Measurements of Student Progress

Test and Item Specifications

Grades 6—8 Mathematics

Office of Superintendent of Public Instruction
OSPI

The purpose of the Measurements of Student Progress (MSP) is to measure the level of mathematics proficiency that Washington students have achieved based on Washington State K-12 Mathematics Standards. In the 2008 revision, the Washington State K-12 Mathematics Standards are organized by areas of emphasis as: Core Content, Additional Key Content and Core Processes. Each area of emphasis has specific performance expectations.

Test and Item Specifications Grades 6, 7, and 8

Contents

Test Development Guidelines Grades 6, 7, and 8

The items on the Measurements of Student Progress reflect the performance expectations of the Washington StateK-8 Mathematics Standards. The guidelines in this document assist in writing items that match the performance expectations and their associated restrictions. Restrictions are necessary to construct a valid and reliable on-demand assessment. These restrictions are not necessary in classroom based assessments.

The item writer should be familiar with all item and rubric development guidelines listed in this section as well as specific considerations listed within each area of emphasis. A style guide determines the format of items and will be applied after the items are written.

Considerations and procedures that make item development more efficient and effective include, but are not limited to, the following guidelines.

Item Development Guidelines

Standards/Performance Expectations

- Students are expected to know all content, vocabulary, and processes in previous grade levels.
- An item may assess all or part of a performance expectation.
- An item may assess one or more performance expectations within a single area of emphasis.
- An item assessing Core Processes will use mathematics from the Core Content or Additional Key Content at the grade level being assessed.
- When applicable use stem, stimulus, and prompt rules for specific performance expectations found in each area of emphasis.

General Considerations

- Any contexts used in an item should be familiar to students.
- Stimulus content will be factually correct.
- Focus on what is essential and consequential to minimize the impact of, or need for, outside knowledge.
- Stimulus should not "trick" students into choosing or developing an incorrect or ineffective response.
- Items should avoid use of "not" or "if" unless it is essential to communicate understanding of the task. Consider substituting "when" for "if".
- Items will include language that is unbiased and that will not disadvantage a particular group of students.
- Items do not contain language or representations that might offend or demean any group of students.
- Character names will be assigned from a database that is representative of the range of ethnic diversity of Washington students.
- Manipulatives are not necessary for the assessment but may be made available in the classroom.

Manipulatives and Tools Allowed	Manipulatives and Tools Not Allowed
Manipulatives that are used during the assessment should not be distributed to the students but should be available in the classroom to students who elect to use them. • Straightedge (all grades) • Ruler with centimeters and inches for grade 3 (required) • Protractor or angle ruler for grade 5 (required) • Compass for Year 2 EOC only • Abacus for visually impaired/blind students using Braille edition • Tiles, algebra tiles, cubes • Base-ten pieces • Pattern blocks, geoboards, Cuisenaire rods • Judy clocks without a digital display • Glossary of Non-Mathematics Terms • Graph paper for grades 3-8 only (must be collected and shredded) *Tools that can remain on teachers' walls:* • Hundreds charts (0-99 or 1-100 only) • Number lines with whole numbers only	Because of the multitude and variety of materials available, the following list of materials that are not allowed is not exhaustive. Consider all manipulatives "Not Allowed" if they are not listed as "Allowed". The following list addresses the most commonly asked questions concerning manipulative use from the field. • Calculators for grades 3-6 • Multiplication or addition matrices • Number lines with integers, fractions, decimals, or markings of multiples, prime, and/or composite numbers • Commercially- or student-made fraction pieces, fraction templates, or fraction materials, whether labeled or unlabeled • Dictionaries or thesauruses • Patty paper or tracing paper • Dry erase boards • Highlighters

- Calculators are allowed on the grade 7, 8, and end-of-course only. Please see the calculator policy at http://www.k12.wa.us/Mathematics/CalculatorPolicy.aspx.
- Calculators are not allowed in grade 6.

Vocabulary/Context

Clear Language

- Item stems and stimulus materials should be straightforward and use simple syntax.
- Stimulus should be clear and simple with a minimum of distracting or irrelevant information unless it is appropriate for the performance expectation being assessed.
- The amount of reading should be kept to a minimum so that each item is clear and precise.
- Items will clearly indicate what is expected in a response and will help students focus their responses.

Vocabulary

- Use vocabulary excel sheet located at http://www.k12.wa.us/Mathematics/TestItemSpec.aspx.
- Items use language targeted to the previous grade level or lower readability, except for required mathematics terms listed in the Test and Item Specifications document.

- Items will not assess vocabulary definitions directly, but will assess conceptual understanding and application.

Notational Considerations

- Numbers, other than years, having more than three digits to the left of the decimal point will include commas to group digits as in 435,000.
- Standard measurement abbreviations may be used; however, the unit should be spelled out if any confusion is possible, e.g., "inch" rather than "in."
- Letters used as variables are always italicized.
- The symbols "×" and "•" may be used to indicate multiplication.
- Parentheses or brackets may be used as grouping symbols to indicate multiplication.
- The symbol "÷" or a horizontal fraction bar may be used to indicate division.
- Fractions will have a horizontal line separating numerator and denominator, e.g., $\frac{1}{2}$.
- Large numbers may be represented with a heading labeled "in thousands" or "in millions" in tables, charts, or graphs.
- Decimals between negative one and one are written with a leading zero, e.g., 0.25 rather than .25.
- Illustrations of figures at grade 7 and 8 may include hash marks on line segments to indicate congruent sides.
- Right angles will be indicated in the graphics or item stem.
- The symbol "⊥" may be used to indicate perpendicular lines, e.g., $\ell_1 \perp \ell_2$ at grade 8.
- The symbol "$\parallel$" may be used to indicate parallel lines, e.g., $\ell_1 \parallel \ell_2$ at grade 8.
- Each graph or table will include a title in the prompt and/or the answer space.

Rules for Stimulus, Stem, and Prompt Content

- Stimulus content should be clear and simple with a minimum of distracting or irrelevant information unless it is appropriate for the performance expectation being assessed.
- Stimulus content should not "trick" students into choosing or developing an incorrect or ineffective response.
- Stimulus may include appropriate and relevant tables, charts, graphs, diagrams, and/or pictorial representations of objects, shapes, or figures.
- Items will focus on what is essential and consequential to minimize the impact of, or need for, outside knowledge.
- The amount of reading will be kept to a minimum so that each item is clear and precise.

Rules for Multiple-Choice Items

- Each Multiple-Choice item has four answer choices, the correct answer and three distractors (wrong answer choices).
- Each Multiple-Choice item will have a stem (question or statement).
- Multiple-Choice item stems will present a clear indication of what is required so that students will know what to do before looking at the answer choices.
- The four answer choices will be approximately the same length, will have the same format, and will be syntactically and semantically parallel.

- The answer choices will be arranged in numerical or chronological order or according to length.
- Students should not be able to rule out a distractor or identify the answer simply because of superficial or trivial characteristics, syntactic complexity, or concept complexity.
- Distractors will reflect common errors or misunderstandings, naive pre-conceptions, or other misconceptions.
- Distractors will not be partially correct responses nor will they be designed to “trick” students into responding incorrectly.
- The responses "All of the above" and "None of the above" will not be used.
- The letters A, B, C, and D will be used for answer choices and will not be used as labels within a multiple-choice item in either upper or lower case.

Rules for Completion Items

- Completion items should be written like a multiple-choice item but no answer choices are provided.
- Completion items will give clear indications of what is required of students.
- Completion items will have a unique numeric answer or a number in a specified interval, i.e. answers derived using estimates of pi.
- Completion items will give a directive and reword the directive in the format of a question in the box with a line for the student’s response. e.g. “Determine the quotient.”, “What is the quotient?”
- Answer will not be scored for labels. Labels should be included in the question and/or answer space.
-

Rules for Short-Answer Items

- Short-Answer items will give clear indications of what is required of students; e.g., “Name two properties of Figure A.” or “Write an equation.”
- Anything required by the scoring rubric will be asked for in the item.
- Item response spaces may be written to guide responses. A response that requires multiple parts may be scaffolded with boxes to draw attention to the parts.
- Directions with multiple requirements will be organized with bullets.
- When an item poses a specific question, the question is repeated at the bottom of the workspace with a line for the student’s response.
- When an item gives a directive, then a question based on the directive will appear in the box with a line for the student’s response. e.g. “Determine the surface area of the pyramid.”, “What is the surface area of the pyramid?”
- General directions that allow the student to construct a response may read as follows: "Show your work using words, numbers and/or pictures." “Show the steps you used to solve the problem.”
- Any Short-Answer item that requires the student to use information from a stimulus will specifically ask for the information; e.g., “Use numbers from the table to …” or “Support your answer with information from the chart.”
- Short-Answer items may ask for a figure, diagram, equation, and/or a few sentences.
- Short Answer items will require a limited number of steps to develop a viable solution, demonstrate an understanding or process, communicate a mathematical

idea or result, or show reasoning.
- Short-Answer items include Enhanced Multiple-Choice items that ask students to select from a list of four answer choices and then show work to support or explain the reason(s) for choosing that response.

