one-variable linear equations with one or many solutions Recognizes that the point of intersection of two linear equations is the solution 	<ul style="list-style-type: none"> Performs operations with decimals and scientific notation Uses scientific notation and chooses appropriate units of measurement for varying magnitudes Uses linear equations and systems of linear equations to represent and solve problems. Compares proportional relationships represented in different ways Recognizes the difference between proportional and non-proportional in linear relationships Solves one-variable linear equations with rational coefficients Solves systems of two linear equations algebraically or graphically in real-world and mathematical problems 	<ul style="list-style-type: none"> Derives 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 Uses linear equations and systems of linear equations to represent, analyze, and solve problems. Estimates solutions to systems of two equations from a graph
Functions	<ul style="list-style-type: none"> Identifies a relationship as a function Interprets the equation of a linear function 	<ul style="list-style-type: none"> Compares the properties of functions represented in different ways Writes a function to model a linear relationship Determines the rate of change and initial value of a function from a description including reading these from a table or graph Describes or sketches functional relationships represented graphically 	<ul style="list-style-type: none"> Identifies functions as linear and non-linear from graphs or equations Interprets the rate of change of a function from a table, graph, equation or description

Grade 8 RICAS Achievement Level Descriptors

Grade 8	Partially Meets Expectations <i>On RICAS, a student at this level:</i>	Meeting Expectations <i>On RICAS, a student at this level:</i>	Exceeding Expectations <i>On RICAS, a student at this level:</i>
Geometry	<ul style="list-style-type: none"> • Identifies the properties of rotations, reflections, and translations • Translates and reflects two dimensional figures • Uses the relationship among the sides of a right triangle to solve problems • Uses the Pythagorean theorem to find the hypotenuse of a right triangle 	<ul style="list-style-type: none"> • Describes the congruence relationship between two congruent figures • Describes the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates • Describes the similarity relationship between two similar figures • Rotates two-dimensional figures around the origin • Finds angle sum and exterior angle of triangles, angles created when parallel lines are cut by a transversal, and angle-angle criterion for similarity of triangles • Applies the Pythagorean theorem to find distances between points on the coordinate plane • Applies the Pythagorean theorem to determine the unknown side lengths in right triangles in mathematical and real-world problems • Solves mathematical and real-world problems involving volume of cones, cylinders, and spheres 	<ul style="list-style-type: none"> • Use informal arguments to establish facts about the angle sum and exterior angle of triangles, angles created when parallel lines are cut by a transversal, and angle-angle criterion for similarity of triangles • Justifies the Pythagorean theorem and its converse • Given the volume of a cone, finds unknown dimensions of the cone • Given the volume of a cylinder, finds unknown dimensions of the cylinder • Given the volume of a sphere, finds unknown dimensions of the sphere

Grade 8 RICAS Achievement Level Descriptors

Grade 8	Partially Meets Expectations <i>On RICAS, a student at this level:</i>	Meeting Expectations <i>On RICAS, a student at this level:</i>	Exceeding Expectations <i>On RICAS, a student at this level:</i>
Statistics and Probability	<ul style="list-style-type: none"> • Identifies and constructs a line of best fit • Describes the patterns associated with bivariate categorical data • Finds relative frequency in a two-way table 	<ul style="list-style-type: none"> • Constructs and interprets scatter plots • Uses the equation of a linear model to solve problems • Constructs and interprets two-way tables 	<ul style="list-style-type: none"> • Analyzes scatter plots • Interprets the slope and intercept of linear models • Analyzes relative frequencies in two-way tables