

Mathematics
Grade 8

Grade 8

Item Types	Cognitive Levels	Calculator	Strand II – Number Sense	Item Totals
			Sub-strand A. Number Sense	By Strand
			Benchmarks	By Sub-strand
			Standard: Use rational and irrational numbers, represented in a variety of ways, to quantify information and to solve real-world and mathematical problems.	By Benchmark
MC or GR	A B	NC	II.A.1 Students will represent rational and irrational numbers symbolically and on a number line Students will order rational and irrational numbers symbolically and on a number line. <i>Content Limit:</i> A number line may be included. Symbols may be $<$, \leq , $>$, \geq , $=$ and \neq .	1 – 2
MC or CR or GR	A B	CN	II.A.2 Students will use rational and irrational numbers to solve real-world and mathematical problems. <i>Content Limit:</i> Items require comparison only; no computation is required.	1 – 2
MC	A B	CN	II.A.3 Students will use scientific notation to solve real-world and mathematical problems. <i>Content Limit:</i> Items may require conversion from scientific notation to standard notation or from standard notation to scientific notation. Items require comparison only; no computation is required (e.g., compare and order).	1 – 2
MC	A	CN	II.A.4 Students will classify numbers as rational or irrational. <i>Content Limit:</i> Repeating decimals using “...” must show three repetitions of the repetend. Notation may be “...” or vinculum.	1 – 2

Mathematics
Grade 8

Item Types	Cognitive Levels	Calculator	Strand II – Number Sense	Item Totals
			Sub-strand B. Computation and Operation	By Strand
			Standard: Compute fluently and make reasonable estimates with rational and irrational numbers in real-world and mathematical problems. Understand the meanings of the basic operations, including the use of integer exponents and n^{th} roots and how the operations relate to one another. Appropriately use calculators and other technologies to solve problems.	<i>continued</i>
			By Sub-strand	
			6 – 8	
			By Benchmark	
MC or CR or GR	A B	CL	II.B.1 Students will use rational numbers and calculator approximations of irrational numbers in multi-step real-world and mathematical problems. <i>Content Limit:</i> When using calculator approximations, answer options will be rounded to the nearest tenth.	2 – 3
MC or GR	A	NC	II.B.2 Students will find integer approximations of square roots of positive integers. <i>Content Limit:</i> Squares must be less than or equal to 150.	1 – 2
MC	A	CN	II.B.3 Students will multiply or divide expressions involving exponents with a common base. <i>Content Limit:</i> Bases may be whole numbers or variables. Items do not include problems involving powers of a power (e.g., $(3^2)^4$ is not allowed). Answer choices must be given as a power expression (e.g., 2^5 rather than 32).	1 – 2

Mathematics
Grade 8

MC	A	CN	<p>II.B.4 Students will use the inverse relationship between n^{th} roots and n^{th} powers of rational numbers to solve real-world and mathematical problems.</p> <p><i>Content Limit:</i> Items are limited to square roots and cube roots. Items require students to compute only the cube root of 8, 27, 64, 125 or 1,000.</p>	1 – 2
MC or GR	A B	NC	<p>II.B.5 Students will apply the correct order of operations and grouping symbols.</p> <p><i>Content Limit:</i> Items may include operations using rational numbers. Operations may include addition, subtraction, multiplication, division, exponentiation, extracting roots, and grouping symbols (e.g., $3x + 4x = 7x$). Items are limited to three nestings within grouping symbols (e.g., $2\{7 - [12 + (3 + 2)]\}$ is allowed and $2\{7 - [(19 - 7) + (3 + 2)]\}$ is not allowed). Identifying correct order of operations shown (calculation not required) is allowed. Roots are limited to square roots and cube roots. The “square root” means the principal square root. Items require students to compute only the cube root of 8, 27, 64, 125 or 1,000. To assure mastery of order of operations and appropriate use of technology, a calculator will not be allowed to assess this benchmark. This addresses the concern that a student will know the correct input for a calculator.</p>	1 – 2

Mathematics
Grade 8

Item Types	Cognitive Levels	Calculator	Strand III – Patterns, Functions and Algebra	Item Totals
			Sub-strand A. Patterns and Functions Standard: Understand and describe progressions. Use graphs and tables to solve real-world and mathematical problems.	By Strand 14 – 15
			Benchmarks	By Sub-strand 5 – 7
			By Benchmark	
MC or GR	A B	CN	III.A.1 Students will recognize when a list of numbers forms an arithmetic or geometric progression. Students will determine subsequent terms in the progression. <i>Content Limit:</i> Progression must provide at least three terms. Items may require a verbal description of the progression. Items will not require students to represent a progression with an algebraic expression.	1 – 2
MC or CR	A B C	CN	III.A.2 Students will represent quantitative relationships graphically and use the graphs to solve real-world and mathematical problems. <i>Content Limit:</i> x and y axes may have different scales. Quantitative relationships may include slope. When calculating slope, two ordered pairs or a graph will be provided.	1 – 3