Scoring Rubric Development Guidelines

- An item-specific scoring rubric will be developed for each Short-Answer item during the writing of the item.
- Short-Answer items will be scored with a 3-level scoring rubric (0-2).
- Score point elements will be based on the requirements of the item and its performance expectation(s).
- Scoring rubrics will focus on conceptual understanding, application of appropriate procedures/strategies, and accuracy.
- Scoring rubrics will not consider conventions of writing (complete sentences, usage/grammar, spelling, capitals, punctuation, and paragraphing), as long as the wording of the response does not interfere with the mathematical communication.
- Scoring rubrics that involve measured values will require students to label units when the labels are not provided in the answer space.
- Scoring rubrics will be edited during pilot range finding.
- Scoring rubrics may be edited during operational range finding.
- When students are required to provide a unit label to earn full credit, directions must be given in the item. Example: Be sure to label your answer.

Cognitive Complexity

from Depth-of-Knowledge Levels for Four Content Areas, Norman L. Webb, March 28, 2002

"Level 1 (Recall) includes the recall of information such as a fact, definition, term, or a simple procedure, as well as performing a simple algorithm or applying a formula. That is, in mathematics a one-step, well-defined, and straight algorithmic procedure should be included at this lowest level. Other key words that signify a Level 1 include "identify," "recall," "recognize," "use," and "measure." Verbs such as "describe" and "explain" could be classified at different levels depending on what is to be described and explained.

"Level 2 (Skill/Concept) includes the engagement of some mental processing beyond a habitual response. A Level 2 assessment item requires students to make some decisions as to how to approach the problem or activity, whereas Level 1 requires students to demonstrate a rote response, perform a well-known algorithm, follow a set procedure (like a recipe), or perform a clearly defined series of steps. Keywords that generally distinguish a Level 2 item include "classify," "organize," "estimate," "make observations," "collect and display data," and "compare data." These actions imply more than one step. … Caution is warranted in interpreting Level 2 as only skills because some reviewers will interpret skills very narrowly, as primarily numerical skills, and such interpretation excludes from this level other skills such as visualization skills and probability skills, which may be more complex simply because they are less common. Other Level 2 activities include explaining the purpose and use of experimental procedures; carrying out experimental procedures; making observations and collecting data; classifying, organizing, and comparing data; and organizing and displaying data in tables, graphs, and charts.

"Level 3 (Strategic Thinking) requires reasoning, planning, using evidence, and a higher level of thinking than the previous two levels. In most instances, requiring students to explain their thinking is a Level 3. Activities that require students to make conjectures are also at this level. The cognitive demands at Level 3 are complex and abstract. The complexity does not result from the fact that there are multiple answers, a possibility for both Levels 1 and 2, but because the task requires more demanding reasoning. An activity, however, that has more than one possible answer and requires students to justify the response they give would most likely be a Level 3. Other Level 3 activities include drawing conclusions from observations; citing evidence and developing a logical argument for concepts; explaining phenomena in terms of concepts; and using concepts to solve problems.

"Level 4 (Extended Thinking) requires complex reasoning, planning, developing, and thinking most likely over an extended period of time." (This level is best assessed at the classroom level and not relevant to this on-demand assessment.)

Grade 6

6.1. Core Content: *Multiplication and division of fractions and decimals (Numbers, Operations, Algebra)*
Students have done extensive work with fractions and decimals in previous grades and are now prepared to learn how to multiply and divide fractions and decimals with understanding. They can solve a wide variety of problems that involve the numbers they see every day—whole numbers, fractions, and decimals. By using approximations of fractions and decimals, students estimate computations and verify that their answers make sense.

6.2. Core Content: *Mathematical expressions and equations (Operations, Algebra)*
Students continue to develop their understanding of how letters are used to represent numbers in mathematics—an important foundation for algebraic thinking. Students use tables, words, numbers, graphs, and equations to describe simple linear relationships. They write and evaluate expressions and write and solve equations. By developing these algebraic skills at the middle school level, students will be able to make a smooth transition to high school mathematics.

6.3. Core Content*: Ratios, rates, and percents (Numbers, Operations, Geometry/Measurement, Algebra, Data/Statistics/Probability)*
Students extend their knowledge of fractions to develop an understanding of what a ratio is and how it relates to a rate and a percent. Fractions, ratios, rates, and percents appear daily in the media and in everyday calculations like determining the sale price at a retail store or figuring out gas mileage. Students solve a variety of problems related to such situations. A solid understanding of ratios and rates is important for work involving proportional relationships in grade seven.

6.4. Core Content: *Two- and three-dimensional figures (Geometry/Measurement, Algebra)*
Students extend what they know about area and perimeter to more complex two-dimensional figures, including circles. They find the surface area and volume of simple three-dimensional figures. As they learn about these important concepts, students can solve problems involving more complex figures than in earlier grades and use geometry to deal with a wider range of situations. These fundamental skills of geometry and measurement are increasingly called for in the workplace and they lead to a more formal study of geometry in high school.

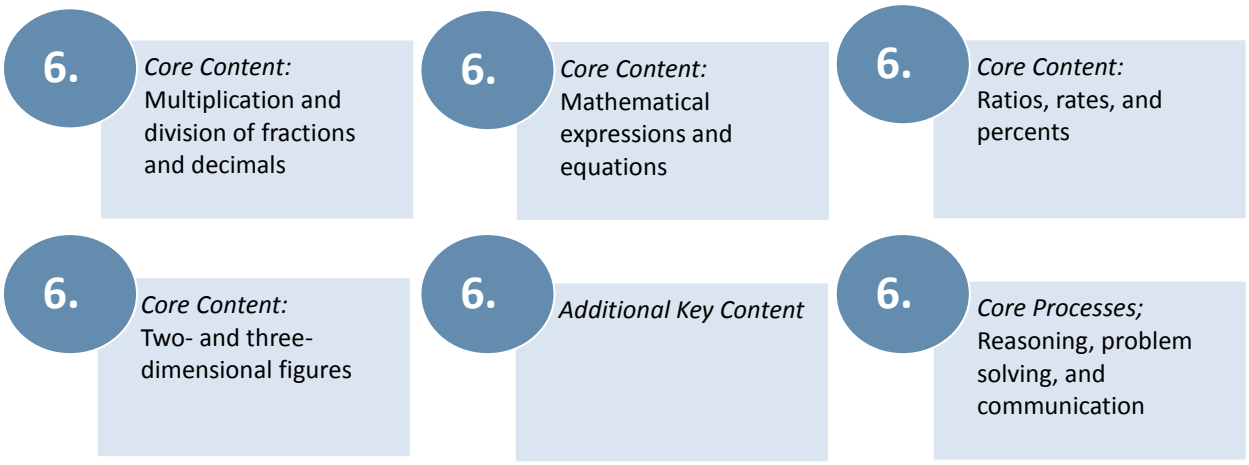
6.5. Additional Key Content *(Numbers, Operations)*
Students extend their mental math skills now that they have learned all of the operations—addition, subtraction, multiplication, and division—with whole numbers, fractions, and decimals. Students continue to expand their understanding of our number system as they are introduced to negative numbers for describing positions or quantities below zero. These numbers are a critical foundation for algebra, and students will learn how to add, subtract, multiply, and divide positive and negative numbers in seventh grade as further preparation for algebraic study.

6.6. Core Processes: *Reasoning, problem solving, and communication*
Students refine their reasoning and problem-solving skills as they move more fully into the symbolic world of algebra and higher-level mathematics. They move easily among representations—numbers, words, pictures, or symbols—to understand and communicate mathematical ideas, to make generalizations, to draw logical conclusions, and to verify the reasonableness of solutions to problems. In grade six, students solve problems that involve fractions and decimals as well as rates and ratios in preparation for studying proportional relationships and algebraic reasoning in grade seven.

Test Organization Grade 6

All Washington State Grade 6 Mathematics Areas of Emphasis are eligible to be assessed in each test. Each item will be classified by the area assessed.

Washington State Grade 6 Areas of Emphasis:



The grade 6 mathematics test will consist of 35 items, resulting in 40 points.
Tests include three item formats: Multiple-Choice, Completion, and Short-Answer.

Multiple-Choice Items	Completion Items	Short-Answer Items
• Each Multiple-Choice item has four answer choices, the correct answer and three distractors. • There will be 25 Multiple-Choice items per operational test, worth one point each. NOTE: Enhanced Multiple-Choice items are scored as Short-Answer items.	• Each Completion item requires the student to enter a numerical answer. • There will be five Completion items per operational test, worth one point each.	• Each Short-Answer item requires a constructed response. • A Short-Answer item may ask the student to write a sentence or equation; complete a table, graph, or chart; draw a picture; construct a diagram; or perform a calculation. • An Enhanced Multiple-Choice item will ask the student to select from a list of four answer choices and then show work to support or explain the reason(s) for choosing that answer. No more than two items on a test will be Enhanced Multiple-Choice items. • There will be five Short-Answer items per operational test, worth two points each.

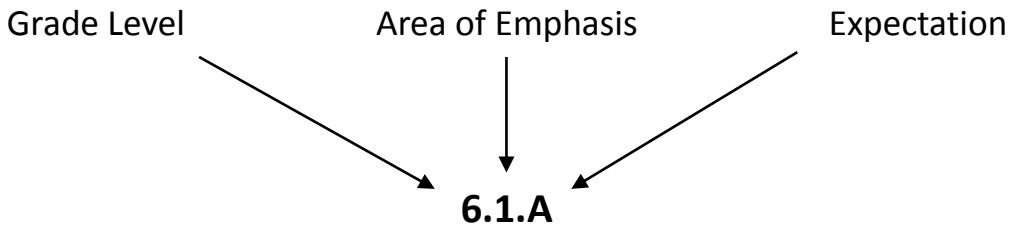
The grade 6 mathematics test is designed to be administered in one session of about 90 minutes. Although the test is not specifically a timed test, total testing time for standard administration should be about 2.5 hours.

- Each test will contain a variety of items from the Washington State Grade 6 Areas of Emphasis.
- For test development purposes, information regarding the area of emphasis, performance expectation(s), item format, and answer key will accompany each item.
- Tools, except calculators, are allowed for the test administration.

Grade 6 Test Map

Areas of Emphasis	MC	CP	SA	Total Number of Points
6.1 Multiplication and division of fractions and decimals	4-6	1-2	0-1	6-8
6.2 Mathematical expressions and equations	4-6	1-2	1-2	7-9
6.3 Ratios, rates, and percents	5-7	1-2	0-1	8-10
6.4 Two- and three-dimensional figures	5-7	1-2	0-1	6-8
6.5 Additional Key Content	1-2	0	0-1	1-3
6.6 Reasoning, problem solving, and communication	0-2	0	1-2	4-6
Total Number of Items	25	5	5	
Total Number of Points	25	5	10	40

Performance Expectation Numbering System



Item Specifications Grade 6

Item specifications for each area of emphasis are organized in two sections:

Stimulus, Stem, and Prompt Rules

Stimulus, stem, and prompt rules list area-specific guidelines for developing items. The rules are in addition to those included in the Item Development Guidelines.

Performance Expectations

The performance expectations in this document are identical to those in the Washington State Grade 6 Mathematics Standards. Performance expectations that will be assessed at the state level appear in **bold text**. The remaining performance expectations, which appear in *italicized text*, should be taught and assessed at the classroom level.

Items assessing 6.6 Core Processes will use Core Content or Additional Key Content performance expectations from grade 6.

The information in the columns to the right of each performance expectation shows item development parameters for:

- Cognitive complexity (C.C.) as Level 1, Level 2, Level 3, or Level 4 as defined by Norman Webb.
- Format as Multiple-Choice (MC), Completion (CP), or Short-Answer (SA).
- Contextual Situation (Ctxt) as required (Y), item dependent (I), or not allowed (N).

6.1 Core Content: Multiplication and division of fractions and decimals

(Numbers, Operations, Algebra)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Stimulus may include illustrations of base ten blocks, decimal grids, number lines, and other pictorial models for whole numbers, fractions, or decimals.
- Number lines will have reference points labeled with fractions, decimals, and/or whole numbers.
- Items assessing 6.1.A will use up to 4 rational numbers from zero to fifty, inclusive.
- Items assessing 6.1.D will use whole numbers, mixed numbers, and/or fractions with denominators of 2-10, or multiples of 2-10 less than or equal to 100.
- Items assessing 6.1.F will use decimal numbers with a product up to the thousandths place, divisor up to the tenths place, and dividend up to the hundredths place.
- Items assessing 6.1.F should include different types of decimal numbers, including those greater than 1, less than 1, and whole numbers.

Performance Expectations

Items may ask students to:		*C.C.*	*Format*	*Ctxt*
6.1.A	**Compare and order non-negative fractions, decimals,** *and integers* **using the number line, lists, and the symbols <, >, or =.**	1	MC	I
6.1.B	*Represent multiplication and division of non-negative fractions and decimals using area models and the number line, and connect each representation to the related equation.*	*1,(2)*	NA	NA
6.1.C	**Estimate products and quotients of fractions and decimals.**	2	*	*
6.1.D	*Fluently and* **accurately multiply and divide non-negative fractions** *and explain the inverse relationship between multiplication and division with fractions.*	1,*(2)*	MC,CP	N
6.1.E	**Multiply and divide whole numbers and decimals by 1000, 100, 10, 1, 0.1, 0.01, and 0.001.**	1	CP	I
6.1.F	*Fluently and* **accurately multiply and divide non-negative decimals.**	1	MC,CP	N
6.1.G	**Describe the effect of multiplying or dividing a number by one, by zero, by a number between zero and one, and by a number greater than one.**	2	*	*
6.1.H	**Solve single- and multi-step word problems involving operations with fractions and decimals and verify the solutions.**	2	MC,SA	Y

*This performance expectation may be included in items assessing core process performance expectations.

Key: ***Format***= Multiple-Choice (MC), Completion (CP), Short-Answer (SA), or Not Assessed (NA)
C.C.= Cognitive Complexity **(#)** = Cognitive Complexity for italicized text
Ctxt=Contextual Situation ***I***= Item dependent ***Y***= Yes Context ***N***= No Context

6.2 Core Content: Mathematical expressions and equations

(Operations, Algebra)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Stimulus may include variables to represent unknown quantities in mathematical expressions or equations.
- Stimulus may use addition, subtraction, multiplication, and/or division of non-negative decimals and fractions.
- Items will not require students to name, identify by name, or define properties.
- Items that require students to graph will include a grid.
- Grids may have the origin and axes labeled.
- Items assessing 6.2.A are restricted to linear relations.
- Items assessing 6.2.A may ask students to define the variable.
- Items assessing 6.2.A and 6.2.B will use linearly related information, not data.
- Items assessing 6.2.C will be limited to two variables.
- Items assessing 6.2.D will not use exponents.
- Items assessing 6.2.F with an equation will only require a single step to solve.

Performance Expectations

Items may ask students to:		*C.C.*	*Format*	*Ctxt*
6.2.A	**Write a mathematical expression or equation with variables to represent information in a table or given situation.**	2	MC,SA	I
6.2.B	**Draw a first-quadrant graph in the coordinate plane to represent information in a table or given situation.**	1,2	SA	I
6.2.C	**Evaluate mathematical expressions when the value for each variable is given.**	1	MC,CP	N
6.2.D	**Apply the commutative, associative, and distributive properties, and use the order of operations to evaluate mathematical expressions.**	1,2	MC,CP	I
6.2.E	**Solve one-step equations and verify solutions.**	1	MC,CP	I
6.2.F	**Solve word problems using mathematical expressions and equations and verify solutions.**	2	MC,SA	Y

6.3 Core Content: Ratios, rates, and percents

(Numbers, Operations, Geometry/Measurement, Algebra, Data/Statistics/Probability)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Stimulus may include illustrations of base-ten blocks, decimal grids, and other pictorial models for whole numbers, fractions, or decimals.
- Pictures of objects such as game spinners, coins, chips, marbles, number cubes, diagrams, tables, charts, and graphs may be used.
- Probability may be expressed as a fraction, decimal, or percent.
- Items assessing 6.3.C will use numbers from zero to one, inclusive.
- Items assessing 6.3.C may ask students to recall equivalent forms of decimals, percents, and common fractions with denominators 2, 3, 4, 5, 8, or 10.
- Items assessing 6.3.B and 6.3.D may include unit rates.

Performance Expectations

Items may ask students to:		*C.C.*	*Format*	*Ctxt*
6.3.A	**Identify** *and write* **ratios as comparisons of part-to-part and part-to-whole relationships.**	1, 2	MC	Y
6.3.B	**Write ratios to represent a variety of rates.**	1	MC	Y
6.3.C	**Represent percents visually and numerically, and convert between the fractional, decimal, and percent representations of a number.**	1	MC	N
6.3.D	**Solve single- and multi-step word problems involving ratios, rates, and percents, and verify the solutions.**	2	MC,SA	Y
6.3.E	*Identify the ratio of the circumference to the diameter of a circle as the constant π, and recognize* $\frac{22}{7}$ *and 3.14 as common approximations of π.*	*(1)*	NA	NA
6.3.F	**Determine the experimental probability of a simple event using data collected in an experiment.**	2	MC,CP	Y
6.3.G	**Determine the theoretical probability of an event and its complement and represent the probability as a fraction or decimal from 0 to 1 or as a percent from 0 to 100.**	2	MC,CP	Y

6.4 Core Content: Two- and three-dimensional figures

(Geometry/Measurement, Algebra)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Stimulus may include illustrations in items that involve finding perimeter, area, surface area, volume, or circumference.
- Stimulus may include illustrations of two-dimensional and/or three-dimensional figures.
- The answer and distractors will be stated in terms of the same system of measurement.
- Items will not require students to convert from U.S. customary to metric or metric to U.S. customary units.
- Items assessing 6.4.F will limit bases to rectangles or triangles.
- A formula page in the test booklet will include:
    - circumference and area of circles
    - surface area and volume of rectangular prisms.
- Items assessing 6.4.A, 6.4.B, and 6.4.C will use a single-digit radius when determining circumference or area.
- Items assessing 6.4.G will limit polyhedra to prisms and pyramids.