Mathematics
Grade 8

MC or CR or GR	A B	CN	<p>III.A.3 Students will generate a table of values from a formula or equation. Students will graph the result of a formula in ordered pair format on a grid.</p> <p><i>Content Limit:</i> <i>x</i> and <i>y</i> axes may have different scales. Items do not require students to graph or generate a table of a non-linear relation; students may read points off of a graph of a non-linear relation. Formulas will only have unknowns to the first degree. In a MC item, students may also generate a linear equation from a table of values. Items may include real-world context (e.g., converting temperature). Given a continuous (i.e., individual points not indicated) linear graph, students will generate a table of values. Linear equations will be given in $y = mx + b$ form.</p>	1 – 3
---------------------------------------	----------------	-----------	---	-------

Mathematics
Grade 8

Item Types	Cognitive Levels	Calculator	Strand III – Patterns, Functions and Algebra	Item Totals
			Sub-strand B. Algebra (Algebraic Thinking)	By Strand
			Standard: Use algebraic operations to generate equivalent expressions and use proportional reasoning to solve real-world and mathematical problems. Demonstrate the ability to manipulate an equation by applying arithmetic operations to both sides to maintain equivalence.	<i>continued</i>
			Benchmarks	By Sub-strand
				8 – 10
				By Benchmark
MC	A B	CN	III.B.1 Students will multiply and divide expressions of the form ax^n . <i>Content Limit:</i> Items involving ax^n times bx^m and ax^n divided by bx^m are acceptable, but $(x^n)^m$ is not acceptable. Problems contain only one variable.	2 – 3
MC or CR or GR	A B C	CL	III.B.2 Students will use formulas with more than one variable to solve real-world and mathematical problems. <i>Content Limit:</i> Formulas must be from a real-world context and may include powers (e.g., area, volume, $I=prt$ or $d=rt$). Items may contain formulas with at most four variables. Students may solve for any one of the variables in the formula. Roots are limited to square roots and cube roots. Items require students to compute only the cube root of 8, 27, 64, 125 or 1,000.	2 – 3

Mathematics
Grade 8

MC or CR or GR	A B C	CN	<p>III.B.3 Students will use proportions to solve real-world and mathematical problems. Students will use percents to solve real-world and mathematical problems. <i>Content Limit:</i> Items will contain only one unknown quantity. Items may include conversions between measurement systems with the conversion provided.</p>	2 – 3
MC or CR or GR	A B	CN	<p>III.B.4 Students will apply the correct order of operation to simplify and evaluate algebraic expressions. <i>Content Limit:</i> Roots are limited to square roots and cube roots. Items require students to compute only the cube root of 8, 27, 64, 125 or 1,000.</p>	1 – 3

Mathematics
Grade 8

Item Types	Cognitive Levels	Calculator	Strand IV – Data Analysis, Statistics and Probability	
			Item Totals	
			By Strand	
			9 – 10	
		Sub-strand A. Data and Statistics		
		Standard: Represent data and use various measures associated with data to draw conclusions and identify trends.		
		Benchmarks		
		By Sub-strand		
		4 – 6		
		By Benchmark		
MC or CR	A B C	CN	IV.A.1 Students will analyze histograms, circle graphs, stem-and-leaf plots and box-and-whisker plots. <i>Content Limit:</i> Graphics may have at most ten data categories. Circle graphs may have at most eight sectors. Scales are in increments appropriate to the application. Histogram intervals must be consistent.	2 – 3
			IV.A.2 Students will compute the quartiles of a data set. <i>Content Limit:</i> Terms used may include minimum, maximum, range, median, first quartile and third quartile. Quartiles will not be referred to in percents. Item may include context.	2 – 3

Mathematics
Grade 8

Item Types	Cognitive Levels	Calculator	Strand IV – Data Analysis, Statistics and Probability	Item Totals
			Sub-strand B. Probability Standard: Calculate and express probabilities numerically and apply probability concepts to solve real-world and mathematical problems.	By Strand
			Benchmarks	<i>continued</i>
			Benchmarks	By Sub-strand
				3 – 5
				By Benchmark
MC or GR	A B	CN	IV.B.1 Students will understand that if p is the probability of an event occurring, then $1-p$ is the probability of the event not occurring. Students will calculate probabilities accordingly. <i>Content Limit:</i> Items may include combinations of events (e.g. - rolling a number cube then spinning a spinner or drawing two cards without replacement). Items may not include conditional probability.	1 – 2
			IV.B.2 Students will convert between odds and probability. <i>Content Limit:</i> Odds may be expressed as “odds against” or “odds in favor.” CR items may provide only outcomes and ask for odds and probability.	1 – 2
			IV.B.3 Students will use a variety of experiments to explore the relationship between experimental and theoretical probabilities and the effect of sample size. <i>Content Limit:</i> Items may include combinations of events (e.g. - rolling a number cube then spinning a spinner or drawing two cards without replacement). Items may not include conditional probability. Items may require comparison between experimental and theoretical probabilities.	1 – 2