Performance Expectations

Items may ask students to:		*C.C.*	*Format*	*Ctxt*
6.4.A	**Determine the circumference and area of circles.**	1	MC	N
6.4.B	**Determine the perimeter and area of a composite figure that can be divided into triangles, rectangles, and parts of circles.**	2	MC,CP	I
6.4.C	**Solve single- and multi-step word problems involving the relationships among radius, diameter, circumference, and area of circles, and verify the solutions.**	2	MC,SA	Y
6.4.D	**Recognize** *and draw* **two-dimensional representations of three-dimensional figures.**	2	MC	I
6.4.E	**Determine the surface area and volume of rectangular prisms using appropriate formulas** *and explain why the formulas work.*	1,*(2)*	MC,CP	I
6.4.F	**Determine the surface area of a pyramid.**	1	MC,CP	I
6.4.G	**Describe and sort polyhedra by their attributes: parallel faces, types of faces, number of faces, edges, and vertices.**	2	MC	I

Key: ***Format***= Multiple-Choice (MC), Completion (CP), Short-Answer (SA), or Not Assessed (NA)
C.C.= Cognitive Complexity **(#)** = Cognitive Complexity for italicized text
Ctxt=Contextual Situation ***I***= Item dependent ***Y***= Yes Context ***N***= No Context

6.5 Additional Key Content

(Numbers, Operations)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Integers may be presented using symbols, number lines, geometric representations, and pictorial models.
- Number lines will have reference points labeled using integers.
- Items assessing 6.5.B may ask students to plot and label points on the number line.
- Items assessing 6.5.C will use integers from negative fifty to fifty, inclusive.

Performance Expectations

Items may ask students to:		*C.C.*	*Format*	*Ctxt*
6.5.A	*Use strategies for mental computations with non-negative whole numbers, fractions, and decimals.*	*(2)*	NA	NA
6.5.B	**Locate positive and negative integers on the number line and use integers to represent quantities in various contexts.**	1	MC,SA	I
6.5.C	**Compare and order positive and negative integers using the number line, lists, and the symbols <, >, or =.**	1	MC	I

6.6 Core Processes: Reasoning, problem solving, and communication

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Problem situations may have multiple viable solutions.
- Items will not require use of a particular strategy in problem solving.
- Items assessing 6.6.D will present a problem situation and will ask students to create a representation such as a diagram, chart, graph, and/or symbol that could be used to solve the problem.
- Items assessing 6.6.G may ask a student to support or contradict a given conclusion.
- Mathematics content for process items must be from Grade 6 performance expectations.

Performance Expectations

Items may ask students to:		*C.C.*	*Format*	*Ctxt*
6.6.A	*Analyze a problem situation to determine the question(s) to be answered.*	*(2)*	NA	NA
6.6.B	**Identify relevant, missing, and extraneous information related to the solution to a problem.**	2	MC	I
6.6.C	*Analyze and compare mathematical strategies for solving problems, and* **select and use one or more strategies to solve a problem.**	3	MC,SA	Y
6.6.D	**Represent a problem situation,** *describe the process used to solve the problem, and* **verify the reasonableness of the solution.**	2,3	SA	Y
6.6.E	*Communicate the answer(s) to the question(s) in a problem using appropriate representations, including symbols and informal and formal mathematical language.*	*(2,3)*	NA	NA
6.6.F	*Apply a previously used problem-solving strategy in a new context.*	*(2,3)*	NA	NA
6.6.G	**Extract and organize mathematical information from symbols, diagrams, and graphs to make inferences, draw conclusions, and justify reasoning.**	2,3	SA	Y
6.6.H	*Make and test conjectures based on data (or information) collected from explorations and experiments***.**	*(4)*	NA	NA

Key: ***Format***= Multiple-Choice (MC), Completion (CP), Short-Answer (SA), or Not Assessed (NA)
C.C.= Cognitive Complexity **(#)** = Cognitive Complexity for italicized text
Ctxt=Contextual Situation ***I***= Item dependent ***Y***= Yes Context ***N***= No Context

Grade 7

7.1. Core Content: *Rational numbers and linear equations (Numbers, Operations, Algebra)*
Students add, subtract, multiply, and divide rational numbers—fractions, decimals, and integers—including both positive and negative numbers. With the inclusion of negative numbers, students can move more deeply into algebraic content that involves the full set of rational numbers. They also approach problems that deal with a wider range of contexts than before. Using generalized algebraic skills and approaches, students can approach a wide range of problems involving any type of rational number, adapting strategies for solving one problem to different problems in different settings with underlying similarities.

7.2. Core Content: *Proportionality and similarity (Operations, Geometry/Measurement, Algebra)*
Students extend their work with ratios to solve problems involving a variety of proportional relationships, such as making conversions between measurement units or finding the percent increase or decrease of an amount. They also solve problems involving the proportional relationships found in similar figures, and in so doing reinforce an important connection between numerical operations and geometric relationships. Students graph proportional relationships and identify the rate of change as the slope of the related line. The skills and concepts related to proportionality represent some of the most important connecting ideas across K–12 mathematics. With a good understanding of how things grow proportionally, students can understand the linear relationships that are the basis for much of high school mathematics. If learned well, proportionality can open the door for success in much of secondary mathematics.

7.3. Core Content: *Surface area and volume (Algebra, Geometry/Measurement)*
Students extend their understanding of surface area and volume to include finding surface area and volume of cylinders and volume of cones and pyramids. They apply formulas and solve a range of problems involving three-dimensional objects, including problems people encounter in everyday life, in certain types of work, and in other school subjects. With a strong understanding of how to work with both two-dimensional and three-dimensional figures, students build an important foundation for the geometry they will study in high school.

7.4. Core Content: *Probability and data (Data/Statistics/Probability)*
Students apply their understanding of rational numbers and proportionality to concepts of probability. They begin to understand how probability is determined, and they make related predictions. Students revisit how to interpret data, now using more sophisticated types of data graphs and thinking about the meaning of certain statistical measures. Statistics, including probability, is considered one of the most important and practical fields of study for making sense of quantitative information, and it plays an important part in secondary mathematics in the 21st century.

7.5. Additional Key Content *(Numbers, Algebra)*
Students extend their coordinate graphing skills to plotting points with both positive and negative coordinates on the coordinate plane. Using pairs of numbers to locate points is a necessary skill for reading maps and tables and a critical foundation for high school mathematics. Students further prepare for algebra by learning how to use exponents to write numbers in terms of their most basic (prime) factors.

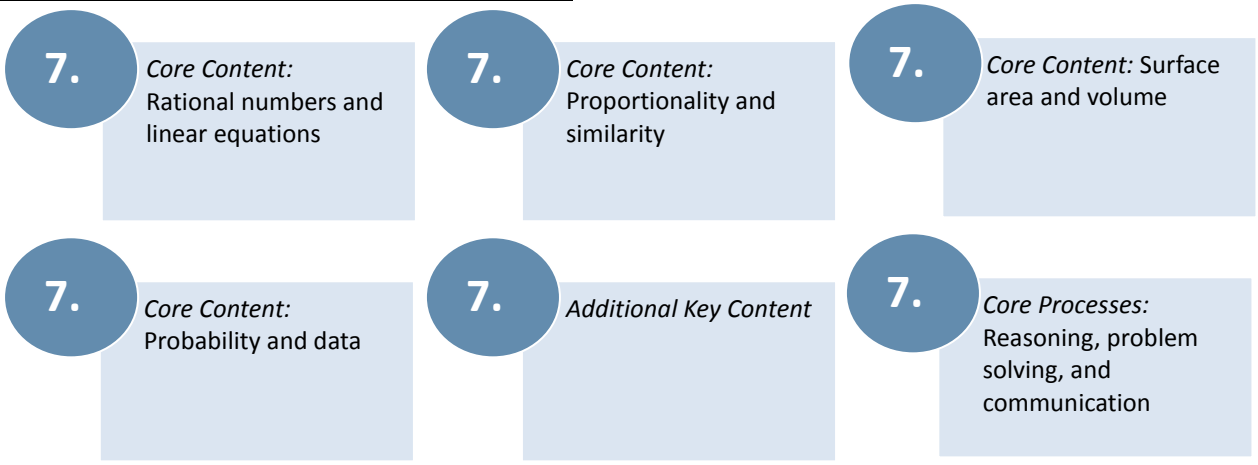
7.6. Core Processes*: Reasoning, problem solving, and communication*

Students refine their reasoning and problem-solving skills as they move more fully into the symbolic world of algebra and higher-level mathematics. They move easily among representations—numbers, words, pictures, or symbols—to understand and communicate mathematical ideas, to make generalizations, to draw logical conclusions, and to verify the reasonableness of solutions to problems. In grade seven, students solve problems that involve positive and negative numbers and often involve proportional relationships. As students solve these types of problems, they build a strong foundation for the study of linear functions that will come in grade eight.

Test Organization Grade 7

All Washington State Grade 7 Mathematics Areas of Emphasis are eligible to be assessed in each test. Each item will be classified by the area assessed.

Washington State Grade 7 Areas of Emphasis



The grade 7 mathematics test will consist of 35 items, resulting in 40 points.
Tests include three item formats: Multiple-Choice, Completion, and Short-Answer.

Multiple-Choice Items	Completion Items	Short-Answer Items
• Each Multiple-Choice item has four answer choices, the correct answer and three distractors. • There will be 25 Multiple-Choice items per operational test, worth one point each. NOTE: Enhanced Multiple-Choice items are scored as Short-Answer items.	• Each Completion item requires the student to enter a numerical answer. • There will be five Completion items per operational test, worth one point each.	• Each Short-Answer item requires a constructed response. • A Short-Answer item may ask the student to write a sentence or equation; complete a table, graph, or chart; draw a picture; construct a diagram; or perform a calculation. • An Enhanced Multiple-Choice item will ask the student to select from a list of four answer choices and then show work to support or explain the reason(s) for choosing that answer. No more than two items on a test will be Enhanced Multiple-Choice items. • There will be five Short-Answer items per operational test, worth two points each.

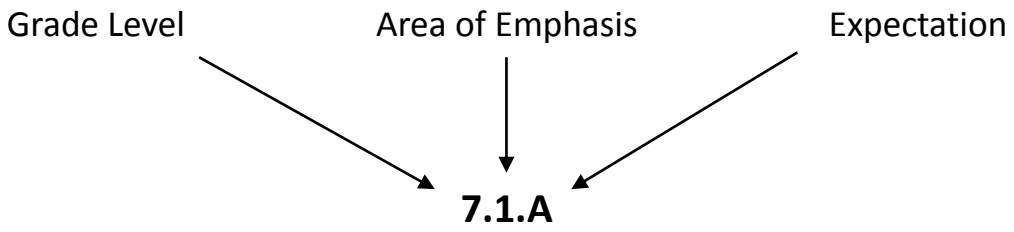
The grade 7 mathematics test is designed to be administered in one session of about 90 minutes. Although the test is not specifically a timed test, total testing time for standard administration should be about 2.5 hours.

- Each test will contain a variety of items from the Washington State Grade 7 Areas of Emphasis.
- For test development purposes, information regarding the area of emphasis, performance expectation(s), item format, and answer key will accompany each item.
- Tools, including calculators, are allowed for the test administration.

Grade 7 Test Map

Areas of Emphasis	MC	CP	SA	Total Number of Points
7.1 Rational numbers and linear equations	5-8	1-3	1-2	8-10
7.2 Proportionality and similarity	6-8	0-1	1-2	9-11
7.3 Surface area and volume	4-6	0-1	0-1	6-8
7.4 Probability and data	4-6	1-2	0-1	6-8
7.5 Additional Key Content	0-1	0	0	0-1
7.6 Reasoning, problem solving, and communication	0-2	0	1-2	4-6
Total Number of Items	25	5	5	
Total Number of Points	25	5	10	40

Performance Expectation Numbering System



Item Specifications Grade 7

Item specifications for each Area of Emphasis are organized in two sections:

Stimulus, Stem, and Prompt Rules

Stimulus, stem, and prompt rules list area-specific guidelines for developing items. The rules are in addition to those included in the Item Development Guidelines.

Performance Expectations

The performance expectations in this document are identical to those in the Washington State Grade 7 Mathematics Standards. Performance expectations that will be assessed at the state level appear in **bold text**. The remaining performance expectations, which appear in *italicized text*, should be taught and assessed at the classroom level.

Items assessing 7.6 Core Processes will use Core Content or Additional Key Content performance expectations from grade 7.

The information in the columns to the right of each performance expectation shows item development parameters for:

- Cognitive complexity (C.C.) as Level 1, Level 2, Level 3, or Level 4 as defined by Norman Webb.
- Format as Multiple-Choice (MC), Completion (CP), or Short-Answer (SA).
- Contextual Situation (Ctxt) as required (Y), item dependent (I), or not allowed (N).

7.1 Core Content: Rational numbers and linear equations

(Numbers, Operations, Algebra)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Stimulus may include variables to represent an unknown quantity in mathematical expressions, equations, or inequalities.
- Items that include an equation will define the variables.
- Number lines will have reference points labeled using fractions, decimals, and/or integers.
- Items assessing 7.1.A will use up to 4 rational numbers or up to 5 integers.
- Items assessing 7.1.C will use fractions whose decimal equivalence terminate up to the thousandths place.
- Items assessing 7.1.C and 7.1.G may use integers, decimals, fractions including mixed numbers, and/or percents.
- Items assessing 7.1.F may ask students to define the variable.

Performance Expectations

Items may ask students to:		*C.C.*	*Format*	*Ctxt*
7.1.A	**Compare and order rational numbers using the number line, lists, and the symbols <, >, or =.**	1	MC	I
7.1.B	*Represent addition, subtraction, multiplication, and division of positive and negative integers visually and numerically.*	*(1,2)*	NA	NA
7.1.C	*Fluently and* **accurately add, subtract, multiply, and divide rational numbers.**	1	MC,CP	N
7.1.D	*Define and* **determine the absolute value of a number.**	1	CP	N
7.1.E	**Solve two-step linear equations.**	1	MC,CP	I
7.1.F	**Write an equation that corresponds to a given problem situation,** *and describe a problem situation that corresponds to a given equation.*	2	MC,SA	I
7.1.G	**Solve single- and multi-step word problems involving rational numbers and verify the solutions.**	2	MC,SA	Y

Key: ***Format***= Multiple-Choice (MC), Completion (CP), Short-Answer (SA), or Not Assessed (NA)
C.C.= Cognitive Complexity **(#)** = Cognitive Complexity for italicized text
Ctxt=Contextual Situation ***I***= Item dependent ***Y***= Yes Context ***N***= No Context

7.2 Core Content: Proportionality and similarity

(Operations, Geometry/Measurement, Algebra)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Stimulus may include illustrations in items that involve finding area or volume.
- The answer and distractors will be stated in terms of the same system of measurement.
- Unfamiliar conversion facts may be given in an item.
- Stimulus may include illustrations of tools that are familiar to seventh-grade students.
- Grids will be provided in items that require students to make graphs or scale drawings.
- Items assessing slope of a proportional relationship will use lines of the form y = kx.
- Items assessing 7.2.C may include overlapping figures or 3-D figures.
- Items assessing 7.2.E will use at least two of the three representations.
- Items assessing 7.2.I will not include area or volume conversions.

Performance Expectations

Items may ask students to:		*C.C.*	*Format*	*Ctxt*
7.2.A	*Mentally add, subtract, multiply, and divide simple fractions, decimals, and percents.*	*(2)*	NA	NA
7.2.B	**Solve single- and multi-step problems involving proportional relationships and verify the solutions.**	2	MC,SA	I
7.2.C	**Describe proportional relationships in similar figures and solve problems involving similar figures.**	2	MC,SA	I
7.2.D	*Make scale drawings and* **solve problems related to scale.**	2	MC,SA	Y
7.2.E	**Represent proportional relationships using graphs, tables, and equations, and make connections among the representations.**	2	MC,SA	I
7.2.F	**Determine the slope of a line corresponding to the graph of a proportional relationship** *and relate slope to similar triangles.*	1	MC,CP	I
7.2.G	**Determine the unit rate in a proportional relationship and relate it to the slope of the associated line.**	1	*	*
7.2.H	*Determine whether or not a relationship is proportional and explain your reasoning.*	*(2)*	NA	NA
7.2.I	**Solve single- and multi-step problems involving conversions within or between measurement systems and verify the solutions.**	2	MC,SA	Y

*This performance expectation may be included in items assessing core process performance expectations.

7.3 Core Content: Surface area and volume

(Geometry/Measurement)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Items may include formulas of geometric figures not listed on formula page.
- Stimulus may include illustrations of two-dimensional and/or three-dimensional figures.
- Items assessing volume of a pyramid will limit bases to rectangles or triangles.
- A formula page in the test booklet will include:
  - surface area and volume of cylinders
  - volume of pyramids and cones.
- Items assessing 7.3.C may ask students to determine the effect a change in perimeter, area, or volume has on a side or edge length of a two- or three-dimensional figure.

Performance Expectations

Items may ask students to:		*C.C.*	*Format*	*Ctxt*
7.3.A	**Determine the surface area and volume of cylinders using the appropriate formulas** *and explain why the formulas work.*	1,*(2)*	MC,CP	N
7.3.B	**Determine the volume of pyramids and cones using formulas.**	1	MC,CP	N
7.3.C	**Describe the effect that a change** *in scale factor* **on one attribute of a two- or three-dimensional figure has on other attributes of the figure, such as the side or edge length, perimeter, area,** *surface area,* **or volume of a geometric figure.**	2	MC,SA	I
7.3.D	**Solve single- and multi-step word problems involving surface area or volume and verify the solutions.**	2	MC,SA	Y

7.4 Core Content: Probability and data

(Data/Statistics/Probability)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Stimulus may include pictures of objects such as game spinners, coins, chips, marbles, number cubes, and diagrams.
- Stimulus may describe scenarios that involve survey questions, collection methods, and populations.
- Stimulus may include tables, charts, diagrams, and graphs, including histograms, stem-and-leaf plots, and circle graphs.
- Items that ask students to construct a circle graph will include a circle and appropriate divisions within the circle of fourths, sixths, eighths, or twelfths.
- Items that ask students to construct a graph will include a title and a grid or circle.
- Items assessing 7.4.A will use contexts where each outcome occurs one time only.
- Items assessing 7.4.C may ask students to determine the missing data value in a set based on a given mean or median.