Mathematics
Grade 8

Item Types	Cognitive Levels	Calculator	Strand V – Spatial Sense, Geometry and Measurement	Item Totals
			By Strand	
			11 – 13	
			By Sub-strand	
			Sub-strand A. Spatial Sense	By Sub-strand
			Standard: Recognize the relationship between different representations of two- and three-dimensional shapes. Understand the effect of various transformations.	1 – 3
			Benchmarks	By Benchmark
MC or CR	A B C	CN	<p>V.A.1 Students will use models and visualization to understand and create various two-dimensional diagrams of three-dimensional shapes.</p> <p><i>Content Limit:</i> Items are limited to top view, side view, front view or net. Shapes are limited to polyhedra, combinations of polyhedra, cylinders and cones. All visible sides of views are clearly labeled. Prisms will have a base with at most six sides. Pyramids will have a base with at most six sides.</p>	1 – 2
MC	A B	CN	<p>V.A.2 Students will predict the position and orientation of simple geometric shapes under transformations.</p> <p><i>Content Limit:</i> When using three-dimensional shapes: Transformations may include reflections, rotation and translations. Items are limited to one transformation per item. Rotations occur in increments of 90°.</p> <p>When using two-dimensional shapes: Transformations may include reflections, rotation, translations and change of scale. Items are limited to two transformations per item. Rotations occur in increments of 45°. Algebraic rules limited to translations and reflections when the figure is shown on a coordinate grid. No algebraic rules are required for items involving more than one transformation. Rotations must indicate clockwise or counterclockwise. This benchmark may be more extensively assessed in the classroom using models.</p>	1 – 2

Mathematics
Grade 8

Item Types	Cognitive Levels	Calculator	Strand V – Spatial Sense, Geometry and Measurement	Item Totals
			Sub-strand B. Geometry	By Strand
			Standard: Use basic geometric principles and proportional reasoning to solve real-world and mathematical problems.	<i>continued</i>
			Benchmarks	By Sub-strand
				8 – 10
				By Benchmark
MC or CR or GR	A B C	CL	V.B.1 Students will show how changing one or more dimensions affects change in area. <i>Content Limit:</i> Shapes are limited to circles, parallelograms and triangles. Items may include context.	1 – 2
MC or CR	A B C	CL	V.B.2 Students will use proportional reasoning to solve problems involving similar figures. <i>Content Limit:</i> Items are limited to two-dimensional figures. Pictures or diagrams may be used but are not required. Similarity may be shown using similarity symbol (\sim) or using markings on figures. Items may include context.	2 – 3
MC or GR	A B	CL	V.B.3 Students will determine the volume of shapes. <i>Content Limit:</i> Shapes are limited to cubes, prisms and cylinders. Pictures or diagrams may be used but are not required. The radius or diameter is supplied for cylinders. Answer options may be left in terms of π (e.g., 7π). Non-rectangular prisms must provide the area of the base.	2 – 3

Mathematics
Grade 8

MC or CR	A B C	CL	<p>V.B.4 Students will find surface area of shapes.</p> <p><i>Content Limit:</i> Shapes are limited to cubes, prisms and cylinders. Pictures or diagrams may be used but are not required. The radius or diameter is supplied for cylinders. Answer options may remain in terms of π (e.g., 7π). Non-rectangular prisms must provide the area of the base.</p>	1 – 2
MC or CR or GR	A B C	CL	<p>V.B.5 Students will calculate perimeter and area of two-dimensional figures obtained by putting together triangles, parallelograms and sectors of circles to solve real-world and mathematical problems.</p> <p><i>Content Limit:</i> Items must provide a picture or diagram.</p>	1 – 2

Mathematics
Grade 8

Item Types	Cognitive Levels	Calculator	Strand V – Spatial Sense, Geometry and Measurement	Item Totals
			Sub-strand C. Measurement Standard: Make calculations of time, length, area and volume within standard measuring systems, using good judgment in choice of units.	By Strand
			Benchmarks	<i>continued</i>
				By Sub-strand
				1 – 2
				By Benchmark
MC or GR	A	NC	V.C.1 Students will know approximate benchmarks within systems for length, weight, temperature and capacity. <i>Content Limit:</i> Items will require recall of appropriate benchmarks such as: within the customary system – inches and feet, feet and yards, ounces and pounds, quarts and gallons, pounds and tons within the metric system – centi and unit, unit and kilo, milli and centi.	0 – 1
MC or CR or GR	A B	CL	V.C.2 Students will use arithmetic to solve real-world and mathematical problems involving mixed units. <i>Content Limit:</i> Items are limited to pounds and ounces; seconds, minutes, hours and days; feet and inches.	0 – 1