Performance Expectations

Items may ask students to:		*C.C.*	*Format*	*Ctxt*
7.4.A	**Represent the sample space of probability experiments in multiple ways, including tree diagrams and organized lists.**	2	MC, SA	Y
7.4.B	**Determine the theoretical probability of a particular event and use theoretical probability to predict experimental outcomes.**	2	MC,CP	Y
7.4.C	**Describe a data set using measures of center (median, mean, and mode) and variability (maximum, minimum, and range)** *and evaluate the suitability and limitations of using each measure for different situations.*	2,*(3)*	MC,CP	Y
7.4.D	**Construct and interpret histograms, stem-and-leaf plots, and circle graphs.**	2,3	MC,SA	Y
7.4.E	**Evaluate different displays of the same data for effectiveness and bias, and explain reasoning.**	3	*	*

*This performance expectation may be included in items assessing core process performance expectations.

7.5 Additional Key Content

(Numbers, Algebra)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Items assessing 7.5.B will use numbers less than 551.

Performance Expectations

Items may ask students to:	*C.C.*	*Format*	*Ctxt*
7.5.A Graph ordered pairs of rational numbers and determine the coordinates of a given point in the coordinate plane.	1,2	MC	I
7.5.B Write the prime factorization of whole numbers greater than 1, using exponents when appropriate.	1	MC	N

7.6 Core Processes: Reasoning, problem solving, and communication

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Problem situations may have multiple viable solutions.
- Items will not require use of a particular strategy in problem solving.
- Items assessing 7.6.D will present a problem situation and will ask students to create a representation such as a diagram, chart, graph, and/or symbol that could be used to solve the problem.
- Items assessing 7.6.G may ask a student to support or contradict a given conclusion.
- Mathematics content for process items must be from Grade 7 performance expectations.

Performance Expectations

Items may ask students to:		*C.C.*	*Format*	*Ctxt*
7.6.A	*Analyze a problem situation to determine the question(s) to be answered.*	*(2)*	NA	NA
7.6.B	**Identify relevant, missing, and extraneous information related to the solution to a problem.**	2	MC	I
7.6.C	*Analyze and compare mathematical strategies for solving problems, and* **select and use one or more strategies to solve a problem.**	3	MC,SA	Y
7.6.D	**Represent a problem situation,** *describe the process used to solve the problem, and* **verify the reasonableness of the solution.**	2,3	SA	Y
7.6.E	*Communicate the answer(s) to the question(s) in a problem using appropriate representations, including symbols and informal and formal mathematical language.*	*(2,3)*	NA	NA
7.6.F	*Apply a previously used problem-solving strategy in a new context.*	*(2,3)*	NA	NA
7.6.G	**Extract and organize mathematical information from symbols, diagrams, and graphs to make inferences, draw conclusions, and justify reasoning.**	2,3	SA	Y
7.6.H	*Make and test conjectures based on data (or information) collected from explorations and experiments.*	*(4)*	NA	NA

Grade 8

8.1. Core Content: *Linear functions and equations* *(Algebra)*

Students solve a variety of linear equations and inequalities. They build on their familiarity with proportional relationships and simple linear equations to work with a broader set of linear relationships, and they learn what functions are. They model applied problems with mathematical functions represented by graphs and other algebraic techniques. This Core Content area includes topics typically addressed in a high school algebra or a first-year integrated math course, but here this content is expected of all middle school students in preparation for a rich high school mathematics program that goes well beyond these basic algebraic ideas.

8.2. Core Content: *Properties of geometric figures* *(Numbers, Geometry/Measurement)*

Students work with lines and angles, especially as they solve problems involving triangles. They use known relationships involving sides and angles of triangles to find unknown measures, connecting geometry and measurement in practical ways that will be useful well after high school. Since squares of numbers arise when using the Pythagorean Theorem, students work with squares and square roots, especially in problems with two- and three-dimensional figures. Using basic geometric theorems such as the Pythagorean Theorem, students get a preview of how geometric theorems are developed and applied in more formal settings, which they will further study in high school.

8.3. Core Content: *Summary and analysis of data sets* *(Algebra, Data/Statistics/Probability)*

Students build on their extensive experience organizing and interpreting data and apply statistical principles to analyze statistical studies or short statistical statements, such as those they might encounter in newspapers, on television, or on the Internet. They use mean, median, and mode to summarize and describe information, even when these measures may not be whole numbers. Students use their knowledge of linear functions to analyze trends in displays of data. They create displays for two sets of data in order to compare the two sets and draw conclusions. They expand their work with probability to deal with more complex situations than they have previously seen. These concepts of statistics and probability are important not only in students' lives, but also throughout the high school mathematics program.

8.4. Additional Key Content *(Numbers, Operations)*

Students deal with a few key topics about numbers as they prepare to shift to higher level mathematics in high school. First, they use scientific notation to represent very large and very small numbers, especially as these numbers are used in technological fields and in everyday tools like calculators or personal computers. Scientific notation has become especially important as "extreme units" continue to be identified to represent increasingly tiny or immense measures arising in technological fields. A second important numerical skill involves using exponents in expressions containing both numbers and variables. Developing this skill extends students' work with order of operations to include more complicated expressions they might encounter in high school mathematics. Finally, to help students understand the full breadth of the real-number system, students are introduced to simple irrational numbers, thus preparing them to study higher level mathematics in which properties and procedures are generalized for the entire set of real numbers.

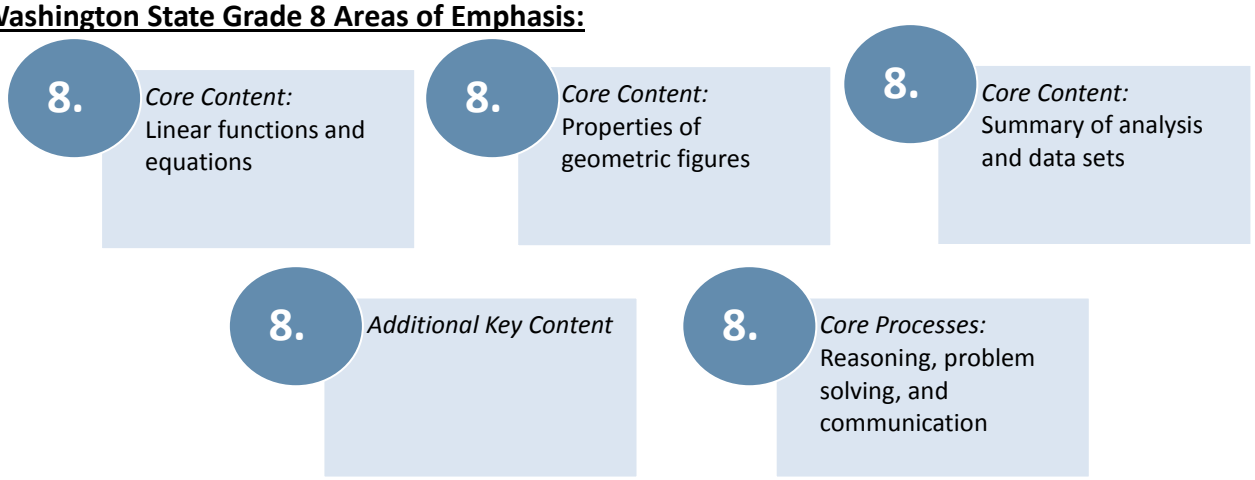
8.5. Core Processes*: Reasoning, problem solving, and communication*

Students refine their reasoning and problem-solving skills as they move more fully into the symbolic world of algebra and higher level mathematics. They move easily among representations—numbers, words, pictures, or symbols—to understand and communicate mathematical ideas, to make generalizations, to draw logical conclusions, and to verify the reasonableness of solutions to problems. In grade eight, students solve problems that involve proportional relationships and linear relationships, including applications found in many contexts outside of school. These problems dealing with proportionality continue to be important in many applied contexts, and they lead directly to the study of algebra. Students also begin to deal with informal proofs for theorems that will be proven more formally in high school.

Test Organization Grade 8

All Washington State Grade 8 Mathematics Areas of Emphasis are eligible to be assessed in each test. Each item will be classified by the area assessed.

Washington State Grade 8 Areas of Emphasis:



The grade 8 mathematics test will consist of 35 items, resulting in 40 points.
Tests include three item formats: Multiple-Choice, Completion, and Short-Answer.

Multiple-Choice Items	Completion Items	Short-Answer Items
• Each Multiple-Choice item has four answer choices, the correct answer and three distractors. • There will be 25 Multiple-Choice items per operational test, worth one point each. NOTE: Enhanced Multiple-Choice items are scored as Short-Answer items.	• Each Completion item requires the student to enter a numerical answer. • There will be five Completion items per operational test, worth one point each.	• Each Short-Answer item requires a constructed response. • A Short-Answer item may ask the student to write a sentence or equation; complete a table, graph, or chart; draw a picture; construct a diagram; or perform a calculation. • An Enhanced Multiple-Choice item will ask the student to select from a list of four answer choices and then show work to support or explain the reason(s) for choosing that answer. No more than two items on a test will be Enhanced Multiple-Choice items. • There will be five Short-Answer items per operational test, worth two points each.

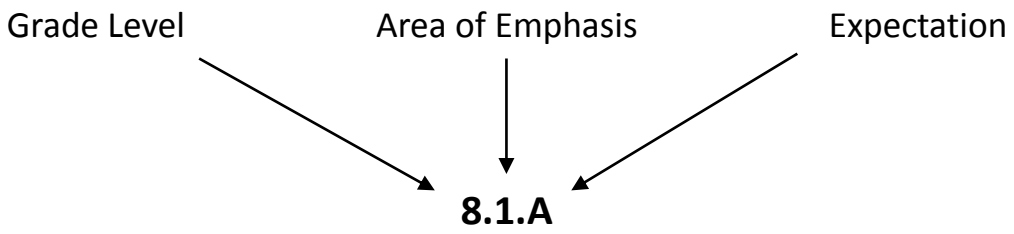
The grade 8 mathematics test is designed to be administered in one session of about 90 minutes. Although the test is not specifically a timed test, total testing time for standard administration should be about 2.5 hours.

- Each test will contain a variety of items from the Washington State Grade 8 Areas of Emphasis.
- For test development purposes, information regarding the area of emphasis, performance expectation(s), item format, and answer key will accompany each item.
- Tools, including calculators, are allowed for the test administration.

Grade 8 Test Map

Areas of Emphasis	MC	CP	SA	Total Number of Points
8.1 Linear functions and equations	6-9	1-2	1-2	10-14
8.2 Properties of geometric figures	6-9	2-3	0-1	8-12
8.3 Summary and analysis of data sets	6-8	0-1	1-2	10-12
8.4 Additional Key Content	0-1	0-1	0-1	1-3
8.5 Reasoning, problem solving, and communication	0-2	0	1-2	4-6
Total Number of Items	25	5	5	
Total Number of Points	25	5	10	40

Performance Expectation Numbering System



Item Specifications Grade 8

Item specifications for each Area of Emphasis are organized in two sections:

Stimulus, Stem, and Prompt Rules

Stimulus, stem, and prompt rules list area-specific guidelines for developing items. The rules are in addition to those included in the Item Development Guidelines.

Performance Expectations

The performance expectations in this document are identical to those in the Washington State Grade 8 Mathematics Standards. Performance expectations that will be assessed at the state level appear in **bold text**. The remaining performance expectations, which appear in *italicized text*, should be taught and assessed at the classroom level.

Items assessing 8.5 Core Processes will use Core Content or Additional Key Content performance expectations from grade 8.

The information in the columns to the right of each performance expectation shows item development parameters for:

- Cognitive complexity (C.C.) as Level 1, Level 2, Level 3, or Level 4 as defined by Norman Webb.
- Format as Multiple-Choice (MC), Completion (CP), or Short-Answer (SA).
- Contextual Situation (Ctxt) as required (Y), item dependent (I), or not allowed (N).

8.1 Core Content: Linear functions and equations

(Algebra)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Stimulus may include variables to represent unknown quantities in mathematical expressions, equations, or inequalities.
- Stimulus will define all variables.
- Items assessing 8.1.B will include positive coefficients only.
- Items assessing 8.1.B may include inequality symbols >, ≥, ≤, <, or ≠.
- Items assessing 8.1.C will use at least two of the four: table, verbal description, graph, or symbolic expression.
- Items assessing 8.1.C may include inequalities.
- Items assessing 8.1.C and 8.1.D may include equations.
- Items assessing 8.1.D and 8.1.E may include equations in forms other than slope intercept form.
- Items assessing 8.1.E may include a verbal description, equation, table, or graph of a linear function.
- Items assessing 8.1.F may ask students to write a linear function.

Performance Expectations

Items may ask students to:		*C.C.*	*Format*	*Ctxt*
8.1.A	**Solve one-variable linear equations.**	1	MC,CP	N
8.1.B	**Solve one- and two-step linear inequalities and graph the solutions on the number line.**	1	MC,SA	N
8.1.C	**Represent a linear function with a verbal description, table, graph, or symbolic expression, and make connections among these representations.**	2	MC,SA	I
8.1.D	**Determine the slope and *y*-intercept of a linear function described by a symbolic expression, table, or graph.**	1	MC,CP	N
8.1.E	**Interpret the slope and *y*-intercept of the graph of a linear function representing a contextual situation.**	2	MC,SA	Y
8.1.F	**Solve single- and multi-step word problems involving linear functions and verify the solutions.**	2	MC,SA	Y
8.1.G	*Determine and justify whether a given verbal description, table, graph, or symbolic expression represents a linear relationship.*	*(2)*	NA	NA

8.2 Core Content: Properties of geometric figures

(Numbers, Geometry/Measurement)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Stimulus may include illustrations of two-dimensional and three-dimensional figures and objects.
- All four quadrants of the Cartesian plane may be used.
- Grids will have the origin and scales labeled.
- Items that require students to represent transformations will include grids.
- Pre-images and images of figures may have orientations other than vertical and horizontal.
- Items assessing 8.2.C that include polygons with 7, 9, or more sides will include a picture of a convex figure.
- Items assessing 8.2.D may include rotations about the origin or a vertex of a figure.
- Items assessing 8.2.D may include reflections over a vertical line, a horizontal line or the line $y = x$.

Performance Expectations

Items may ask students to:		*C.C.*	*Format*	*Ctxt*
8.2.A	**Identify pairs of angles as complementary, supplementary, adjacent, or vertical, and use these relationships to determine missing angle measures.**	1	MC,CP	N
8.2.B	**Determine missing angle measures using the relationships among the angles formed by parallel lines and transversals.**	1,2	MC,CP	I
8.2.C	*Demonstrate that the sum of the angle measures in a triangle is 180 degrees, and* **apply this fact to determine the sum of the angle measures of polygons and to determine unknown angle measures.**	1,2	MC,CP	I
8.2.D	**Represent and explain the effect of one or more translations, rotations, reflections, or dilations (centered at the origin) of a geometric figure on the coordinate plane.**	1,2	MC,SA	I
8.2.E	*Quickly* **recall the square roots of the perfect squares from 1 through 225 and estimate the square roots of other positive numbers.**	1	*	*
8.2.F	*Demonstrate the Pythagorean Theorem and its converse and* **apply them to solve problems.**	2	MC,SA	I
8.2.G	**Apply the Pythagorean Theorem to determine the distance between two points on the coordinate plane.**	1	MC,CP	I

*This performance expectation may be included in items assessing core process performance expectations.

8.3 Core Content: Summary and analysis of data sets

(Algebra, Data/Statistics/Probability)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Circles and the universal set will be provided for items requiring students to represent information in a Venn diagram.
- Items that ask students to construct a graph will include a title and a grid or circle.
- Items that ask students to construct a circle graph will include a circle and appropriate divisions within the circle of fourths, sixths, eighths, or twelfths.
- Items assessing 8.3.A may include mean, median, mode, range, interquartile range, and outliers.
- Items that assess 8.3.B may include box-and-whisker plots, stem-and-leaf plots, histograms, circle graphs, and line plots.
- Items assessing 8.3.F mutually exclusive events will include the word "or."

Performance Expectations

Items may ask students to:		*C.C.*	*Format*	*Ctxt*
8.3.A	**Summarize and compare data sets in terms of variability and measures of center.**	2	MC,SA	Y
8.3.B	**Select, construct, and analyze data displays, including box-and-whisker plots, to compare two sets of data.**	2,3	MC,SA	Y
8.3.C	**Create a scatterplot for a two-variable data set, and, when appropriate, sketch and use a trend line to make predictions.**	2	SA	Y
8.3.D	*Describe different methods of selecting statistical samples and analyze the strengths and weaknesses of each method.*	*(2)*	NA	NA
8.3.E	*Determine whether conclusions of statistical studies reported in the media are reasonable.*	*(3)*	NA	NA
8.3.F	**Determine probabilities for mutually exclusive, dependent, and independent events from small sample spaces.**	2	MC,CP	Y
8.3.G	**Solve single- and multi-step problems using counting techniques and Venn diagrams and verify the solutions.**	2	MC,SA	Y

8.4 Additional Key Content

(Numbers, Operations)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Items assessing 8.4.B will use powers of ten from 10^{-3} to 10^{9}.
- Items assessing 8.4.C will use non-negative integer exponents less than or equal to ten.
- Items assessing 8.4.C may ask students to identify equivalent expressions.

Performance Expectations

Items may ask students to:		*C.C.*	*Format*	*Ctxt*
8.4.A	**Represent numbers in scientific notation, and translate numbers written in scientific notation into standard form.**	1	MC	I
8.4.B	**Solve problems involving operations with numbers in scientific notation and verify solutions.**	2	MC,SA	I
8.4.C	**Evaluate numerical expressions involving non-negative integer exponents using the laws of exponents and the order of operations.**	1	MC,CP	I
8.4.D	**Identify rational and irrational numbers.**	1	MC	N

8.5 Core Processes: Reasoning, problem solving, and communication

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Problem situations may have multiple viable solutions.
- Items will not require use of a particular strategy in problem solving.
- Items assessing 8.5.D will present a problem situation and will ask students to create a representation such as a diagram, chart, graph, and/or symbol that could be used to solve the problem.
- Items assessing 8.5.G may ask a student to support or contradict a given conclusion.
- Mathematics content for process items must be from Grade 8 performance expectations.

Performance Expectations

Items may ask students to:		*C.C.*	*Format*	*Ctxt*
8.5.A	*Analyze a problem situation to determine the question(s) to be answered.*	*(2)*	NA	NA
8.5.B	**Identify relevant, missing, and extraneous information related to the solution to a problem.**	2	MC	I
8.5.C	*Analyze and compare mathematical strategies for solving problems, and* **select and use one or more strategies to solve a problem.**	3	MC,SA	I
8.5.D	**Represent a problem situation,** *describe the process used to solve the problem, and* **verify the reasonableness of the solution.**	2,3	SA	Y
8.5.E	*Communicate the answer(s) to the question(s) in a problem using appropriate representations, including symbols and informal and formal mathematical language.*	*(2,3)*	NA	NA
8.5.F	*Apply a previously used problem-solving strategy in a new context.*	*(2,3)*	NA	NA
8.5.G	**Extract and organize mathematical information from symbols, diagrams, and graphs to make inferences, draw conclusions, and justify reasoning.**	2,3	SA	Y
8.5.H	*Make and test conjectures based on data (or information) collected from explorations and experiments.*	*(4)*	NA	NA

Data Displays Assessed in Grades 3-8

Construct/ Display	Extract for a Purpose	Type	Description
3.5.E 4.4.H	3.5.E 4.4.H	Pictograph	A diagram that uses pictures or symbols to compare data. Each picture may represent two or more data values.
3.5.E 4.4.H	3.5.E 4.4.H	Frequency Table	A table that shows the category names a tally of the data set by category and a number for the total number of occurrences in each category.
3.5.E 4.4.H	3.5.E 4.4.H	Line Plot	A plot that shows the frequency of data on a number line.
3.5.E 4.4.H	3.5.E 4.4.H	Bar Graph	A graph that uses the length of solid bars to represent data.
5.5.C	5.5.C	Line Graph	A graph that uses one or more lines to show changes in data over time.
7.4.D 8.3.B	7.4.D 7.6.G 8.3.B 8.5.G	Stem-and-Leaf Plot	A plot that organizes data from least to greatest using the digits of the greatest place value to group data.
7.4.D 8.3.B	7.4.D 7.6.G 8.3.B 8.5.G	Histogram	Histogram is a form of a bar graph in which the categories are consecutive equal intervals along a numeric scale. The height of each bar is determined by the number of data elements falling into that particular interval.
7.4.D 8.3.B	7.4.D 7.6.G 8.3.B 8.5.G	Circle Graph	A graph that uses a divided circle to show pictorially how a total amount is divided.
8.3.B	8.3.B 8.5.G	Box-and-Whisker Plot	A plot that displays the distribution and variance of data. It uses a rectangle to represent the middle 50% of a set of data and “whiskers” at both ends to represent the remainder of the data.
8.3.C	8.3.C 8.5.G	Scatter Plot	A graph consisting of points, one for each item being measured. The two coordinates of a point represent the measures of two attributes of each item.
8.3.G	8.3.G 8.5.G	Venn Diagram	A diagram that shows grouping of people or objects in overlapping categories.

NOTE: 5.4.D and 6.2.B are not data displays.

Probability Assessed in Grades 6-8

P.E.	Skills
6.3.F	Determine the experimental probability of a simple event using data collected in an experiment.
6.3.G	Determine the theoretical probability of an event and its complement and represent the probability as a fraction or decimal from 0 to 1 or as a percent from 0 to 100.
7.4.A	Represent the sample space of probability experiments in multiple was, including tree diagrams and organized lists.
7.4.B	Determine the theoretical probability of a particular event and use theoretical probability to predict experimental outcomes.
8.3.F	Determine probabilities for mutually exclusive, dependent, and independent events from small sample spaces.
8.3.G	Solve single- and multi-step problems using counting techniques and Venn diagrams and verify the solutions.

Computation Guidelines

Grade Level	Numbers	P.E.	Operations/Expectations	Restrictions Pertain to stimulus, stem, and prompt rules
6	Non-negative rational numbers	6.1.D	Multiplication/Division-non-negative fractions	-with denominators of 2 - 10 or multiples of 2 – 10 ≤ 100
		6.1.E	Multiplication/Division-whole numbers and decimals by powers of ten	-by 1,000, 100, 10, 1, 0.1, 0.01, 0.001
		6.1.F	Multiplication/Division-non-negative decimals	-products up to thousandths place -divisor up to tenths place -dividend up to hundredths place
7	Rational	7.1.C	Addition, Subtraction, Multiplication, Division	-fractions whose decimal equivalence terminates up to thousandths
		7.1.D	Absolute Value	
8	Real	8.2.E	Square Root	
		8.4.B	Computation with scientific notation	-powers of ten from 10^{-3} to 10^{9}
		8.4.C	Computation with exponents	-non-negative integer exponents ≤ 10

Mathematics Symbols First Used in Assessment Items

Strand	Name	Symbol	Grade
Operations	addition	+	3
	subtraction	-	3
	multiplication	×	3
		no symbol e.g. 5*n*	6
		( )	6
		•	6
	division	÷	3
		– (for ex. $\frac{6}{3}$)	4
	absolute value of *a*	$\|a\|$	7
	exponents	base exponent (for ex. 3^2)	8
Algebra	square root of *a*	$\sqrt{a}$	8
	equal to	=	3
	less than	<	3
	greater than	>	3
	approximately	≈	6
	less than or equal to	≤	8
	greater than or equal to	≥	8
Geometric Sense	not equal to	≠	8
	right angle		3
	pi	π	6
	congruent		7
	line segment AB	$\overline{AB}$	7
	angle A	$\angle A,\ \angle BAC$	8
	triangle ABC	$\Delta\ ABC$	8
	perpendicular	⊥	8

Measurement: Skills, Facts, and Derived Measures

P.E.	Skills/Facts	Derived Measures
6.4.A	Know common approximations of pi, 3.14 and $\frac{22}{7}$.	Determine circumference and area of a circle.
6.4.B		Determine perimeter and area of composite figures.
6.4.E		Determine surface area and volume of rectangular prism using formulas.
6.4.F		Determine surface area of a pyramid.
7.3.A		Determine surface area and volume of cylinders using formulas.
7.3.B		Determine volume of pyramids and cones using formulas.
8.2.A-C	Required to know: -Sum of 3 angles of a triangle is 180^{o}. -Complementary angles total 90^{o}. -Supplementary angles total 180^{o}. -Vertical angles are congruent. -Given parallel lines and a transversal, alternate interior angles are congruent and corresponding angles are congruent.	Determine missing angle measures.
8.2.F-G		Know and apply Pythagorean theorem.

Measurement Vocabulary

Attributes, Units, Abbreviations, and Grade Level First-Used in Assessment Items

The levels in parentheses refer to the grades at which students should develop an oral understanding of the terms according to the K-2 Standards.

Attribute	Unit	Grade
Length (K)	inch (in.)	3 (2)
	foot (ft)	3 (2)
	yard (yd)	3 (2)
	mile (mi)	4
	millimeter (mm)	4
	centimeter (cm)	3 (2)
	meter (m)	3 (2)
	kilometer (km)	4
Capacity (K)	cup (c)	3
	pint (pt)	3
	quart (qt)	3
	gallon (gal)	3
	milliliter (mL)	3
	liter (L)	3
	kiloliter (kL)	4
Weight (K)	ounce (oz)	3
	pound (lb)	3
	ton (t)	7
Mass	gram (g)	3
	kilogram (kg)	4

Attribute	Unit	Grade
Time	second (s)	4
	minute (min)	4 (2)
	hour (h)	4 (2)
	day (d)	4 (2)
	week (wk)	4 (2)
	month (mo)	4 (2)
	year (y)	4 (2)
Temperature	Degree Fahrenheit (^oF)	3
	Degree Celsius (^oC)	3
Angle	Degrees (^{o})	5

Conversions

- In grades 4-6, students are expected to convert within a measurement system but not between measurement systems. For example, 3 feet = 1 yard is a conversion within the U.S. customary system, but 1 yard ≈ 0.91 meter is a conversion between U.S. Customary and metric systems.
- In grade 7, students may be asked to convert between systems and conversion factors will be provided.
- Most dictionaries list conversion factors.

Mathematics Formula Sheet for Grades 6-8

Mathematics Formula Sheet for Grade 6—8—During the mathematics testing session students are permitted to use this formula sheet as a reference. This sheet may not be used as scratch paper.

Below are formulas you may find useful as you work the items.

Use 3.14 or $\frac{22}{7}$ when calculating with π.

Figure	**Formula**	**Variables**
Circle	$A = \pi r^2$	*A*: Area *r*: radius
	$C = \pi d$ or $C = 2\pi r$	*C*: Circumference *d*: diameter *r*: radius
Cylinder	$SA = 2\pi r^2 + 2\pi rh$	*SA*: Surface Area *r*: radius *h*: height
	$V = \pi r^2 h$	*V*: Volume *r*: radius *h*: height
Cone	$V = \frac{1}{3}Bh$ or $V = \frac{1}{3}\pi r^2 h$	*V*: Volume *r*: radius *h*: height *B*: area of base
Rectangular Prism	$SA = 2lw + 2lh + 2wh$ or $SA = 2(lw + lh + wh)$	*SA*: Surface Area *l*: length *w*: width *h*: height
	$V = lwh$	*V*: Volume *l*: length *w*: width *h*: height
Pyramid	$V = \frac{1}{3}Bh$	*V*: Volume *B*: area of base *h*: height